

# In Depth Case Study of the Lullemeden Aquifer System<sup>1</sup>

*This case study on the Memorandum of Understanding relating to the setting up of a Consultative Mechanism for the management of the Lullemeden Aquifer System (the “Memorandum”)<sup>2</sup> is one of a series that has been prepared as part of the Global Environment Facility (GEF) Good Practices and Portfolio Learning in GEF Transboundary Freshwater and Marine Legal and Institutional Frameworks Project International Waters Governance project. The objective of these case studies is to provide insight into how these agreements were negotiated and how well they are working. Each case study has been peer reviewed by one or more experts with direct knowledge of the agreement being analyzed.*

## 1. Background

### 1.1. Geographic context

The Lullemeden Aquifer System (IAS) is situated in the arid and semi arid zone of West Africa. It expands between the latitudes 10°30 and 22° N and the longitudes 0°50 and 9°20 E, and covers 500,000 km<sup>2</sup>. As a whole the IAS includes Algeria, Benin, Burkina Faso, Mali, Niger, and Nigeria, but it is principally shared among Mali, Niger and Nigeria, in the approximate percentages of 6%, 82% and 12%, respectively.

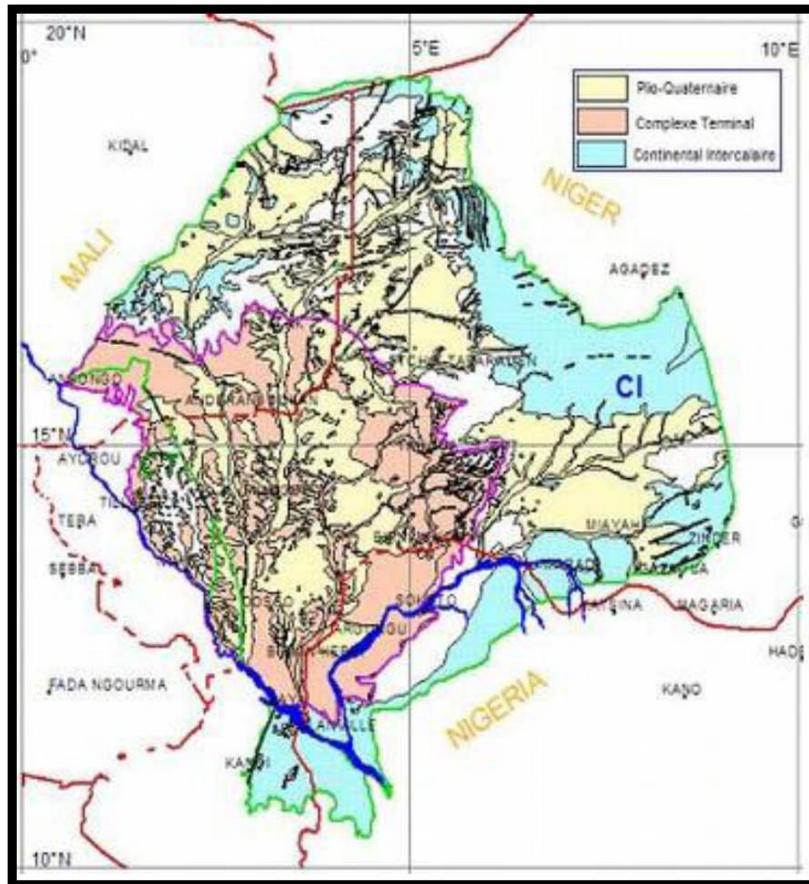
Figure 1 shows that the system is characterized by two major aquifers: the Continental Intercalaire (CI – in green) and the shallower and smaller Continental Terminal (CT - red). The aquifer system receives approximately 150 million m<sup>3</sup>/year modern recharge along its basement fringes in the river valleys, with runoff from the bordering highlands in Mali, Niger and Nigeria. However, estimates of water use currently exceed 200 million m<sup>3</sup>/year, and aquifer levels have dropped substantially in some areas over the past decades. The basin is home to some 15 million people, with 65 per cent in Niger, 34 per cent in Nigeria and 2 per cent in Mali. This is projected to grow to 28 million by 2025.<sup>3</sup>

---

<sup>1</sup> This Case Study was prepared by researchers at the Good Practices and Portfolio Learning in GEF Transboundary Freshwater and Marine Legal and Institutional Frameworks Project at UBC. It has been peer reviewed by Gabriel Ekstein (Director of International Water Law Project (Texas Tech)); Abdul Kader Dodo (Project Manager of the IAS Project (l'Observatoire du Sahara et du Sahel) and Alice Aureli (UNESCO). We thank Glen Hearn, Hilary Norris, Maaria Curlier and Theresa Etmanski for their work.

