AQUIFER SYSTEM TDA AND LEGAL FRAMEWORKS - WHAT LESSON FOR DIKTAS?

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Abstract: A transboundary diagnostic analysis (TDA) and a Strategic Action Programme (SAP) are two elements of GEF projects under the International Waters (IW) focal area. IW projects, such as DIKTAS, invoke country cooperation. In parallel, international legal frameworks have developed, primarily by the UN's International Law Commission (ILC) Draft Articles. The underlying feature of GEF financing is that countries reach an accord on how they may cooperate over the aquifer systems and thus deliver global environmental gains through a possible SAP. Many aquifer SAP's remain quiescent being generic and require additional financing, which countries cannot release having no common financial pot. Consequently the 'gain', a viable outcome of the GEF financing, remains intangible (from a study of several project documents). If, having conducted a TDA, the sharing countries consider a SAP, with bench marked rules, such as the Draft Articles, for joint actions, the gain could be made more tangible, because a legal framework could enable joint financing for sustainable utilisation. While the Draft Articles are not yet a formal international treaty, unlike the Climate Change and Biodiversity Conventions, they could still be the best vehicle for transboundary aquifer agreements.

Thus far aquifer TDA's completed under the GEF lack globally consistent legal frameworks for a future SAP. The assessment in this brief paper hypothesises that GEF projects could significantly benefit from the provisions of the Draft Articles. This would help to secure financial means to promote the SAPs underwritten by agreements modelled on available international legal instruments. The specific cases for the GEF funded DIKTAS, the Guarani, the Iullemeden and the Nubian aquifers are discussed and suggestion on linkage between the TDA/SAP and the Draft Articles is provided.

Key Words: Transboundary Diagnostic Analysis, Strategic Action Plan, transboundary aquifers, ILC Draft Articles, GEF International Waters, Karst transboundary aquifers

INTRODUCTION

Any student of karst aquifers will readily reaffirm that defining boundaries and flow paths of the hydro dynamic system requires skill, field data and an element of luck. The skill derives from years of scholarly work. The data comes from many seasons of field work involving observations of groundwater levels, spring discharges, river flows and tracer testing. Yet, none of these are sufficient if that certain element of good luck in conducting tracer tests is missing (Puri 2007). Apart from the Dinaric Karst region (Fig 1), there are many other karst systems in the world where attempts to define boundaries of a karst system are much frustrated for insufficiency of the three requirements. Consequently the DIKTAS Project is a unique opportunity to treat this karst region as laboratory for testing out innovative ideas.

The available knowledge base and intellectual capital allow the broader aims of GEF, i.e. delivery of 'global environmental gains' for well defined karst systems, to be achievable. The steps in defining and achieving the GEF global gains include, a TDA and then the preparation of a SAP. As a first step, the TDA, establishes 'what aspect of the transboundary aquifer

system needs joint actions?' and as the second step, the SAP sets out the manner (through joint policies or financial commitments) in which the agreed aspect is tackled. Experience shows that the second step i.e. the SAP for aquifer systems suffers from weaknesses, barriers and hurdles, which in essence arise from the lack of a recognised international legal instrument that countries can relate to, in the same way as they can to globally agreed Conventions on biodiversity or combating desertification which explicitly commit countries to undertaking certain on-the-ground actions.

Here some of the TDA's for aquifers and the ensuing SAP's are related to the provisions of international legal instruments, primarily the UN International Law Commissions (ILC) Draft Articles (ILC 2008). The hypothesis is *that aquifer TDA's and SAP's can be made significantly more effective, if they are developed within the framework of an international legal instrument, which provides countries with a legal base, on which to promote actions to yield global environmental gains.* While ILC's Draft Articles will be applied in this assessment, it is noted that there are other legal instruments such as the EC's Groundwater Framework Directive and the recently adopted model provisions of the UN ECE. However both have a limited regional jurisdiction. Elsewhere transboundary aquifer systems have to rely on the ILC Draft Articles. The developing TDA of the DIKTAS project is of interest (Fig 2), so that lessons learnt can be applied elsewhere.

