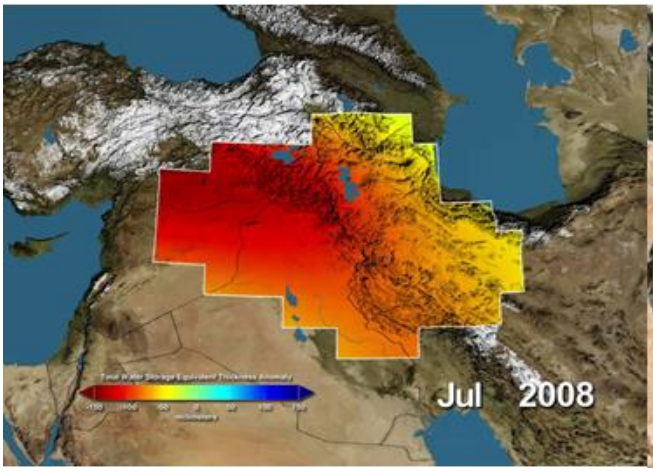
The Middle East

A New Hydro Diplomacy

Why?



HYDROPOLITICS ACADEMY

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Hydropolitics Academy

The Middle East

A New Hydro Diplomacy WHY ?

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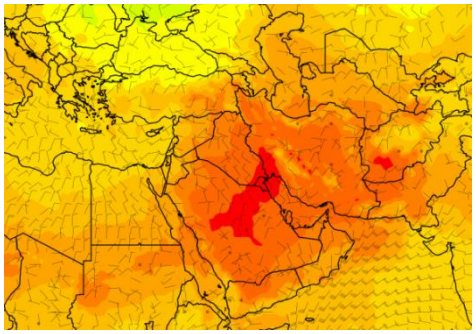

Whydro Diplomacy

"Yesterday is gone .Tomorrow has not yet come .We have only today.
Let us begin "

Mother Teresa

"The Future depends on what you do today"

Mahatma Gandhi

PREFACE

Why does the Middle East need a new Hydro Diplomacy ?

In fact answer of this question is not difficult. But the implementation of a new approach to solve vital problems have always been very difficult in the Middle East. They have been more difficult if they are related with water .

In the Middle East , the international water management situation is getting extremely difficult as the years go by. So it requires an urgent applicable plan that accepted by all neighboring countries. It also requires basin wide river and soil management commission.

First of all there should be a ***"shared goal"*** and ***"unity of effort"*** for implementation of the solution. Solution efforts should firstly consider current and near future tragedy in daily life It requires a paradigm shift from vision to action anymore. The climate change effect and current collapsed situation with non-cooperation in the last five years must lead to paradigm shift on regional hydro diplomacy .

Very new and extremely valuable report titled "***Cost of Non-Cooperation on Water Crisis of Survival in the Middle East"*** has been published by Stratetic Foresight Group in August 2016.

Executive Director of the Strategic Foresight Group Ilmas Futehally stated in Foreword of the report that

"In particular, in Iraq and Syria, the institutions of state have collapsed. Social contract between the state and citizens has broken down. Farms, villages, cities have lost their economic drive. Millions of people have been forced to migrate either within the region or outside. The failure of the summer of 2011 to consolidate the elements of the new Middle East led to the refugee crisis of the summer of 2016, having an impact on Europe. It is logical to argue that the rise of some of the extremist right wing forces in Europe was thus a result of the refugee crisis which in in turn was on account of the collapse of government and cooperation in the Levant region".

Behind the dramatic pictures, and emotional outpouring in various media, are hard facts of the cost of non-cooperation in the last 5 years. These facts provide evidence of the exact extent of the loss of crops, reduction in access to water, damage to infrastructure, impact on health and loss of livelihoods, and other realities of daily life.

These facts should convince governments, civil society, international organisations in the Middle East and those outside concerned about the region to reflect on the great tragedy that we invited on ourselves exactly at a time when the region was moving towards cooperation. It is still possible to reverse the direction of events in the Middle East and move back to the spirit of 2010. It is indeed essential to build on what was achieved in 2010 to foster cooperation in water, food and environment so that the region can finally begin its journey from deep crisis to stability and from stability to an era of peace and prosperity."

We as Hydropolitics Academy of Turkey are pointing out that the cost of non cooperative days have passed without solution on water issues in the Middle East will not only be paid by regional countries.

Our Hydropolitics Association's applied research studies also concluded that Euphrates and Tigris long term natural annual streamflows have been decreased by the effect of climate change.We aim to present some articles includes our key findings in this report to rise awaranes on this vital issue.

Therefore there is no time to vast for not only regional countries but also the global system if they sincierely want peace in the region.

This regional tragedy has also created multi dimensional problems (such as mass migration) at a global scale.

It is time to be ready to regional collaboration just on time.

No time to vast for the Middle East ,

the Middle East need a new Hydro Diplomacy with paradigm shift

Hydropolitics Academy

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Contents

From being at the age of Cooperation to fall long term Conflict

The situation has been described in the Latest Strategic Foresight Group Report as follows;

During 2009-2010, the spirit of cooperation between Iraq, Jordan, Lebanon, Syria and Turkey, paved the ground for building what was described by some as "a step towards the Union of the Middle East, similar to the European Union." However, during 2011-2016, cooperation gave way to conflict, a system of states to a system of nonstate armed actors, and co-existence to migration.