<sup>2</sup> It was developed in 2009 in order to facilitate joint management of the water resources of the Lullemeden Aquifer.

<sup>3</sup> Glen Hearn, *Terminal Evaluation of Managing Hydrological Risks in the Lullemeden Aquifer System*, UNEP EVALUATION AND OVERSIGHT UNITY, (January 2009) at 5, available at <http://projects.csg.uwaterloo.ca/inweh/display.php?ID=5281>.



**Figure 1.** Lullemeden Aquifer System<sup>4</sup>

A GEF-funded project, “Managing Hydrological Risks in the Lullemeden Aquifer System,” was undertaken to examine the relationship between the different parts of the aquifer and the impact of the management of the water resources in different areas. The project revealed that adverse impacts on water resources are expected to be amplified by climate change, which is predicted to cause reduced precipitation and increasing evaporation losses as well as declining water levels on the vegetation cover in the humid zones. In addition, salinization, water pollution and inter-aquifer leakage threaten water quality, and have transboundary implications.<sup>5</sup>

The project also demonstrated the interchange between surface waters of the Niger River and the Lullemeden Aquifer System, with each feeding the other at various times during the year. The waters of the Niger River are governed by an agreement with 9 basin states. This surface

<sup>4</sup> *Managing Hydrological Risks in the Lullemeden Aquifer System*, L'OBSERVATOIRE DU SAHARA ET DU SAHAL, available at <http://iullemeden.iwlearn.org/gis/iullemeden%20basin.jpg/view> (last visited Feb. 12, 2012).

<sup>5</sup> See Hearn, *supra* note 3.

water – groundwater interaction is now being explored under a new project funded by the GEF and is expected to yield results in 2012.<sup>6</sup>

The Memorandum of Understanding relating to the setting up of a Consultative Mechanism for the management of the lullemeden Aquifer System was developed to address management concerns for the IAS.<sup>7</sup> Informally signed in 2009, the Memorandum outlines a consultation mechanism for information gathering, information exchange and decision making for sustainable water resource management of the aquifer.

---

<sup>6</sup> *Blazing a trail: Mali, Niger and Nigeria establish a tripartite consultation mechanism on the IAS* L'OBSERVATOIRE DU SAHARA ET DU SAHAL, (Jun. 26 2009), available at [http://www.oss-online.org/index.php?option=com\\_content&task=view&id=825&Itemid=643&lang=en](http://www.oss-online.org/index.php?option=com_content&task=view&id=825&Itemid=643&lang=en).

<sup>7</sup> The DRAFT Memorandum of Understanding adopted by the council of ministers relating to the setting up of a Consultative Mechanism for the management of the lullemeden Aquifer System (IAS), 20 June 2009. Copy on file with author.

## 2. Negotiation of the Agreement

### 2.1. Development of the Agreement

Changes in land use in the recharge areas over the past 50 years have affected the recharge to the upper aquifer. Expanding agriculture, into marginal low-rainfall areas, and changes in land use in both recharge areas and humid zones pose growing transboundary risks to the environmental integrity of the IAS. Salinization, water pollution and inter-aquifer leakage from human activity risk increasing water degradation. The expected effects of climate change, namely reduced precipitation and increased evaporation losses, are anticipated to intensify these problems, and will likely lead to declining water levels on the vegetation cover in humid zones.<sup>8</sup>

With the assistance of GEF and UNESCO, the countries of Mali, Niger and Nigeria took part in the “Managing Hydrological Risks in the Iullemeden Aquifer System” project to jointly identify and manage the risks associated with sustainable water use of the IAS. This was originally conceived of by UNESCO in 2001, and was initiated through GEF with the support of FAO, UNESCO, and UNEP in 2004.<sup>9</sup> Its goal was to establish the capacity to identify risks and uncertainty in groundwater use, develop a mechanism to formulate policy towards sustainable management, and create a legal cooperative framework to manage the aquifer. UNESCO and FAO terminated their involvement in 2006, and the GEF project ended in 2008 with the development of a hydrological model, an informal mechanism for information exchange, and growing awareness and appreciation for the importance of groundwater resources.