Several TDA's and SAP's have been reviewed. The lack of linkage to the provisions of the Draft Articles suggests that GEF projects should encourage countries to sign on to the provision of the Draft Articles. This could deliver global environmental gains, as anticipated in GEF funding.

TRANSBOUNDARY DIAGNOSTIC ANALYSIS OF AQUIFER SYSTEMS

Guidance on conducting TDA is amply given on IWLEARN web site. The essential feature of the TDA is to investigate 'what is it all about?' Based on the guidance, many GEF projects produce an immense volume of material, sometimes without a critical sifting. Abbreviated summaries of the TDA's of four GEF financed projects follow.

The Guarani Aquifer System: (see IWLEARN 2007 & 2009). In a causal-chain-analysis approach, the TDA determined three significant aspects to the aquifer system – pollution in the aquifer and wells, impact of overexploitation and macro challenges related to aquifer management. However, considerable uncertainty of detail in space, time and economic impact is noted. The ensuing SAP determined to conduct further studies, to reinforce and continue the institutional structures set up during the consultation process and to commit modest funds to maintain nationally established structures. The framework for transboundary agreement was subsumed into the La Plata Basin Treaty. Finally, a draft formal agreement, partially drawing on the ILC Draft Articles has been signed, yet to be ratified, but has been found to be exceedingly weak (Casuto 2013).

The Nubian Aquifer System: (see IWLEARN 2010). The causal-chain-analysis leading to the TDA focussed around five aspects: declining water levels, threats to dependent ecosystems, water quality deterioration, and climate change. Despite modelling since the '70's by several agencies, there remain uncertainties. The ensuing SAP (agreed Sept 2013), is structured around three objectives: joint regional planning, conservation of the dependent ecosystems, and utilisation for regional socio-economic development. Proposed activities, including pilot actions with outline investment costs are included in the SAP. The Joint

Authority of 1992, remains largely advisory, though draws on the provision of the ILC Draft Articles to enhance the data sharing and data exchange.

The Iullemeden Aquifer System: (IWLEARN web site 2008, 2010). The causal-chain-analysis for the TDA focussed on three aspects: change in available resources, degradation of water quality and climate variability. Modelling enabled risk assessments to be performed, so that hot spots may be prioritised. While a formal SAP was not prepared, in 2009 after the GEF funding, the countries established a Joint Consultative Mechanism for future mitigation of risks identified in the TDA. Majority are soft measures concerning capacity building and sensitisation of decision makers, with only one measure involving financial outlay i.e. increase in the monitoring network.

Fig. 1 Distribution of the Dinaric Karst System and locations of selected 'sub-systems' involved in the DIKTAS GEF Project (extracted from the DIKTAS web site GIS)

The Dinaric Karst Aquifer System: the value of transboundary assessment of the whole aquifer system was conceptualised in 2006 (Puri 2006). The ongoing GEF Project (Stevanovic 2012), involves a portion of the entire aquifer system (Fig 1). The TDA and SAP are under preparation. This aquifer system displays the absolutely classic example of hydro-schizophrenia in policies on surface water and groundwater catchments (Bakalowicz 2005), in places they coincide exactly and in others there is no coincidence at all. This mismatch has been replicated in water resource investments and one prime purpose of the GEF project is to try to bring some order to this malaise by testing solutions in the Balkan region for extrapolation to other global karsts. Not surprisingly therefore, the country TDAs stress the mismatched recognition of the aquifer system and its functions, on the potential for rapid contaminations and the discordance in policies between neighbouring jurisdictions.

LEGAL FRAMEWORKS UNDER INTERNATIONAL INSTRUMENTS

As far as global legal instruments go there are two, the UN 1997 Convention, not yet ratified (but likely to be shortly), and the UN Resolution on the Law of Transboundary Aquifers, in the form of Draft Articles. In addition there is the Helsinki Convention of 1992, ratified for the ECE region (and open to other regions) and the EU Groundwater Directive.

Thorough TDA's of some of the worlds significant aquifers (four illustrated above) suggest that the UN 1997 Convention only partially applies to aquifer systems. Neither the Guarani, nor the Nubian aquifer systems constitute a 'unitary whole' with river basins. The Iullemeden is only partially linked to river Niger and the Dinaric Karst is sporadically connected with

specific transboundary river catchments. The ILC's scope of the Draft Articles took particular note of these situations.