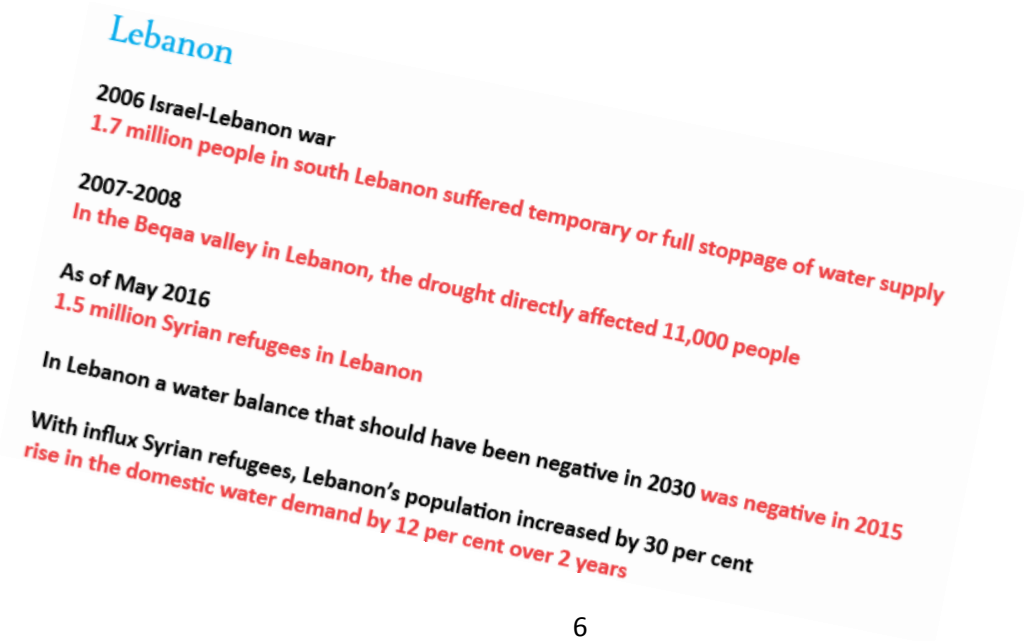
The cost of non-cooperation has been immense. Almost 40 million people in 30 governorates of Iraq, Jordan, Lebanon, Syria and Turkey are hydro-insecure. More than five million people have become internally displaced or refugees. In parts of Jordan and Lebanon, refugees outnumber the local population. Syria, which was most obstinate in refusing cooperation in water and environment, has experienced the largest devastation and the collapse of its institutions.

Out of 500 public and private hospitals in the country, almost 200 are either out of service, destroyed or inaccessible. The water availability has fallen from 75 litres per person per day in 2011 to 25 litres in 2016. Crop production has reduced by 60% from 2011 to 2016. Food inflation has been 400-700% depending on the specific commodity. Not only in Syria but also across the region, the share of agriculture in GDP has declined by 50%.

Iraq, Lebanon and Syria have experienced significant increase in water and food borne diseases since 2011. Iraq had cholera outbreak in 2015 and also the return of polio epidemic for the first time in the 21st century. And away from the front pages, people in Gaza continue to suffer.

This report provides the details of costs incurred by common people across the Middle East due to lack of cooperation in water, environment and other issues critical for human survival. We hope that it will encourage debate and make people see reason at the end of the tunnel

Figures taken from the report shows the situation in the region .

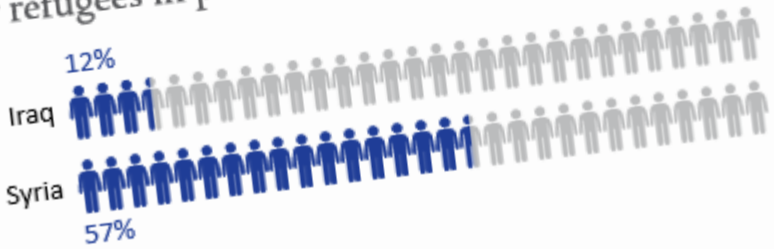


CHAPTER 5

Human Costs - Forced Migrations and Water Refugees

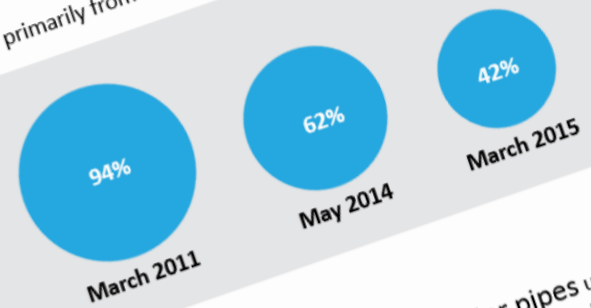
The term water-refugees is accorded to people who were displaced as the direct result of droughts, climate change, poor water management and imbalance of population/resource ratio.

Water refugees in percentage of the displaced population



Eastern Aleppo

Access to drinking water primarily from the municipal network via in home pipelines



June 2015 an explosion **destroyed three out of four major pipes** used for pumping water from the Sulaiman al-Halabi station and also cut power cables required to feed the water pump

Jordan

During **1999-2000 drought**
most of the rural populations and small farmers numbering **180,000 were affected**
4.75 million people faced **food insecurity**

As of February 2016,
637,859 registered Syrian refugees in Jordan

More than **80 per cent refugees**
live in host communities rather than in the refugee camps

Since the arrival of Syrian refugees in Jordan
water consumption per capita dropped from **88 to 66 litres**

Syria

Drought in Syria and its effects on population

2007-2008 drought
herders sold their livestock for **60 to 70 per cent below their normal prices**

59,000 small herders **lost all of their livestock**

47,000 small herders **lost half of their livestock**

Overall **1.3 million people** directly **impacted**

More than **160 villages** **abandoned**

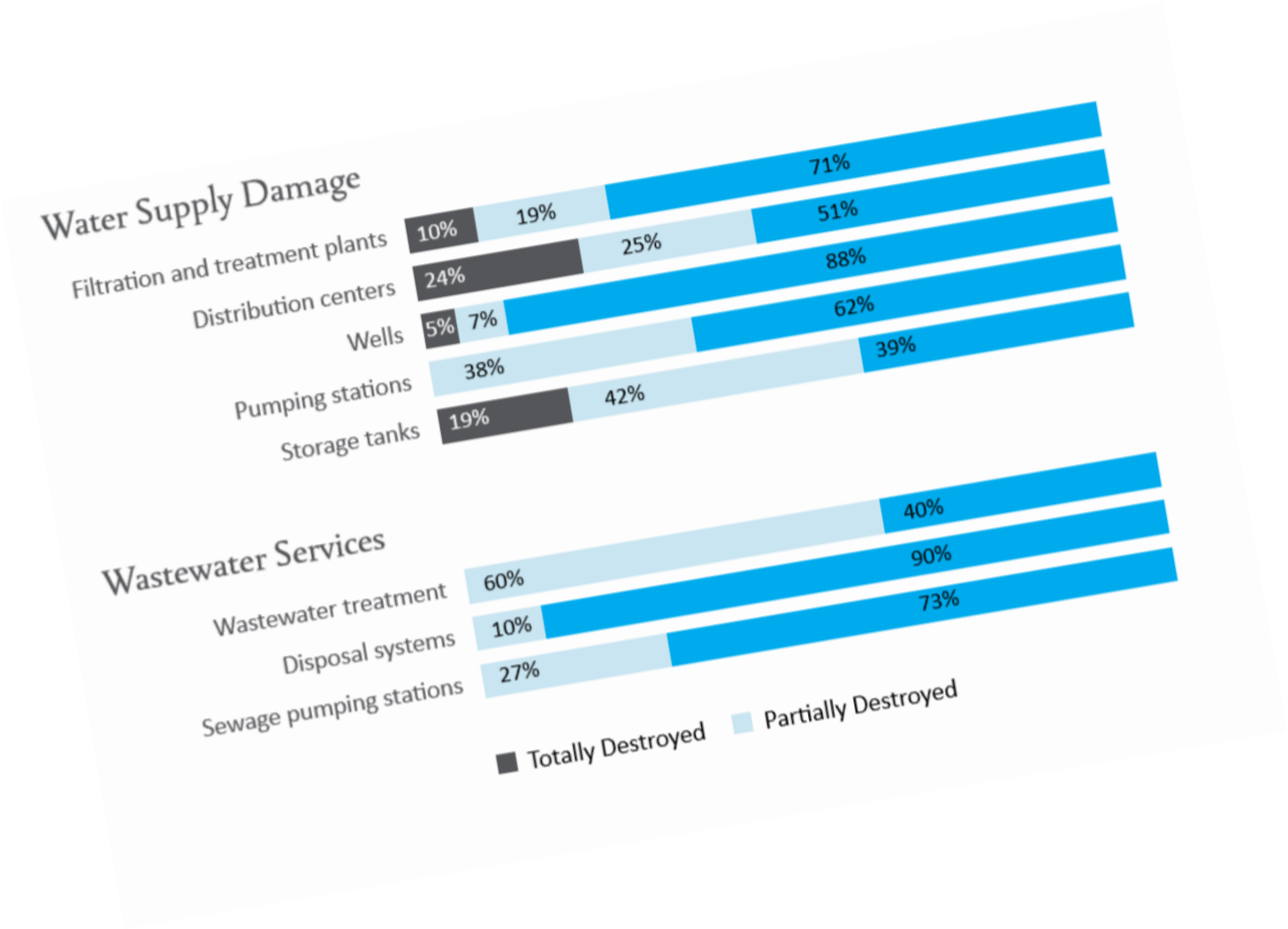
65,000 rural families forced to **migrate to urban slums**

