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Water Diplomacy and Water Disputes in the Maghreb Region

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Abstract. In recent decades, with the rapid growth of the population of the Maghreb low-water region, the countries of this region have begun to make the most of their water resources. In this regard, the importance of the transboundary water resources of the region has been increased and disputes over these common resources have been gradually developed. Due to the historical political differences between some of the important countries in the Maghreb region, the lack of integrated water resources management and lack of sharing data has made it extremely difficult to form joint committees to oversee transboundary water resources as well as to negotiate the management of these waters; While conventions and initiatives that the countries of the region are members of them, can provide good conditions for water diplomacy and cooperation at the regional level and capacities should be used.

Keywords. Hydropolitics, Maghreb, Transboundary Rivers, Water Diplomacy, Water Disputes

1. Introduction

In the first half of the 21st century, the water problem is considered to be more important than the problem of food and energy, and most of the planet's population is facing a catastrophic situation in terms of water security during the same period [7].

The Maghreb region includes six Islamic countries, consisting of five countries in North Africa (Algeria, Morocco, Tunisia, Libya and the Western Sahara) and one country in West Africa (Mauritania) (Map 1). This region forms the western part of the Islamic World, and Arabic is its predominant language. Egypt (another Islamic country in North Africa), due to its many similarities to the countries of the West Asian region, usually forms the Middle East region with these countries; As a result, the Arab-speaking countries on the west side of the Egypt (located from Libya to the Western Sahara and Mauritania) is known as the Maghreb; In other words, the Maghreb means the countries to the west side of the central part of the Islamic and Arab world.

Map 1. Map of the countries that make up the Maghreb region [26]

In the Maghreb, as in other parts of the world, where food security is more dependent on irrigated agriculture (the opposite of rainfed agriculture), water managers and consumers face growing and increasing problems in terms of quantity or quality of management. Of course, through significant programs, governments have demonstrated their willingness to support modern irrigation systems that use less water to save water resources.

It is noteworthy that the regional governments have also experienced some failures in the field of centralized water management, generally due to the non-participation of consumers. To compensate for these failures, alternative models, specifically water management, are proposed with the help of consumers themselves; Thus, as population and food needs increase, agricultural production will be maintained and even increased (Imache et al., 2011).

The per capita renewable water resources of each country are obtained by dividing the total annual renewable water resources of that country (the total fresh water that enters the country through rainfall or rivers over a year) and the amount of fresh water available, and it means the amount of fresh water available annually per person in different countries of the world.

Among the countries of the Maghreb region, Morocco has the highest annual rainfall with an average of 346 mm and Libya has the lowest annual rainfall with an average of 56 mm. Also, in terms of per capita renewable water resources, Mauritania with 2,452 cubic meters per year has the highest and Libya with 102 cubic meters per year has the lowest amount of renewable water per person; In other words, in terms of both indicators. Libya is in the worst situation in the region. However, due to the fact that Morocco has not presented yet any official statistics of the Western Sahara on water resources and rainfall, the latter's data is not included in these rankings (Table 1 and Figure 1).

Table 1. Comparison of population, total and per capita renewable water resources and average rainfall in the countries of the Maghreb region [9, 25]

Row	Country name	Country population (2020)	Total renewable water resources ($\text{m}^3 \times 10^9/\text{year}$)	Per capita renewable water resources (m^3/year)	Average rainfall (mm/year)
1	Algeria	43,851,043	11.67	266	89
2	Morocco	36,910,558	29	786	346
3	Tunisia	11,818,618	4.615	390	207
4	Libya	6,871,287	0.7	102	56
5	Mauritania	4,649,660	11.4	2,452	92
6	Western Sahara	597,330	-	-	-

Figure 1. Comparison of the per capita renewable water resources and average rainfall in the countries of the Maghreb region [9, 25]

Water crisis is a condition in which clean drinking water in an area is less than demand [11]. Based on the per capita annual renewable water resources, Falcon Mark *et al.* have classified countries at risk of water crisis. According to the “Falcon Mark Index” (FI), countries with per capita renewable water resources of less than 1,700 cubic meters per year are in the state of “Chronic Water Scarcity”, less than one thousand cubic meters per year are in the state of “Water Stress” and less than 500 cubic meters per year are in the state of “Absolute Water Scarcity” (water crisis) [15].