It is therefore proposed here that in aquifers illustrated above, Draft Articles apply and the 1997 Conventional does not. There are situations where provisions of both these two instruments need to be utilised in conjunction with each other. For the Iullemeden Aquifer system, on balance, the Draft Articles are more appropriate, as neither the Helsinki Convention, nor the EU Framework Directive have jurisdiction. In contrast, for the Dinaric Karst Aquifer System the Helsinki Convention and its model groundwater rules might be adopted, while the EU Directive is binding only on the Member States (Croatia). It is noteworthy that Draft Articles, as the root of the ECE model rules, are more appropriate for the aquifer system.

By virtue of certain features a common link to all of the above transboundary aquifer systems are the Draft Articles. Firstly the basic definitions of an 'aquifer', 'aquifer system' and 'utilisation of the aquifer system' are significantly more appropriate than the provisions of the other three, which focus on 'preservation and protection' of the *water* alone in the water courses. Secondly, the Draft Articles also cover 'other activities' (in addition to the utilisation of the aquifer) that may have an impact, thus ensuring that recharge and discharge functions of aquifers are regulated. Thirdly, the term 'utilisation of the aquifer system' encompasses the extraction of heat, minerals and storage / disposal of substances. In the case of the Guarani the geothermal heat and its uses is noted as more of a transboundary concern than the water; in other aquifers, the extraction of shale gas or the sequestration of CO2 are relevant. In the case of the Dinaric Aquifer System, its role in preserving the hydropower potential, and the dependent ecosystems, through the sound functioning of the aquifer system is also envisaged.

In conclusion the Draft Articles provide the hydrogeologist and the water resources decision makers with a consistent basis for conducting transboundary aquifer system negotiations to consider joint and common actions over their shared sub surface resources, including water, minerals, heat, shale gas and sequestration of CO2. Any joint and cooperative actions that countries might take on these resources would truly contribute to global environmental gains.

TRANSPOSING THE GEF TDA/SAP GUIDANCE INTO ILC DRAFT ARTICLES

GEF's TDA-SAP activities aim to stimulate cooperation and joint actions over transboundary aquifers. Restating the GEF guidance on TDA-SAP into the terminology of the Draft Articles, would read "Aquifer System States shall cooperate on the basis of sovereign equality, territorial integrity, sustainable development, mutual benefit and good faith in order to attain equitable and reasonable utilization and appropriate protection of their transboundary aquifers or aquifer systems" [based on Article 7 – general obligation to cooperate].

Further transposing the TDA guidance into the Draft Articles terminology, would read "Aquifer System States will take into account all relevant factors, including:
(a) the population dependent on the aquifer or aquifer system in each aquifer State; (b) the social, economic and other needs, present and future, of the aquifer States concerned; (c) the natural characteristics of the aquifer or aquifer system; (d) the contribution to the formation and recharge of the aquifer or aquifer system; (e) the existing and potential utilization of the aquifer or aquifer system; (f) the actual and potential effects of the utilization of the aquifer or aquifer system in one aquifer State on other aquifer States concerned; (g) the availability of alternatives to a particular existing and planned utilization

of the aquifer or aquifer system; (h) the development, protection and conservation of the aquifer or aquifer system and the costs of measures to be taken to that effect; (i) the role of the aquifer or aquifer system in the related ecosystem."
[based on Article 5 – Factor relevant to equitable and reasonable utilisation]

Once the TDA has been conducted in the spirit of the Articles 7 and 5, as indicated above, the common issues can then be prioritised, into the short, medium or the long term, for inclusion into the SAP.