1.5 million people forced to **move to overburdened Syrian cities** from the rural areas due to declining water availability and prolonged mismanagement of water resources

Since March 2011,
4.5 million people have fled the country and 6.5 million are internally displaced
mainly because of severe damage to the water infrastructure and prolonged droughts combined with the conflict.

Water Pricing

USD 5 per month	Between **USD 2 to 10 per litre**, provided by water tankers
Before 2011	End of 2015



COST OF NON-COOPERATION ON WATER

CRISIS OF SURVIVAL IN THE MIDDLE EAST

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International Water Issues Need More Than Cooperation

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ABSTRACT

UN Secretary-General Ban ki-Mun pointed out extremely important and extraordinary points in his remark at Opening of the 7th World Water Forum held in Daegu, Gyeongbuk, The Republic of Korea in 12 April 2015. He said that;

"Instead of seeing scarce water as a reason for competition or conflict, we have to treat it as a challenge to collaborate, a challenge to engage in innovative hydro-diplomacy. In today's world, we must be more aware of the risks of water conflict."It is important to note the emphasis on "collaboration and innovative hydro-diplomacy" in his remarks

While speaking on the occasion of World Water Day 2013, the Secretary General had also said, "Water scarcity threatens economic and social gains … And it is a potent fuel for wars and conflict." Secretary General Ban Ki-moon's warnings were reflected in the offcial definition of water security provided by the United Nations University- IWEH, which says

"The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

It is important to note the emphasis on "in a climate of peace and political stability" in this definition.

The concerns of the United Nations are justified as the world faces an era of depleting water resources. The World Water Development Report of UNESCO, released in March 2015 warns us of serious depletion of water supplies by 2050, while at the same time, significant increase in demand due to population growth, economic development and urbanisation, among other factors.

Different effects of climate change are today contributing to even more water scarcity and greater security risks.It shows us that we need an effective and mutually beneficial solution of water resources-related problems.

At the global scale, the effective and mutually beneficial solution of water resources-related problems underlie peace, security and stability. But this can become a reality only if we change our conceptual approaches to domestic and transboundary water management.

Keywords: Transboundary Water ,New Water Paradigm, Water Conceptional Change,New Hydro Diplomacy,Traditional Water Cooperation,New Hydropolitcs, Shared vision, Shared goal

1.INTRODUCTION

Throughout history, nations have generally focused on how to share the transboundary river discharges. New developments force the nations to share cost and benefits of the river on the basis of river basin.The key issue here has always been and remains to be the development of new Hydro Diplomacy. If water more often unites than divides people and societies then we can find the best suitable way to get increasing risk and threat out.

The major task, which the international community is facing today in the field of water resources, is the transfer of committed obligations into concrete actions that need Shifting Paradigm from classical cooperation to real collaboration.

1.1.Water Cooperation Term's Definition and Meaning

Cooperation is defined as "Voluntarily arrangement in which two or more entities engage in a mutually beneficial exchange instead of competing. Cooperation can happen where resources adequate for both parties exist or are created by their interaction." In the business dictionary[1].

As it is indicated in the dictionary "Cooperation can happen where resources adequate for both parties exist". If the resources are not adequate and under serious threat like water resources , we realized that it hasn't been easy to cooperate especially on international water basins.

There are still some fundamental steps to be taken. Even now it hasn't been reached a global consensus on the term to be used to refer to a water source (rivers/lakes/aquifer) that flows

[1] http://www.businessdictionary.com/definition/cooperation.html

from one country to another. Transboundary, international, shared are some of the ways that countries characterise these water bodies. In this case water cooperation effort begins with the lack of same definitions that can be effective to block further steps.

it is now necessary to be clear about what we mean by cooperation.

In the report [6] it is identified like that "Merely signing treaties for allocation of water resources between riparian countries is not cooperation. Even signing treaties which go beyond allocation and provide for exchanges and joint ventures is also not cooperation. For cooperation to be meaningful, it must be active in an operational way."

This identification clearly shows that classical cooperation approach is not enough and it needs redefining the cooperation term

As it is said in the identification "For cooperation to be meaningful, it must be active in an operational way.". It is a certainly true an extended explanation of cooperation that means Active Cooperation.

Infact if a meaningful cooperation is identified as " active in an operational way" this requires that more than classical cooperation approach . It is a more meaningful and more goal-oriented approach which can be identified as collaborative approach .