According to this index, in the Maghreb region, only Mauritania in terms of available water resources is in normal condition. Morocco is in the state of water stress, and Tunisia, Algeria, Libya [and the Western Sahara] are in the state of absolute water scarcity.

The main question of this paper, written in a descriptive-analytical way, is why in the Maghreb region, despite some regional conventions and initiatives in the field of management and exploitation of transboundary water resources that all countries in the region have signed or they have joined, some of the water disputes between these countries have still not been resolved peacefully and through water diplomacy, and little has been paid to the contracts?

The answer to the main question, by examining the state of political relations between each countries in the region and the prevailing conditions in the common basins, is that due to the historical political differences between some of the important countries in the region, the lack of integrated water resources management and lack of sharing data has made it extremely difficult to form joint committees to oversee transboundary water resources as well as to negotiate the management of these waters; While conventions and initiatives that the countries of the region are members of them, can provide good conditions for water diplomacy and cooperation at the regional level and capacities should be used.

2. Methodology

The study area is the Maghreb region, which includes 6 countries: Algeria, Libya, Mauritania, Morocco, Tunisia, and the Western Sahara. This paper is written in a descriptive-analytical way. The population data of the countries have been extracted from the latest United Nations statistics; Data on countries water resources have been extracted from the Food and Agriculture Organization statistics; Data on the specifications of the basins have been extracted from the Transboundary Waters Assessment Programme statistics.

3. Facts and findings

As the rate of transboundary water resources utilization is gradually increasing among the countries of the Maghreb region, therefore, water resources management cannot be unilateral. In other words, such unilateral management would be ineffective if no similar action was taken by other users and managers of the common water resources. On the other hand, proper management of water resources should integrate all parts of a basin (integrated or interconnected water resources management).

Proposed solutions for managing transboundary basins in the Maghreb region could include data sharing, establishing a joint water monitoring committee to provide arrangements for transboundary water management negotiations, and involving the interests of all stakeholders (including farmers, home and industry consumers) in formulating any possible agreement on transboundary water management.

On the other hand, climate change can affect access to irrigation water in the future. Therefore, maintaining irrigation water while strengthening agricultural value chains is the key to improving food security in the Maghreb. Collective action and learning are essential in this region and need constant innovation to adapt. Moving from gross irrigation to drip irrigation and less water consumption systems is the best way for countries in the southern Mediterranean region.

4. Concept of water diplomacy

Water diplomacy in general is a tool that seeks to resolve water disputes between stakeholders through negotiation, especially between independent countries, and is part of a country's foreign policy. But there are different definitions of this concept:

1. Water diplomacy is an interdisciplinary concept that focuses on technical, political, social, and economic sciences. This concept is the intersection of science, politics and practice, and

includes governmental and non-governmental actors. Water diplomacy tools are necessary to activate coordinated actions during water cooperation [13];

2. Addressing cross-border water disputes is the most important goal of water diplomacy, which is rooted in international relations. Water diplomacy supports achieving the desired goals of foreign policy by controlling, preventing and resolving disputes between different countries for cross-border water cooperation and expanding regional integration [18];

3. Due to the constant flow of water from one place or country to another place or country and due to the existence of political borders of different countries in the path of a number of these water flows, some differences and consequently, negotiations and cooperation on the management of these common resources in the form of the foreign policy of the countries of the world has emerged that this part of the foreign policy of the countries is known as water diplomacy [4];

4. Water diplomacy means the potential of “Cooperation” and “Management” over the management of common and international water resources, which has received much attention in recent years due to the ongoing shortage or sometimes water crisis. Water diplomacy is the ability of stakeholders to share common waters in order to achieve a stable political situation; That is, to use stable border and international water resources without any tension or conflict between the water-right owners parties [16].