The project concluded that:

- Aquifer levels have dropped markedly in some areas, particularly in the CT;
- There is a complex and dynamic interaction between the surface water regime and ground water regime, with each supplying the other at different locations and in different seasons; and
- Over exploitation is likely to exacerbate existing problems.
- The goals of the project were to establish joint mechanisms and capacity to identify risk and uncertainty in the aquifers, formulate policy to address them, and establish a legal framework for their implementation.<sup>10</sup>

The countries themselves then developed a formal agreement for the management of the aquifer system.

---

<sup>8</sup> See Hearn, *supra* note 3, at 5.

<sup>9</sup> *Id.* at 6.

<sup>10</sup> *supra* 4.

## 2.2. Negotiation Process

Through the GEF project Mali, Niger and Nigeria had worked together for several years to establish a joint database and hydrogeological model of the IAS. When the official GEF funding terminated in 2008, the countries determined that it was beneficial to continue to push forward and develop a Memorandum of Understanding on their own.

Though international organizations played a pivotal role in initiating the science and research needed to understand the aquifer system, they played less of an overt role in facilitating the development of the Memorandum. A regional organisation, l'Observatoire du Sahara et du Sahal (OSS), based in Tunis, played a fundamental role in facilitating negotiations. Having developed a hydrogeological model for the North Western Sahara Aquifer System, the OSS was well-respected for its technical abilities, and was seen to be unbiased. It was also perceived to have insight into the 'West African context,' which assisted negotiations and in building relations among states.<sup>11</sup>

As groundwater is not generally well known or understood, in order to reach agreements, discussions were based on scientific and technical information. This science-based approach was a focal point on which the negotiating countries developed relationships. In the words of one senior government official, "the data base and model were instrumental in motivating the highest political levels to move towards formalising the informal mechanisms."<sup>12</sup> With the experience of working together through the GEF project, those involved in the drafting of the Memorandum shared similar understandings of the IAS. These technical experts then convinced their superiors of the need for an agreement between the countries. Negotiations were not politicized as technical experts, not politicians, made key decisions over information that was primarily technical and scientific in subject matter. Additionally, the ministers who signed the treaty were not necessarily the key actors in the negotiation process.

Discussions and activities focussed on information and data exchange between the countries through the development of a transdiagnostic analysis and the subsequent creation of a joint database and hydrogeological model of the system.

The Memorandum of Understanding resulted from a solid understanding at the ministerial level in each of the countries that sustainable management of the water resources would require collaboration. Once political will was developed, the negotiation process moved forward without financial support of international organisations. The agreement was therefore predicated on sound science and reflects the need for greater understanding of the resource, and continual adaptation to evolving situations.

---

<sup>11</sup> Personal Communication with J. Chabo, Director of Nigeria Hydrological Service Agency, Ministry of Agriculture and Water (Nov.18, 2008); and I. Issaka, General Secretary, Ministère de l'Hydrologique, Niger (Nov. 14, 2008) (on file with author).

<sup>12</sup> Personal Communication with M. Keïta, Senior Technical Council to the Minister, Ministère des Mines, de l'Energie et de l'Eau (Nov. 21, 2008) (on file with author).

## 3. The Agreement

### 3.1. Overview

The Memorandum seeks to promote integrated and sustainable management of IAS water resources through the establishment of a joint Consultative Mechanism. The intention behind the design of the Consultative Mechanism was to keep the body as bureaucratically “light” as possible, in an effort to encourage greater efficiency.

#### *Dispute Resolution*

To resolve disputes is one of the Consultative Mechanism’s duties.<sup>13</sup> Informal means are the first step in any disputes regarding the Memorandum, and are to be settled through the Consultative Mechanism’s offices, mediation or conciliation, or other peaceful means.<sup>14</sup> However, if the issue remains unresolved, it is submitted to review by the National Scientific and Technical committees, who must propose a solution to the Council of Ministers within 3 months of receiving the issue.<sup>15</sup>

The Council of Ministers have decision making authority and must make decisions unanimously.<sup>16</sup> If a unanimous decision cannot be made, the issue is taken to the Court of Justice and Human Rights of the African Union.<sup>17</sup> This linkage of the Memorandum to a higher body is not unique in international law, but is not common in many agreements related to transboundary water resources, and is novel in relation to groundwater resources. Though this feature has yet to be tested, it corresponds with the desire to keep the agreement as bureaucratically “light” as possible.