1.2 Water cooperation mechanisms

Water cooperation needs some mechanisms .There can be found several water cooperation mechanism in the literature. Some examples of water cooperation mechanisms used in the report [6] to calculate[2] Water Cooperation Quotient[3] are given below;

Agreement , Commission , Ministerial Meetings ,Technical Projects , Environmental Protection & Quality Harmonization, Joint monitoring of Water Flows, Flood Dam, Reservoir Cooperation, High Political Commitment and/ or Involvement of HOGs , Integration into Economic Development , Actual Functioning of Mechanism

It is difficult to see all of them even some of them in a cooperation process between riparian states .Because we can find different kind of cooperation identification needed to put this effort in force. But even so, it seems that traditional cooperation concept itself is not enough to strengthen shared water management relations between riparian states.

1.3.What kind of Cooperation?

[2] Each cooperative mechanism gets scored under each indicator depending on whether it exhibits the conditions mentioned.
[3] The WCQ is a set of ten indicators that help determine and quantify the extent of collaboration between two or more countries with shared watercourses.

In the water sector, the cooperative approach is still too often based only on hydrological and climatological data, on modeling and engineering, all relying on the application of scientific and mathematical principles to practical ends[9]. But this doesn't bring any mutual dependent relationship and trust. It could be a very preliminary step further for a mutually beneficial way .Therefore some experts have needed stronger , more beneficial and meaningful terms of cooperation to support their traditional thesis based on cooperative approach.

These are given below ;

1. Intensive water cooperation
2. Improved water cooperation
3. Active water cooperation
4. Efficient water cooperation
5. Meaningful water cooperation

It seems that only cooperation intention didin't bring satisfactory results and these different kind of cooperation types are needed for being succesful in cooperation process .

But if we can't go beyond the traditional cooperative approach as a concept , these new kind of definitions of cooperation dosen't help us to improve international water management.

1.4. Traditional "Water Conflict or Cooperation" Approach Ends

Conventional term *"Hydro-politics"* now should encompass consideration of variety of scale, new actors, increased interdependency nexus water, energy, food, new geopolitics and new technology.

The Oxford English Dictionary defines the word 'cooperation' as "working or acting together to the same end" for a common purpose or benefit [9].Unfortunately, this process does not always take into account a "*shared vision"* to reach an ultimate goal. Real collaboration requires mutual dependent relationship and trust.

Conceptualizing conflict and cooperation in a linear fashion is not a solution-oriented approach. It is very hard to achieve transboundary water cooperation with normative assumptions starting from existing conflicted water issues. Therefore it needs a new conceptual approach .It may be productive to focus on the analyses of rapid changing which brought new areas to collaborate between basin states rather than taking discrete events related to transboundary water interactions.

We can say that **"**Traditional "Water Conflict or Cooperation**"** concept ends with integrated approach with an emphasis on increased diversity and flexibility is needed. It is because of that numerous challenges are involved in water management . These various challenges call for multifaceted, more flexible hydro policy processes.

1.5. Water Cooperation Quotient

Water Cooperation Quotient Report prepared by **Strategic Foresight Group** is a very valuable one[6] .It is aimed to propose how to measure the intensity and operational strength of trans-boundary cooperation in the water sector.

It is done by constructing Water Cooperation Quotient based on certain parameters. The parameters are drawn from the experiences of River Basin Organisations which are respected all over the world for successfully implementing water cooperation arrangements[6].

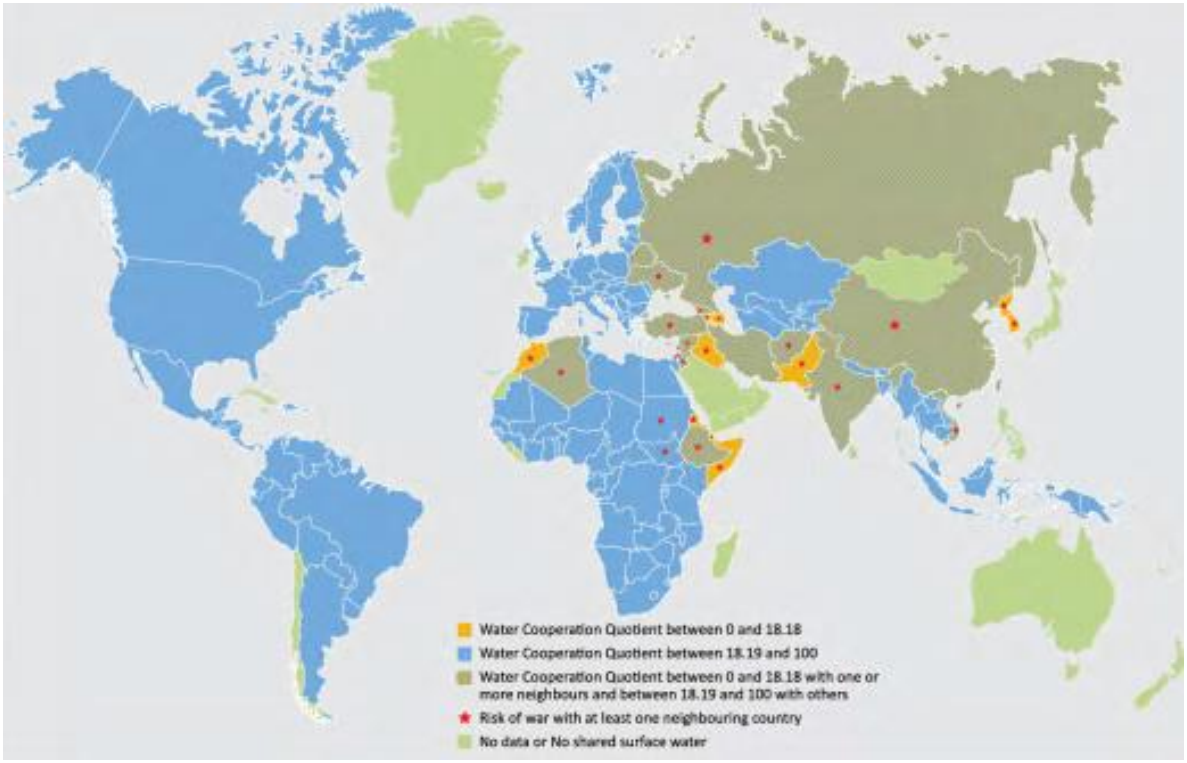

Figure 1 . Active Water Cooperation and Risk of War [6].

Water Cooperation Quotient can be used to identify gaps in the cooperative mechanisms and improve the strategies and methods of cooperation.

The Quotient helped me to evaluate the already existing regional cooperation mechanisms that are not working well.

As shown in Figure 1, the red plotted points are representing the risk of war with at least one neighbouring country. That means that effort of active water cooperation mechanisms doesn't work well or cooperation effort itself doesn't bring any meaningful relations in the most water-stressed regions of the world.