5. Common basins in the Maghreb region

Algeria, Morocco and Tunisia, located in the Maghreb region, like other countries in the region have domestic water resources, and also share a number of transboundary basins (Table 2 and Map 2). Of course, the current consumption pattern of water resources in these three countries is unstable, so these countries must decide to change their past management policies and actions and look at the water sector as an integrated unit through water diplomacy, to achieve economic, social and environmental sustainability.

Table 2. List of transboundary basins in the Maghreb region and their characteristics [19-24]

Row	Name of transboundary basin	Common countries in the basin	Population of the basin in each country	Area of the basin in each country (km ²)	Annual use of water in each country (m ³ ×10 ⁹)
1	Medjerda	Tunisia	1,883,000	15,000	2,683.8
		Algeria	671,000	8,000	387.71
2	Dra	Morocco	1,178,000	79,000	2,180.66
		Algeria	6,000	16,000	1.85
3	Tafna	Algeria	557,000	5,000	459.67
		Morocco	438,000	2,000	676.28
4	Daoura	Morocco	707,000	40,000	534.3
		Algeria	18,000	10,000	2.52
5	Guir	Morocco	175,000	25,000	120.29
		Algeria	173,000	84,000	130.33
6	Bon Naima	Morocco	40,000	325	-
		Algeria	12,000	188	-

Map 2. Map of the location of transboundary basins in the Maghreb region [17]

Due to the current challenges and the global movement for integrated water resources management, the three countries of Algeria, Morocco and Tunisia need to reform their water management methods. Changes in thinking and action in the field of water resources management are taking place slowly in the Maghreb region, and Moroccan measures are an example in this regard. This indicates a strategic approach to water planning and management in these countries [3].

As shown in Map 2, Algeria (the most populous and largest country in the region) is one of the beneficiary countries in all transboundary basins in the Maghreb region. However, due to the desert nature of a large part of this vast country, most of its surface waters leads to the Great Sahara of Africa; As a result, more than 90 percent of Algeria's population are inhabited in the northern part of the country, including the coastline along the Mediterranean Sea, the plains, the mountains and the highlands.

The Medjerda Transboundary Basin, with a population of 2,554,202 (the most populous) and an area of 23,175 square kilometers, is shared between Algeria and Tunisia. The rest of the transboundary basins of this region are shared between Algeria and Morocco. These basins are included the Dra Transboundary Basin with a population of 1,183,624 and an area of 94,178 square kilometers, the Tafna Transboundary Basin area with a population of 995,141 and an area of 7,264 square kilometers, the Daoura Transboundary Basin with a population of 725,088 and an area of 49,690 square kilometers, the Guir Transboundary Basin (the largest basin) with a population of 347,709 and an area of 108,733 square kilometers and the Bon Naima transboundary (the least populated and smallest basin) with a population of 52,447 and an area of 369 square kilometers [5, 17].

6. Water diplomacy and water disputes between Algeria and Morocco

Water in the Maghreb is a valuable commodity, like anywhere else where the demand for water exceeds the available water resources. Rapid economic development in Algeria and Morocco, population growth and climate change, on the one hand has caused widespread use of available water resources and, on the other hand has caused pollution of water resources.

According to forecasts, by 2025, the per capita water resources for each Algerian will reach 300 cubic meters per year and for each Moroccan it will reach 500 cubic meters per year, and it making Morocco, like most countries in the Maghreb, including Algeria, at the worst situation

in terms of available water resources (absolute water scarcity). For this reason, the two countries must expand their efforts to conserve existing water resources in order to rationalize their management in a more efficient way, mainly in the agricultural sector (consuming 88 percent of the volume of consuming water).

The use of unconventional dams and water can be used to combat water shortages. Since 1967, Morocco has made the construction of dams its top priority in the country's strategy in the field of confrontation with water shortage, and the total volume of dams in the country is estimated at 16.16 billion cubic meters. Algeria is also looking for alternative water sources, including the construction of 42 desalination plants on the Mediterranean coast, which in 2004 had a freshwater volume of 59 million cubic meters. Algeria also announced the construction of 28 more desalination plants by 2009.