GEF guidance on the SAP suggests joint financial investment on transboundary issues. In relation to this, the Draft Articles state that "For the purpose of managing a particular transboundary aquifer or aquifer system, aquifer States are encouraged to enter into bilateral or regional agreements or arrangements among themselves. Such agreements or arrangements may be entered into with respect to an entire aquifer or aquifer system or any part thereof or a particular project, programme or utilization except insofar as an agreement or arrangement adversely affects, to a significant extent, the utilization, by one or more other aquifer States of the water in that aquifer or aquifer system, without their express consent" [based on Article 8 – bilateral and regional agreements and arrangements]

Experience from GEF projects (e.g. Iullemeden) has shown that aquifer TDA and SAP develop in two separate processes and poorly linking the 'technical, non negotiated' TDA and the 'political, negotiated' SAP. GEF Secretariat reports that practitioners have commented that TDA and SAP relationship is not robust, e.g. both the Iullemeden and the Guarani ministerial agreements are patchy on the TDA-SAP link. One way to avoid this separation is to promote the full adoption of the Draft Articles as the backdrop to the implementation of a GEF transboundary aquifer projects – thus seamlessly linking the two processes, giving technical experts, as well as the policy makers a set of consistent legal articles, connecting the technical and policy aspects. Lacking such linkage the Iullemeden and the Guarani agreements remain a 'paper' exercise and the on-the-ground actions are still awaited. As the GEF documentation notes "Failure to recognise that the two components are not separate entities; (…) and are parts of the same strategic planning process, is likely to have a negative effect on the development and implementation of an effective and SAP".

NATIONAL SCALE ADJUSTMENTS TO CATER FOR TRANSBOUNDARY ACTIONS

When embarking on transboundary cooperative actions adjustment or harmonisation of national regulations and institutions is needed. Just as States adopt appropriate national legislation and suitable institutions on acceding to Conventions on Biodiversity, or Combating Desertification, so also on adopting the Draft Articles, national adjustments are needed. GEF projects are instrumental in bringing this realisation. In the case of the Guarani the countries made several such adjustments, as summarised below.

In Argentina the Federal Groundwater Plan (2009) induced all provinces involved in the aquifer to coordinate their activities; a Thermal Water Act of Entre Rios (2006) included a framework on hydrogeothermal resources. In Brazil the CONAMA Regulations (2005, 2008) included water well protection and areas of potential pollution control and the CERH Deliberation Sao Paulo (2005) adopted restriction areas and control of abstraction. In Paraguay the National Water Act (2007) included management and protection; SEAM Resolutions (2005, 2006 & 2007) included guidelines for drilling and abstraction, regulation of water councils and a national register. In Uruguay Constitutional Amendment (2005) and

Water Policies Act (2009) declared that groundwater was in the public domain and created the possibility for local 'groundwater management communities'; National Decrees (2004 & 2006) provided technical guidelines for deep drilling and National Commission for Water & Sanitation was set up.

An interesting observation is that Argentina introduced legislation on hydrogeothermal resources and that Uruguay made a Constitutional amendment declaring groundwater a public good.

BENCHMARKS FOR NATIONAL LEGISLATION INTO TRANSBOUNDARY GOVERNANCE

Experience from the Guarani Project indicated that national rules, regulations and institutional structures are unsuited to transboundary issues. With the TDA was done it was evident that some rules and regulations (and in the case of Uruguay, even the Constitution) needed adjustment to the reality of acceding to the Guarani Agreement (Acordo, Aug 2010). However, the adjustments made by the countries may be inadequate to deliver the full global environmental gains. As stated by Casuuto (2013) "The Acordo is a strong beginning to the creation of a multilateral management regime, but it cannot yet function effectively. Significant changes in both the domestic hydro-legal regimes of the overlying countries remain necessary, as is the [implementation} of the Acordo itself."

It may also be of interest that the parallel GEF funded Transboundary Waters Assessment Programme (TWAP)[7] is benchmarking the extent of congruence of national legislation with the Draft Articles for the countries sharing the Trifinio Aquifer System (see TWAP web site). Here, the applicability of Article 4 (equitable & reasonable utilisation) and Article 6 (Obligation not to cause significant harm) could only just be accommodated in existing national legislations. The Report of the assessment (Burchi 2013) suggests that national legislation seldom includes explicit provisions for shared aquifer system.

This finding is important and underlines the value of the Draft Articles TDA-SAP processes could have a clear cut context for countries to develop them (taking the provisions of the relevant Draft Articles as the benchmark), rather than as a remote academic exercise, resulting in the disconnect between the technical TDA and the policy relevant SAP.