We need a new paradigm to step further. I believe that it is necessary to begin with a new vision to criticise past experience gained from all over the world's transboundary issues.

This new paradigm and approach are not exist at all and It is badly needed.

2.SHIFTING PARADIGM and CONCEPTIONAL CHANGE

We need to shift the transboundary water management approach from Water Cooperation to Collaboration to achieve one step ahead to water related goals and security issues as soon as possible

Concerns over transboundary water "cooperation" has to shift away from absolute water quantity to applicable benefit sharing collaboration on water supply. If collaboration is

essential in sustainable transboundary water management, a mutually beneficial way can help built this collaboration in appropriate transboundary river basins.

Most of the developments including climate change and nexus water ,energy,food and ecosystem showed that a vital need is growing to get innovative approaches to transboundary water governance. We should develop very innovative approach to transboundary water governance in various basins of the World.

First of all we should downscale the concepts and principles of international treaties and regulations on water to a very local level. We should take into account that multilevel governance considering the balance between them.

İf building trust between the riparian countries is a must .Then we should find a new and innovative approach and more interdependent relationship apart from classical "cooperation " approach to built dependable and sustainable trust.

2.1.Building Trust-Basin target approach

Building trust is not only a matter of international relationship. It basically needs of an engineering approach anymore. First of all it needs to find a effective way to create a unity of effort for the scale of transboundary basin. It can be called basin target trust building approach.

In this equation ,we should specify that how basin target trust building can be concretely implemented while adapting to local rules and specificities.

This process could be called as of new innovative hydrodiplomacy**.** Even if it is not identified properly yet the new innovative hydro diplomacy concept has already been in process under the influence of new geopolitics, nexus, new security paradigm and climate change threat .

It is clear that one of the main concerns of the 7th World Water Forum is to move from identifying solutions to implementing them.We can find some example project that its partners are bringing concrete solutions and implementation techniques to one of the key challenges of wate management.

By new innovative hydro diplomacy we should create more example of how water-related dialogue,water related goals and security issues can go one step ahead. We should develop a strong collaborative approach sharing the same goals amongst countries which can establish strong partnership mechanisms applicable to all sectors and stakeholders. actually serves various broader purposes, in this case strengthening international cooperation.

2.2.Why must we do that?

The rising demands of a growing world population for food, water, and energy has put an increasing stress on land use, water resources and ecosystems. Despite considerable progress over the past ten years, forecasts for natural water cycle variability and extreme weather conditions show that in the short and medium term endeavors will still suffer from severe limitations. Therefore water management won't be any easier in future. Therefore, we should improve the understanding of the impacts of climate change on the hydrological cycle and develop a better scientific understanding of the land-water-energy-climate nexus.

Under these conditions, water management in many transboundary basins will be more important than others due to having been highly politicized and a considerable impact on conflict prevention, regional stability, and environmental peace-making and international governance. Taking into account the new inherent and external threats to water management, the strategy we propose, bottom-to-up local level approach with an adaptive new Hydro-

Diplomacy, will pave the way for broader goals in regional and international collaboration through harnessing cooperation mechanisms, taking local level water related problems for granted at a minimum.

2.3.Why do we need of Conceptional Change

- Classical Cooperative approach is ineffective
- Creative process is necessary to built confidence and hydro stability
- Water energy food nexus also links crises effects to each sector
- Adaptation to Climate change effects is not a single play and needs working together and unity of effort
- Increased interdependency linked local crises to regional and global crises
- New Food Geopolitics opened new disputed areas
- A high level comprehensive collaboration reduce a tendency towards greater securitisation

- Collaboration is the bedrock of creative solutions and innovation
- We need creative solutions and innovation for moving forward

We must change the nature of international relations in water management from a zero-sum game based on resource grasps to a platform of mutually beneficial interrelations.

Moving forward requires shared vision, shared goal and unity of effort which means a real collaborative approach on the basis of new Hydro-diplomacy approach instead of tight classical cooperative one

Sustainable transboundary water management has been a collaborative issue Therefore We need a conceptual change from classical cooperation to collaborative approachThat requires unity of effort, regional economic and political integration, We need a way of cooperation that strengthens regional integration

2.4. Diversity and Fexibility is needed

Transboundary as well as national water development and management are strongly linked to sustainable growth and development of the regional peace and stability.

Thus, an integrated approach with an emphasis on increased diversity and flexibility is needed. New management approaches should be based on regional muttually beneficial principles, focusing on river basins and aquifer systems together.This requires a holistic management of surface and groundwater implemented with the entire river basin in mind.

Flexibility is needed in new management approach .It is because of that numerous challenges are involved, such as continuous changes in people's demands and values and structural transformations in society and environment, not to mention climatic anomalies and other exogenous shifts. These various challenges call for multifaceted, flexible decision-making processes

Many existing transboundary cooperation arrangements are highly sectoral; the majority address specific waterworks, water uses and measures to control and regulate water flows, others pollution or the environment. There is a need to revise these approaches in order to follow IWRM principles.
Sectoral entities should be actively used as the building blocks of an integrated approach, with the right mechanisms as well as changes in legislation.

3.AN ADAPTIVE NEW HYDRO-DIPLOMACY, A FURTHER STEP

Transboundary River Basin Management is not totally differs from general river basin management in terms of general rules and regulations. Therefore Adaptive Transboundary River Basin Management could be a key to go one step ahead of this complex prosses.

Adaptive management can more generally be defined as a systematic process for improving management policies and practices by learning from the outcomes of management strategies that have already been implemented. Adaptive water management aims to increase the adaptive capacity of the water system by putting in place both learning processes and the conditions needed for learning processes to take place. As pointed out by Bormann et al. (1993), "Adaptive transboundary management is learning to manage by managing to learn." In this case, learning encompasses a wide range of processes that span the ecological, economic, and socio-political domains in the testing of hard and soft approaches (Pahl-Wostl 2002, Gleick 2003).

In this respect, adaptive management emphasizes the importance of the management process rather than focusing on goals, but without claiming that the process is an end in itself. It explicitly recognizes that management strategies and even goals may have to be adapted during the process as new information becomes available, and that the quality of the process, e.g., who is involved and which kind of information is taken into account, is essential for the outcomes finally achieved.

As it is explained above transboundary basin management also should emphasize the importance of the management process and sharing benefits rather than focusing on sharing water discharge.Therefore we need to be aware of new learnings from the outcomes of management strategies .We should adapt during the process as new information becomes available and new development occurs.