The two neighboring countries of Algeria and Morocco can work together to establish hydropolitical laws and to increase their forces and expertise. In the current situation, Algeria and Morocco need to improve the level of cooperation and mutual policies in the field of proper governance of transboundary waters in order to preserve this blue gold. The two countries can also emulate each other's experiences as well as the successes of their neighbors in the Maghreb and other areas in the field of transboundary water resources management [27].

Prior to the signing of the 1989 agreement to create the "Arab Maghreb Union" (AMU), diplomatic relations between Algeria and Morocco were seriously challenged by geopolitical differences: in 1963, the "Sand War" between Algeria and Morocco took place; In 1975, about 75 thousands of Moroccan families have been expelled from Algeria following the outbreak of the Western Sahara conflict; In 1994, the two countries borders were closed and the borders were considered as military zones; Also "Words War" between these countries continues to this day.

Algeria and Morocco share five transboundary basins:

1. Dra Transboundary Basin: This basin is located in southeastern Morocco and eastern Algeria. Of the 2,182 billion and 510 million cubic meters of annually water consumption in this basin, 99.92 percent is consumed in Morocco and 0.88 percent in Algeria. Given that both countries supply part of the basin's water in the Dra Basin, Algeria could use more of its share in the future.

The Dra River, the main watershed of the Dra Basin, is the longest river in Morocco, with a length of about 1,100 km. The basin starts at the "Atlas Mountains" and leads to the shores of the Atlantic Ocean. The main feature of the basin is its semi-arid climate and limited surface water resources [6, 8].

In recent years, the Dra Basin has been facing drought. In 1972, a large water reservoir called the "El Mansour Eddahbi Dam" was built near the city of "Ouarzazate" in central Morocco. The dam is 529 million cubic meters in size and covers more than half of the average annual flow of the Dra River. El Mansour Eddahbi Dam collects water flowing from the mountainous areas of the basin. With the construction of this reservoir, the distribution of surface water was managed and the water is discharged from the reservoir at certain intervals.

The water reservoir, along with its main function as a hydroelectric power generation and a shield against drought, also provides a more uniform distribution of water between different areas of the Dra Basin from north to south; So that the southern areas near the Atlantic Ocean use water for agriculture and also the northern parts at the Atlas Heights (where agriculture is not possible) have the advantage that the groundwater of the region is fed.

In general, basins in the south of the Atlas Mountains have been facing a negative balance of water resources since 1990 (higher levels of groundwater abstraction compared to feeding these resources), and this trend is gradually intensifying. Prior to the 1990s drought, centralized water

management had balanced agricultural water supply. However, with declining rainfall and high evapotranspiration rates, the release of water from the El Mansour Eddahbi Dam reservoir has gradually become less and more irregular, as most of the stored water is used to feed groundwater resources (to prevent hazards such as land subsidence).

By reducing the release of water from the El Mansour Eddahbi Dam, farmers have been extracting groundwater by drilling various wells; As a result, groundwater levels have dropped in recent years, and as a result, 57 percent of the groundwater resources of the Dra Basin have either become too salty or have moderate salinity due to the advancement of salt water. Of course, the construction of a new dam in the Dra Basin has recently been completed, with a volume of 270 million cubic meters and can improve the management of water resources in this basin [8, 12].

2. Tafna Transboundary Basin: This basin is located at the western end of Algeria and eastern Morocco. Out of a total of 8 sub-basins of this transboundary basin, 2 are located in the upstream country (Morocco) and 6 in the downstream country (Algeria). Of the 1,135 billion and 940 million cubic meters of water consumed annually in the Tafna Basin, 59.53 percent is consumed in Morocco and another 40.47 percent in Algeria. Due to Algeria's relatively high consumption, the country is dependent on some of the transboundary waters in the basin.

The Tafna Basin, bounded by the "Tlemcen Mountains" between the Mediterranean Sea and the high plains of the "Oran", extends westward to the "Central Atlas Mountains" in Morocco and eastward to the "Saida Mountains" in Algeria.

Since 1975, rainfall in the Tafna Basin has dropped by 26 percent. This decrease in rainfall has also led to a 62 percent decrease in runoff. The number of dry years has also increased to about 62 percent during this period [14].