#### *Financing*

The Memorandum utilizes water use subject to taxation or fees, known as the “user - pays” principle, as a sustainable financing mechanism for implementing the agreement. It also utilizes the “polluter – pays” principle as a means of compensation for injured parties. The exact details of these mechanisms have yet to be determined, and it is not yet clear when and how this taxation will be established, and for whom. Presumably, this will also require appropriate national legislation to implement. Nevertheless, it demonstrates a foresight into the need to separate the operational costs of the programme from the general national expenses and programmes. This is critical in countries where often departments are strapped for funding or dependent on central financing for their programmes.

Those involved in the creation of the Consultative Mechanism are mindful of the need for sustainable financing, and with that in mind they are seeking to devise a “light” bureaucracy

---

<sup>13</sup> See MOU, *supra* note 7, art. 5.

<sup>14</sup> *Id.* art. 29.

<sup>15</sup> *Id.* art. 30.

<sup>16</sup> *Id.* art. 29.

<sup>17</sup> *Id.* art. 31.

that will be efficient and effective. As a legal entity, the Consultative Mechanism will be able to negotiate financing and loans, and has sought to receive funding from international organizations such as the Africa Water Facility, UNEP, and GEF.

### *Data and Information Exchange*

Given that the entire programme of work associated with reaching an agreement on the management of the resources of the IAS was founded on data and information exchange, it is no surprise that parties to the Memorandum commit to exchange information in a variety of situations. Information exchanges are centred on scientific and technical information regarding the aquifer, but information regarding its use may be included in the future.

The OSS has played a large role in encouraging information exchange in the area, which contributed to the success of negotiations. As a neutral third party to which states submit information, OSS encourages free data and information exchange, as well as joint information processing. Contributing to its reputation as unbiased, OSS employs technical experts from all over Western Africa, and holds regional seminars that encourage participants to work together transparently.

The creation of the Memorandum itself would likely not have been possible without the years of data and information exchange that the countries involved had experienced through the OSS. As a result, all three countries involved in the Memorandum shared the same level of understanding of the IAS and important issues regarding it. As they all share a similar knowledge base, decisions therefore focussed on the different values regarding what knowledge gaps remain to be filled, and more importantly how water resources should be utilised, as opposed to what data is correct or what is to be believed.

However, information gathering regarding water use has not been a high priority in the area, and has limited the quality and quantity of data obtained.<sup>18</sup> Nevertheless, it is hoped that the Memorandum will encourage continued attention at the national level to support information gathering as a basis for collective action, both at the national level and at the international level.

### *Flexibility*

As a step towards deeper cooperation, the text of the Memorandum allows for considerable flexibility. It requires parties to take into consideration equitable and reasonable water use,<sup>19</sup> but does not discuss details. Flexibility in terms of the direction of cooperation is built into the Memorandum through the establishment of an Action Plan that is to be created by the

---

<sup>18</sup> Before the “Managing Hydrogeological Risks in the Iullemeden Aquifer” project was launched, the last time estimates of groundwater reserves had been made in the area was in the 1970’s. *Analyse Diagnostique Transfrontalière du Système Aquifère d’Iullemeden*. L’OBSERVATOIRE DU SAHARA ET DU SAHAL, (2007) at 2, available at [www.oss-online.org/index.php?option=com\\_content&view=article&id=1234%3Asai--analyse-diagnostique-transfrontaliere-tome-i&catid=167%3Aeau&Itemid=100002&lang=fr](http://www.oss-online.org/index.php?option=com_content&view=article&id=1234%3Asai--analyse-diagnostique-transfrontaliere-tome-i&catid=167%3Aeau&Itemid=100002&lang=fr)

<sup>19</sup> See MOU, *supra* note 7, art. 13.

Consultative Mechanism.<sup>20</sup> The agreement allows for flexibility in changes and amendments, which can be made by any party with respect to any new issue that arises.