Gained experiences have shown that sustainable solution of transboundary water management issues are not only a matter of cooperation and dialogue between riparian states but also finding more effective way to collaborate for regional development ,peace and stability.Therefore belowementioned new approaches could be considered as more effective way to create shared vision ,shared goal and unity of effort to stimulate collaborative action and political commitment that will help to deliver benefits in all areas, including collaborative water management.

- **A multilevel, inclusive approach for water cooperation**: Water resources management issues must be addressed at the local, national and at appropriate regional and international levels. All stakeholders, including those in government, international organizations, the private sector, civil society and academia, should be engaged, paying special attention to the livelihoods of the poor and most vulnerable people.
- **Innovative approaches for water cooperation**:Mobilizing political will and commitment to address water issues worldwide remains crucial. Equally important are forward thinking and a

willingness to consider innovative ways to approach local, regional and international cooperation.

3.1.Benefits and Costs Sharing Approach

Riparian countries should focus first on optimizing the generation of basin-wide benefits, and secondly on sharing those benefits in a manner that is agreed as fair. The use of water, rather than the allocation of water itself, provides by far the best scope for identifying mutually beneficial actions. The perception by all countries that a collaborative basin development and management plan which maximizes overall benefits is "fair" is essential to motivating and sustaining collaboration. It is therefore important that consensus over basic entitlements is reached and that attention is paid to the differential distribution of costs resulting from the use of the water resources of the entire water body in question. It should be recognized, however, that due to the limited amount of overall available water in some cases, such decisions sometimes involve very difficult trade-offs and choices[5].

Payments for benefits (or compensation for costs) can only be made in the context of collaborative arrangements. Downstream countries can be compensated, for example, for the creation and operation of additional storage capacity by upstream countries. This basin solidarity also might entitle upstream countries to share some portion of the downstream benefits that are generated, and thus share the costs of these practices. It is important, however, to apply a special approach to those benefits and costs that are not easily quantifiable or commensurable. Payment for ecosystem services (PES) – such as for flood mitigation, regulating run-off and water supply – is a new and still contested approach. Nonetheless, if implemented well, PES has the potential to be an environmentally effective, economically efficient and socially equitable tool for IWRM that can internalize environmental costs, broaden sources of finance and create incentives for environmentally friendly investments and behaviour[5].

7.CONCLUSIONS

Gained experiences have shown that there is a lot to do in transboundary surface and groundwater basin management. Radical change in way of thinking is a must in transboundary basin management .Therefore what to do first is simply accepting that "It needs more then cooperation" anymore.

It's time now to focus on the implementation of already identified tools, technological advancements, and new approaches (such as many of the great proposals that were presented during the conference) and evaluate and document what works and what doesn't.

There is also a need to move from the global analysis (which is very useful to quantify the problem) to localized and contextualized solutions that involve local partners. One solution definitely doesn't fit all. Participants concluded that during the past years there has been positive

progress in awareness, knowledge and tools development but there is a need to advance on policy coherence and sectorial planning.

Climate change progressively became a security issue for the countries, leading to a necessary change of water policies as well as their behavior to transboundary water management. It should therefore be a priority to promote deeper cooperation, comprehensive collaboration on transboundary water management in assessing climate change and its impacts on these strategical water resources.

In fact, classical cooperation approach between co-riparian states wouldn't be enough to manage the Transboundary Rivers and transboundary aquifers under the effects of climate change as well as new international relationships and new geopolitics. Besides the Transboundary Rivers, the proper governance of transboundary aquifers requires particularly high levels of international collaboration.

Sustainable transboundary water management need greater political and diplomatic engagement that can't be achieved only classical cooperative approach on water issues.

It requires shared vision, shared goal and unity of effort which means a real collaborative approach on the basis of new Hydro-diplomacy approach instead of tight classical cooperative one.

International water issues need more then Cooperation.

Biography

Dursun Yıldız is a hydropolitics expert and Director of the Hydropolitics Academy Association located in Ankara-Turkey. He is a civil engineer and used to be Deputy Director at State Hydraulic Works in Turkey; completed hydro informatics post-graduate course at the IHE in Delft,Technical training programme in USSR-USA and a master degree in Hydropolitics at the Hacettepe University-Turkey. He has over 5 years of teaching experiences in some Turkish Universities and now works as head of his own Hydro Energy & Strategy consulting company located in Ankara. He has published several international articles and 11 Books. He received Most Succesful Reseracher Award on International Water Issues from Turkish Agricultural Association in 2008. dursun.yildiz@gmail.com

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ISIS has turned the "Middle East Hydro-Politics" upside down

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ABSTRACT

The "Arab Spring"—a wave of pro-democracy demonstrations that began in Tunisia in late 2010 and swept across Libya and Egypt—finally reached Syria in early March 2011 The unrest resulted from a combination of socio-economic and political problems that had been building for years and that affect especially Syria's large rural population. One of the things that preceded the failure of the nation-state of Syria and the rise of ISIS have been considered the effect of climate change and the mega-drought that affected that region.

However, four years after the conflict began, it has degenerated into a civil war with more than 200,000 deaths and about 4 million registered refugees. And it has put Syria at the center of nasty geopolitical struggles.In most evaluations of the Syrian civil war an future, the most neglected analysis is: How water resources will affect the ongoing civil war and how changing situation will affect hydropolitics relations between countries after the war.

A far more sustained and thoughtful consideration of Syria's future, and how the country will be governed democratically, is needed. There are at least seven scenarios for the future of the country from Assad victory to ,stalemate, country breaks up ,regional conflict,chaos etc. In details, autonomy in some regions. confederal, federal,independent all or a bicameral parliament and highly decentralized provincial

structures, whatsoever the type of New Syrian system will be , there will be transboundary water issues that are more conflicted and somehow different than it was before.

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ISIS has been the most important and powerful actor in the civil war. It has played a very important role to change the region till now. If current political system of the Syria is changed or fragmented after the civil war that is likely to be , we can easily say that ISIS has turned the "Middle East Hydro Politics" upside down. Even if it is not well known right now ,this change will affect future of the regional stability with climate change effects in near future.

Keywords: ISIS,Hydro-politics, Orontes , Alawie State ,New Syria,New Middle East Map,

1. INTRODUCTION

The Civil War in Syria has become one of the most bloody and geopolitically important events to come out of the Arab Spring. While the war has become in many ways a sectarian Shi'a-Sunni battle, in Syria there is a third religious group that has played a pivotal role in the history of that country: the Alawites.