Due to the commonality of Algeria and Morocco in the Tafna Basin and considering the growing trend of drought in it, the need for water cooperation and water diplomacy between the two countries in this regard is quite felt. But the Tafna Basin, located in the northern part of the administrative borders of Algeria and Morocco, is an example of a policy of silence and non-cooperation.

3. Daoura Transboundary Basin: In this basin, the main part of the common waters originates from the upstream (Morocco) and flows down to the downstream (Algeria). Of the total 536 billion and 810 million cubic meters of water consumed annually, 99.59 percent is consumed in Morocco (mostly in the agricultural sector) and 0.47 percent in Algeria (Due to lack of agricultural land). Given that Algeria, as a downstream country in the basin, has very low water consumption, the probability of a dispute is very low.

4. Guir Transboundary Basin: The Guir River flows about 250 km after originating from Morocco (upstream) and joining its other tributaries. The river enters Algeria (downstream) and then disappears into the "Grand Erg Occidental". 77 percent of the basin is located in Algeria and another 23 percent in Morocco.

Of the 250 billion and 620 million cubic meters of water consumed annually in the Guir Basin, 52 percent is consumed in Algeria and the remaining 48 percent in Morocco. Due to the fact that a large part of the river's water originates from Morocco and the amount of Algerian consumption from Morocco is higher, there is a kind of dependence on transboundary water resources in this basin is observed by Algeria.

In 1969, the "Djorf Torba Dam" was built on the Guir River in Algeria. The volume of this dam is 299 million cubic meters [8].

5. Bon Naima Transboundary Basin: The Bon Naima River eventually flows into the Mediterranean Sea after joining its eastern and western tributaries in Algeria and Morocco. 73 percent of the basin's area is in Morocco and another 27 percent in Algeria.

7. Water diplomacy and water disputes between Algeria and Tunisia

Although Tunisia has developed systems for monitoring and controlling common rivers with Algeria, due to its urgent need for these common waters, however, due to the lack of information about the upstream sections of the rivers in the Algerian territory, it is facing information gaps. Also, given that Tunisia is at the downstream of these common rivers, the transfer of information must be so rapid that warnings such as floods can be issued to the people immediately in case of emergency; As floods can cross the Algerian border within 6 hours and arrive in the city of “Jendouba” in Tunisia.

In general, although various institutions in the Maghreb region carry out similar operations and projects, the culture of information sharing in the region is weak. This underscores the need for new and additional agreements between neighboring countries on common waters to better manage water resources and to issue immediate warnings.

Algeria and Tunisia share a transboundary basin (Medjerda Transboundary Basin). With a length of 450 km, the Medjerda River is the longest and most important Tunisian river. The river originates in the semi-arid Atlas Mountains in eastern Algeria (upstream) and then flows east (Tunisia: downstream). Medjerda eventually flows into the “Gulf of Utica” in the Mediterranean Sea.

The Medjerda River is Tunisia's main waterway and supplies water to more than half of the country's population (more than 5 million people). Agriculture is the main economic activity within the basin, providing about 35 percent of the production and employment in the basin and plays an important role in the national food security strategy. Given that out of a total of 3,711 billion and 510 million cubic meters of water consumed annually in the basin, 87.38 percent is consumed in Tunisia and only 122.62 percent in Algeria, this indicates that Tunisia is heavily dependent on transboundary waters in the basin.

In addition to the 900 square kilometers of land that is irrigated within the main basin by the Medjerda River, after the construction of the “Larrouisia Dam”, which is located 20 km from the mouth of the river and about 180 square kilometers of the plains of “Cape Bon”, a fertile peninsula in northeastern Tunisia surrounded by the Mediterranean Sea, are also irrigated by Medjerda waters. The river's water is also used to supply water to several other areas in Tunisia. Given that most of the river's water comes from the Algerian mountains, and in contrast, the most use of the river's water is in Tunisia, there is a need for water cooperation on the river and the transboundary basin. However, due to the lack of network cooperation in this field and the lack of a unified and integrated view of the entire basin, problems have arisen in this regard [2].