DIKTAS ENVIRONMENTAL GAIN THROUGH THE ILC DRAFT ARTICLES

How can the hypothesis mentioned above be tested out in the updating of the TDA and the later ensuing SAP? To answer this question the Country Reports (accessible from the DIKTAS web site) provide the background as they have a SWOT analysis and discuss perceived transboundary issues.

All countries report a concern over water quality emanating from waste disposal, indicate that inadequate data and information is available, mentioning also that the laws and regulations between the countries are inconsistent. There is a concern about insufficient participation in transboundary aquifer affairs. The reports point out some specific issues e.g. impact of mining (Montenegro), constructions of hydropower plants (Albania, Croatia) and disposal of solid / municipal waste (Montenegro, Albania). In order for the TDA and the SAP to deliver global gains, the DIKTAS project proponents will have to consider specific joint actions.

[7] that is conducting a 'state of the condition' of IW projects, with the aim of defining investment priorities, monitoring trends and, in the long term, monitoring impacts of interventions,

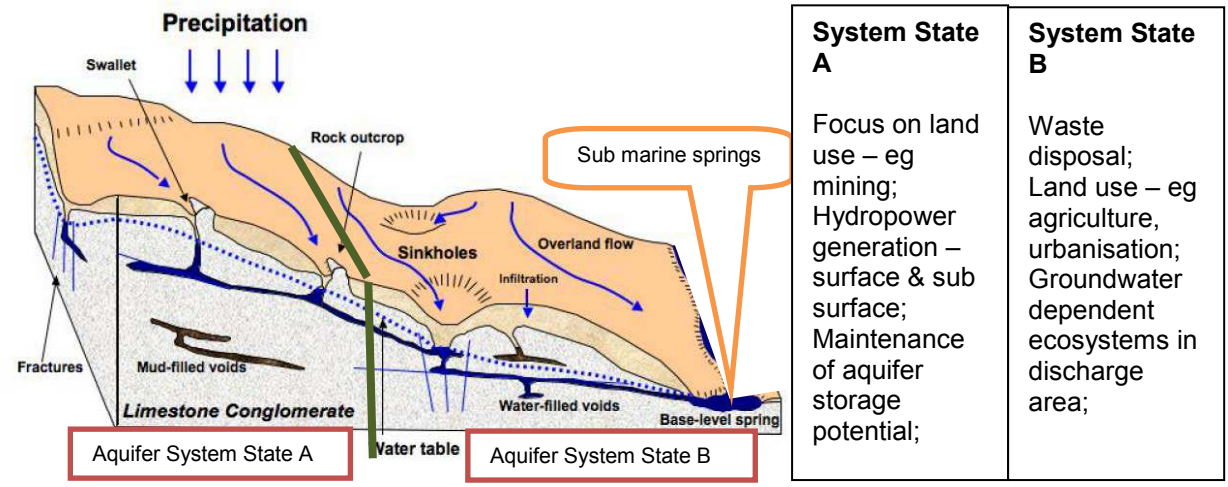

Fig. 2 Schematic of two Aquifer System States involved in conducting TDA based on the principles of the UN ILC Draft Articles on the Use of Transboundary Aquifers

The premise of the hypothesis that TDA-SAP based on the Draft Articles yield significant gains, can be shown on the simple schematic of a transboundary karst aquifer (Fig.2). The clearest first element of the TDA structure is the explicit geo-physical definition of the transboundary *aquifer system*. As noted in the Country Report by Croatia "sound scientific (…) approach is needed in (…) delineation of e.g.: aquifers, catchment areas, (..)". This would suggest that starting from the highest hydraulic head, tracing its down gradient flow to the point of exit from the aquifer. Article 2 (b) & (c) of the Draft Articles refer to this most basic element for the TDA so that project proponents could refine the boundaries of their aquifer systems shown on Fig 1.

The Country Reports note existing bi lateral and multi lateral agreements, practically all dominated by surface waters. Consequently the significant steps for the adoption Article 7 (general obligations to cooperate) are already in place. The project proponents could facilitate Aquifer System States to add additional clauses to existing agreements, thus explicitly including the aquifer systems.