Syria Civil war is entering into a very interesting situation in coming months. Even if reaching an agreement seems to be very difficult between parties, the Future of the Syria and Al Assad's future could be under discussion between external parties.

Over the course of the Syrian civil war, there has been much speculation as to what the Assad regime's endgame plan might be.In this context has come the notion of establishing something along the lines of the "Alawite State" that existed under the French Mandate of Syria . A hypothetical Alawite State would be based along the northwestern Mediterranean coastline, including the traditional homeland of the rural mountains. Further, the port cities of Latakia, whose population is still predominantly Sunni, and Tartous would be included, being vital economic assets[20].

The Alawite region became a part of Syria as a by product of the notorious secret 1916 Sykes-Picot Agreement between France and Britain. It was placed under the French mandate after the end of World War I.

Alawite cooperation with French authorities culminated on July 1, 1922 when Alawite territory became an independent state. The new state had low taxation and a sizeable French subsidy.This independence did not last long. Although Latakia lost its autonomous status in December 1936, the province continued to benefit from a "special administrative and financial regime."When war broke out in 1939, a new generation of Alawites proved more flexible in cooperating with Syrian nationalists, most of whom were Sunni urban elites.

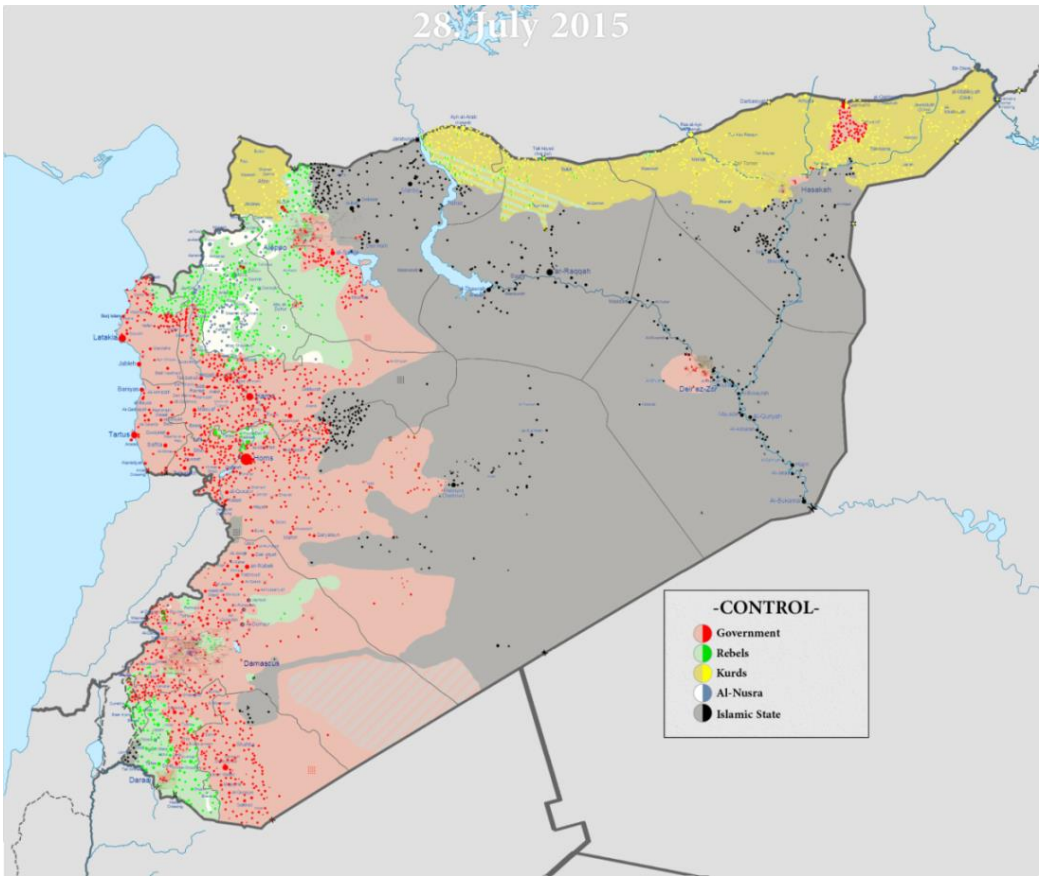

Figure 1. Situation in Iraq 28 July 2015

After the war, Syria obtained independence in 1946, but entered into a period of political instability, unrest, and experimentation with pan-Arab connections to Egypt.Once they recognized that their future lay within independent Syria, Alawites started to play an active role in two key institutions: the armed forces and political parties. About 15 percent of Syrians are Alawites, as is Assad.

1.1 **Fragmentation potential**

There is still a lot of uncertainties to make a robust projection about the future of the region. For instance, whether the Alawites who do want to secure an autonomous Alawite enclave or state can succeed largely depends on how divided the rebels remain after Assad's fall.

A Syrian professor says Iran hopes to fragment Syria and create an Alawite state to maintain power in the region. Syrian Professor Murhaf Jouejati, a member of the faculty at the National Defense University in Washington D.C said that[23].

"We were not talking about the fragmentation of the country before," Jouejati said. "However, the debate on the fragmentation of Syria is more serious than ever because the crisis in the country has become more sectarianized.

"We, Syrians, are against the division of the country which could lead to the establishment of an Alawite state."

There are numerous pressures- including social divisions among Sunnis (urban, tribal and so forth), ideological divides and personal power struggles among the rebel battalions, internal displacement owing to climate change and the civil war, and the issue of Kurdish autonomy.

Climate change mentioned above will not only be effective on divisions among Sunnis, but also be effective on water resources most of them are transboundary and conflicted . These transboundary waters affected by climate change will be one of the most important actors that will shape of the future of the Syria as well as the region. This also means that regional hydro-politics will affect new establishments in the region and will be drastically affected by the new shape of the Syrian political system.