8. Algiers Convention

The “African Convention on the Conservation of Nature and Natural Resources” (Algiers Convention) was signed in 1968 in Algiers, the capital of Algeria, by 27 African countries, including all countries in the Maghreb (except the Western Sahara). The convention was revised in 2003 and was adopted by all 53 African countries (except the Western Sahara).

The Article 7 of the Algiers Convention deals with the issue of “Water”, which is agreed upon by all countries in the Maghreb. This article contains the following 4 paragraphs [1]:

1. The Parties shall manage their water resources so as to maintain them at the highest possible quantitative and qualitative levels. They shall, to that effect, take measures designed to:
 - a) maintain water-based essential ecological processes as well as to protect human health against pollutants and water-borne diseases,
 - b) prevent damage that could affect human health or natural resource in another State by the discharge of pollutants, and
 - c) prevent excessive abstraction, to the benefit of downstream communities and States.

2. The Parties shall establish and implement policies for the planning, conservation, management, utilization and development of underground and surface water, as well as the harvesting and use of rain water, and shall endeavour to guarantee for their populations a sufficient and continuous supply of suitable water, taking appropriate measures with due regard to:

- a) the study of water cycles and the investigation of each catchment area,
- b) the integrated management of water resources,
- c) the conservation of forested and other catchment areas and the co-ordination and planning of water resources development projects,
- d) the inventory and management of all water resources, including the administration and control of all water utilization, and
- e) the prevention and control of water pollution through, inter alia, the establishment of effluent and water quality standards.

3. Where surface or underground water resources and related ecosystems, including wetlands, are transboundary to two or more of the Parties, the latter shall act in consultation, and if the need arises, set up inter-State Commissions for their rational management and equitable utilization and to resolve disputes arising from the use of these resources, and for the cooperative development, management and conservation thereof.

4. The Parties undertake, individually or within sub-regional arrangements, to cooperate in rational water husbandry and conservation in irrigated agriculture for improved food security and sustainable agro-based industrialization.

9. Network of Farmers in Mediterranean Irrigated Systems

An initiative called the “Network of Farmers in Mediterranean Irrigated Systems” (Réseau des Irrigants Méditerranéens) (RIM) has started as a pilot project focusing on providing technical training to farmers in the Maghreb region and in order to save water consumption. The development of agricultural value chains in line with the interests of farmers' organizations in the region is another goal of this initiative. The Rim initiative has so far been implemented in Morocco and Algeria. In Morocco, the first phase of the RIM initiative took place between 2008-2009 and the second phase between 2010-2011; in Algeria, the first phase of the initiative took place between 2010-2011.

With the implementation of two phases of the RIM initiative, 400 farmers and heads of specialized agricultural organizations have received specialized training in five irrigated areas in Morocco and two irrigated areas in Algeria. In these courses, various topics such as “Drip Irrigation”, “Interconnected Water Management”, “Agricultural Water Consumer Associations” and “Value Chains in Irrigation Systems” have been taught.

“Support for creating a network for supporting rural cooperatives and organizations”, “Educational meetings for heads and members of agricultural organizations”, “Educational meetings to support farmers' plans to save water consumption: planning, management and financing”, “Granting more autonomy for agricultural organizations to hold training sessions to build the capacity within these organizations and ensure the sustainability of the training program” and “Establish cooperative networks and associations of agricultural water consumers at the national level (within Algeria and Morocco) and at the regional level (between Algeria and Morocco: a kind of water diplomacy)” are some of the results of the implementation of two steps from the RIM initiative.

RIM initiative can be taken in a broader context, including issues related to economic development, social and political developments, and environmental issues in the Maghreb

region. Such initiatives could be extended to other parts of the Maghreb (beyond Algeria and Morocco) to achieve “Participate in the creation of innovation capacity”, “Coordination and negotiation for agricultural specialists in the field of sustainable water resources management”, “Strengthening dynamism and creating demand for support and education”, “Proposing new tools for public policy to support farmers at the micro and medium level with the aim of combining economic development through agriculture and saving water consumption with the aim of increasing the number of participants”, “Strengthening capacities of collective thinking of agricultural experts on water issues (think tank or water thinking room)” and “Develop collaboration and synergy with other ongoing programs and projects” [10].