Majority of the effort in the updated TDA should focus on Article 5 (factors relevant to equitable and reasonable utilisation). The data to address the 'factors' in sub clauses (a) to (i) are already available, for later aggregation for the system summary. Then the TDA process will move to the provisions of clause 2, and in particular to the application of weights. This is the main point of cooperative interaction. It is these weightings that need to be cross checked against the perceptions of the stakeholders in the consultation process.

Once these elements of the TDA structure have been completed that countries may look towards a SAP, focussing on those aspects of the TDA, where countries would take on joint actions and thus mutually benefit each other and through this also deliver global environmental goals.

It is clear that procedural guidance on the use of the ILC Draft Articles has not developed sufficiently and thus the inter linkage with the GEF financed TDA and SAP are under used. This gap will be filled by a new IAH Commission on the sound governance of transboundary aquifers. This work of the Commission will be finalised within the next 18 months.

CONCLUSIONS

In conclusion GEF financing for transboundary aquifer projects would deliver increased global gains, if countries adopted the approach set out in the ILC's Draft Articles on the Law of Transboundary Aquifers, even though the final form of the Articles has not yet been established. A review of several GEF transboundary aquifer projects justifies this suggestion, given that the Articles are the among the only global set of rules that provide a suitable framework for the practicing hydrogeologist and address all the conceptual aquifer system approaches that are missing, or are only implicit in the UN 1997 Convention and others that relate to this instrument.

A statement to the TWAP project (Puri 2013) may be worth repeating here as a conclusion. The task of the GEF financed IW aquifer projects in the coming years will be two fold: (i) how to translate the UN ILC's Draft Articles into national and regional policies, and (ii) how to forecast the trends in recharge-storage-discharge of transboundary aquifers in the 10 – 15 years ahead to maintain aquifer system functions. TWAP experts should help governments incorporate good transboundary governance, drawing on ILC Articles. The DIKTAS GEF funded project is a perfect laboratory to apply these approaches so that the experience from karstic aquifers can be leveraged to other regions and even to other groundwater flow systems.

REFERENCES

Bakalowicz M 2005 Karst Groundwater: a challenge for new resources. Hydrogeology Journal vol 13 pp148-160

Burchi S 2013 Trifinio Aquifer – Test Case to assess the TWAP adopted indicators relevant to the Draft Articles on transboundary aquifers. *(Personal communication)*

Cassuto D N 2013 Hard, Soft & Uncertain: The Guarani Aquifer and the Challenges of Transboundary Groundwater. 24 Colo. J. Int'l Envtl. Law & Policy

Guarani Project Decuments in IWLEARN, 2007, 2009. *TDA*; SAP http://iwlearn.net/iw-projects/974/reports/transboundary-diagnostic-analysis/view

International Law Commission 2008 Text of the Draft Articles – found on http://www.isarm.org/dynamics/modules/SFIL0100/view.php?fil_Id=154

Iullemeden Aquifer System Documents in IWLEARN , 2008, 2010 *TAD and SAP documents;* http://iwlearn.net/iw-projects/2041/reports/view

Nubian Sandstone Aquifer System – TDA & SAP IWLEARN, 2010 http://iwlearn.net/iw-projects/2020/reports/regional-shared-aquifer-diagnostic-analysis-for-the-nubian-sandstone-aquifer-system/view;

Puri S 2006 Initial Project Document based on Report of workshop held in Belgrade to conceptualise the DIKTAS project for GEF funding. UNESCO UNEP DGEF March 2006

Puri S 2007 Managing transboundary karst aquifer systems: is it some myth and more magic, than logic? Keynote Lecture . June 2007. Karst Research Institute

Puri S 2013 in Report of Inception Meeting for the TWAP Project – 14 -15 May 2013, held in WWAP Centre, Perugia – available from TWAP web site .

Stevanovic Z et al 2012 Characterisation of transbondary aquifers in Dinaric Karst – a base study for sustainable water management at regional and local scale. In IAH Congress, Niagara Falls Sept 2012 (in press, accessible at http://www.un-igrac.org/dynamics/modules/SFIL0100/view.php?fil_Id=227)