Unlike many agreements, which specify a time period for review, the Memorandum allows for alterations at any time. These changes, however, must have unanimous agreement by all parties.<sup>21</sup> This will become increasingly difficult to achieve if other countries who share parts of the IAS also join.

---

<sup>20</sup> Id. art. 5.

<sup>21</sup> Id. art. 43.

## 4. Implementation and Monitoring

The Memorandum has not yet been ratified at the national level, but this is expected to be done in 2011; however there have been delays associated with national ratification. Implementation and monitoring continue in the same fashion that was established under the original GEF project, with the OSS as the primary clearing house for data exchange and analysis.

## 5. Assessment

The Memorandum represents the first phase towards deeper cooperation regarding the IAS. Those involved in its drafting in June 2009 also established a Road Map, and are working towards establishing “Phase Two,” the creation of a larger regional water agreement that links four of the IAS countries with the Niger River Basin Commission.<sup>22</sup>

As it is only in its earliest stages of ratification and implementation, it is still too early to definitively evaluate the costs and benefits of the agreement. The implementation, monitoring, and enforcement of the memorandum will be costly, as will the movement into “Phase Two” of integrated IAS management. Furthermore, it is unsure what the nature of management activities will be developed under the Action Plan. If limiting extraction is one of the objectives, as scientific knowledge would suggest, it is not clear how this will be achieved and who would pay for it. The hardest decisions have not yet been put forward, such as allocation and benefit sharing. Nevertheless, the creation of an agreement regarding groundwater recognizes its importance in the sustainable development and management of a transboundary resource. It recognizes the need to cooperate and collaborate in order to manage water sustainably in the area. That those involved are looking to link groundwater to surface water in future phases represents greater understanding and awareness of sustainable water management in general.

A major benefit of the Memorandum has been its success in encouraging improved relations amongst the countries currently involved. The pattern left by colonization has not completely faded with time; relations between the former English colony of Nigeria with the former French colonies of Mali and Niger are more distant than might be expected from neighbours.<sup>23</sup> That these countries collaborated to create and agree to an agreement represents quite an achievement, given their historical detachment.

### 5.1. Effectiveness

The Memorandum marks the first stage towards achieving sustainable use of water resources in the West African region. However, as the agreement itself is only in the early stages of acceptance by the countries involved, it remains to be seen whether it will indeed encourage sustainable management of the IAS.

---

<sup>22</sup> Personal Communication with A. K. Dodo, Regional Coordinator, IAS Project, OSS (July 27, 2010) (on file with author).

<sup>23</sup> Given their relative economic detachment, it is not surprising to note that transportation between the countries is not easy; Air Mali, the only national airline of the three signatory states, does not offer direct flights from Bamako, capital city of Mali, to Niamey, capital city of Niger, and does not fly at all into Nigeria (Air Mali, “Compagnie Aérienne du Mali”, [http://www.camaero.com/pages/home\\_en.aspx?language=en](http://www.camaero.com/pages/home_en.aspx?language=en)).

## 5.2. Need for Additional Agreements?

The Memorandum encourages general principles of sustainable water management, such as the polluter pays mechanism and a mechanism regarding prior informed notification of use.<sup>24</sup> Its parties commit to sustainable and equitable use of water, but these principles are declared in general terms.

The Memorandum is not intended to be an agreement that will stand on its own, and it is expected that it will be eventually accompanied or superseded by a more comprehensive agreement that will include all countries that are part of the IAS, and that will address use of both ground- and surface waters.

---

<sup>24</sup> Note that this is not the same as prior informed consent.

## 6. Concluding Remarks

The Memorandum of Understanding relating to the setting up of a Consultative Mechanism for the management of the lullemeden Aquifer System is an ambitious and forward looking agreement in several areas. Notably, the MOU goes much farther, in terms of collaborative management of water resources, than do the two other international groundwater agreements in Africa<sup>1</sup>, which deal primarily with data and information exchange. The MOU discusses the need for collaborative and joint management, and thus decision-making over a shared resource. While the concepts of sustainable management are vague, they are to be defined through scientific and technical bodies in the development of an action based management plan.