A number of institutions are cooperating with RIM initiative. These institutions combine competencies and resources and, as a result, in different steps, and specifically for designing and conducting experimental training sessions and publish results, they act as supplements [10]:

1. Farmers' organizations in the Maghreb; for example, in Morocco, farmers' organizations that involved in innovative initiative training programs have come together in the “Network for Support of Cooperatives and Rural Development Organizations” and, in short, the “Association Raccord” (Réseau d’accompagnement des coopératives et organisations rurales de développement);
2. Research institutes in the south and north of the Mediterranean Sea, from 3 countries, France, Algeria and Morocco, which are working on this initiative;
3. The “Foundation for World Agriculture and Rurality” (Fondation pour l'Agriculture et la Ruralité dans le Monde) (FARM), and the “French Committee of the International Commission on Irrigation and Drainage” (l'Association Française pour l'Eau, l'Irrigation et le Drainage) (AFEID); Support the initiative in terms of coordination, expertise and implementation of pilot projects and dissemination of results;
4. Consulting firms that specialize in developing participatory approaches to agriculture, including firms from France, Algeria, and Morocco that support the initiative.

10. Results and discussion

Concerning the Medjerda Basin, the largest volume of water use in this basin is by Tunisia (downstream), and it is trying to manage its water use by constructing dams such as the Larrouisia Dam, management and transmission plans, and water quality control. But Algeria's (upstream) lack of co-operation in sharing information on the source of the common waters has put Tunisia at risk from floods and contaminated water resources. According to paragraph 1 of the African Convention on the Conservation of Nature and Natural Resources (Algiers Convention), African countries must prevent damages that could affect human health or natural resources in another state by discharging pollutants, as well as extreme indifference to the interests of downstream communities and governments. As a result, Algeria must cooperate with Tunisia in the field of transboundary waters of the Medjerda Basin, in accordance with the Algiers Convention.

In the Dra and Daoura Basins that are common between Morocco and Algeria, almost the most exploitation takes place by Morocco. In this context, Morocco's construction of El Mansour Eddahbi Dam to manage water resources in the Dra Basin has caused agricultural prosperity at the downstream of the basin as well as groundwater supply at the upstream of the basin. Morocco's this move is in line with paragraph 2 of the Algiers Convention, which emphasizes the integrated management of water resources and the protection of basins.

Tafna and Guir Basins are common between Algeria and Morocco, and both countries have high utilization of water resources in these basins. But most of the water in these basins originates from Morocco, and this has made Algeria dependent on Morocco. In particular, dams

such as the Djorf Torba Dam in Algeria depend on the inlet waters of Morocco. At the same time, the policy of silence and non-cooperation towards the water resources of Tafna and Guir basins is ongoing. However, according to paragraph 3 of the Algiers Convention, if surface or groundwater resources are common between two or more African countries, these resources must be negotiated, and where appropriate, intergovernmental commissions for rational management, fair exploitation and settlement of disputes arising from the use of these resources, must be created. Consequently, in view of the special conditions of the Tafna and Guir Basins, it is necessary to negotiate and establish intergovernmental commissions under the Algiers Convention.

11. Conclusion

Given the positive results of the first and second phases of the Réseau des Irrigants Méditerranéens (RIM) initiative in Morocco and the first phase of that in Algeria, further steps are needed to be implemented in these two countries as well as in the rest of the Maghreb countries facing drought. By conducting these training courses, countries in the region will acquire the necessary expertise in water management. On the other hand, given the growing trend in the region's population and the Maghreb countries attention to transboundary and common water resources, RIM initiative in holding "Interconnected Water Management" and "Creating cooperative networks and associations of agricultural water consumers at the regional level" is needed more efforts to create a kind of water diplomacy and cooperation in the region. These measures could provide the realization of paragraph 4 of the Algiers Convention on the obligation of African countries to cooperate individually or within sub-regional arrangements in the field of water conservation.

12. Consideration

All of the article content has been achieved as a result of independent research accomplished by independent authors mainly grounded over scientific position. In consequence, the results do not reflect any formal position.

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