The MOU is forward thinking both in terms of its linkage to surface water resources, as well as maintaining a viable and long term funding for the Secretariat and its activities. The clear linkage with the surface water of the Niger River is a holistic approach to water resources. While it may complicate the tasks of the technical groups when developing management plans, it is helpful to advance overall sustainable management of water in the region. Caution should be applied however, as the potential expansion of scope to link with surface water will need to be carefully thought out so as not to encumber management decisions of the three member IAS states with the complexities of dealing with nine member states of the Niger Basin Authority. This is also true when considering the expansion geographically to include Algeria and Benin. While inclusiveness is laudable, the portion of the lullemeden Aquifer in each country is very small in comparison to the three member countries, and there are efficiencies in keeping management authorities small and focussed. If new members are to have similar standing to the three current members, then coming to unanimous decisions will either become increasingly difficult, or decisions may become increasingly inconsequential to allow all to agree. Careful consideration will therefore be needed when including the incorporation of surface water issues or additional membership.

Funding for the secretariat and its activities of planning and implementation are to be secured through water taxes in each of the countries. Details are not given and presumably each country will determine how best to approach that issue based on their constitution and existing legislation. There are obvious complexities in terms of how this may be implemented. Not only will additional costs for a resource be unpopular, but many of the thousands of wells are private, making monitoring and enforcement very difficult. There could easily be problems with implementation of a national policy that is directed to only certain regions of a nation, such as which body will collect and administer revenues. There could also be jurisdictional issues related to control of water. In many countries, water is under the jurisdiction of provincial or state authorities as opposed the central government. Despite the shortcoming in its implementation, the foresight of needing a sustainable financial mechanism is commendable. Moreover, implementing a cost associated with groundwater extraction may help reduce the over subscription to the resource which is depleting the resource. That said, there is a debate as to whether water is a human right, and careful consideration will have to be given to this issue

when considering that many of the communities which depend on water from the IAS are extremely poor.

The concept of polluter pays is also important in addressing the sense of equitable responsibility over the resource. Pollution is particularly pernicious with groundwater resources where contaminants may reside for long periods of time potentially rendering water sources unusable for decades. How compensation would actually be estimated and provided is difficult question. The problem of course lies in the nature of groundwater - it is very difficult to understand. Nevertheless, the fact that there is the potential for penalties and compensation is important, both for prevention, as states cannot externalise the impact of their actions, as well as a sense of security for those that might be affected.

One of the cornerstones of the development of the MOU was the exchange of information as a basis for developing a common understanding and thus common decision-making. This remains central in the development and implementation of the management plans, where national scientific and technical committees will provide the bulk of recommendations regarding management and policy. Such an information and scientific based approach is important to keep all parties on a level playing field with respect to knowledge and understanding. Moreover, the collaboration between the technical experts in each country helps to deepen the collective approach to resource utilisation, and thus a more equitable allocation of the resource.

Decision making by the council of ministers suggests that they will be approving management plans as opposed to determining the details of those plans, despite the fact that the MOU suggests they will draft plans. Unanimity is also important as it promotes a more collaborative approach. While it can have the effect of limiting decision-making, the fact that the dispute resolution mechanism appears well thought out in that it ultimately depends upon an external mechanism, in this case the Court of Justice and Human Rights of the African Union, is functional in that it promotes agreement and compromise at the ministerial level, as few countries would wish to have external arbitrators determine water management issues for them.

This is related to another interesting observation: the use of the OSS as a neutral member to collect information and analyse it for all members reduces the sense of non-compliance between member states to the MOU. The use of the OSS as a technical broker of information is similar to the use of the International Joint Commission in the development of the Columbia River Treaty. The difference however, is that the OSS will continue to serve as that neutral party during implementation, whereas most neutral parties are not influential beyond the development of the agreement. It will be interesting to see how this approach unfolds in the coming years.

The open flexibility in the agreement is also important and uncharacteristic of many agreements. Most agreements provide for review at some stage, however, few allow for any changes at any time based on agreement by other parties. This is similar to the Colorado and

Rio Grande (Rio Bravo) model where significant decisions can to be made by the International Boundary and Water Commission through the creation of Minutes, which have legal standing.

As with most agreements, ‘the Devil lies in the details.’ While the Memorandum of Understanding is an impressive approach, it will be interesting to see how its implementation is conducted and supported by the member states.