2.WATER POTENTIAL IN SYRIA

2.1. Hydrology

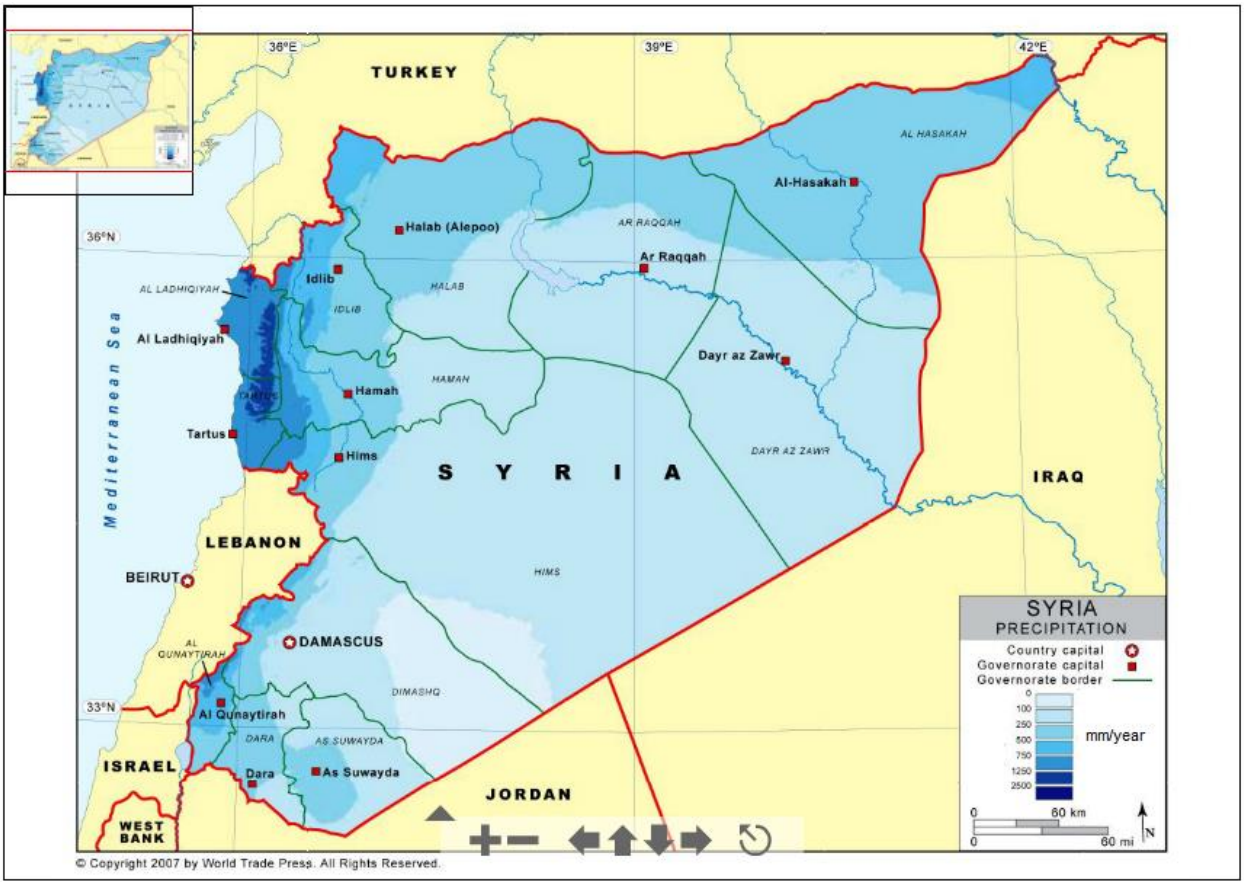

Figure 2. Rainfall in Syria

Syria, with an area of about 185,180 km and a total population of 21.13 million, has five agro- 2 10 ecological zones depending on rainfall. Humid zones are located in the west, along the Mediterranean coast (Fig. 1). Arid and semiarid zones are located in the east, north, and south. There is a large seasonal variation in water resource availability.

The annual rainfall in Syria decreases from about 900 mm at the coast to about 60 mm in the eastern parts (Fig.2). More than 60% of the country receives less than 250 mm/year, which makes the country water scarce. About 1300 mm/year in the western parts and reaches 3000 mm/year in the eastern and south- of Syria. Renewable and available water resources were estimated using all publicly available data on surface and groundwater[4].Fig 2 shows that the rainiest part of the country is now under governmental control part.

2.2. Surface waters

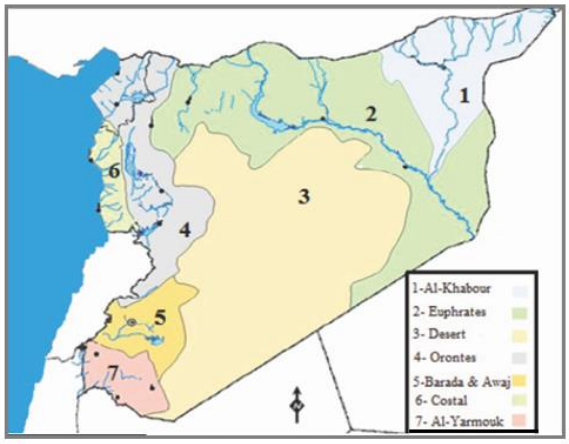

Figure 3. Hydrological basins in Syria

Syria can be divided into seven main water basins: Khabour, Barada and Awaj, Al-Yarmouk, Orontes, Dajleh and Euphrates and Aleppo, Desert, and the Coastal Basin, each of which has its own geological, meteorological, hydrological, and demographic characteristics (Fig. 3).

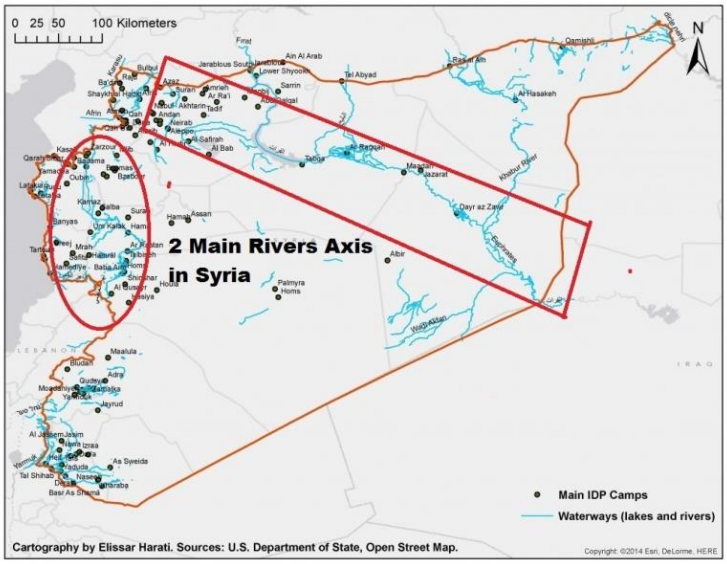

Figure4. Main River Systems in Syria

For these basins, Syria has 21 main rivers, 12 of which are shared with other countries in the region and some of them are now seasonal streams[4].

But the main river systems in Syria can be considered as Euphrates with Khabur and Orontes as shown in Fig. 4. Distribution of agricultural land can be seen in Fig. 5.

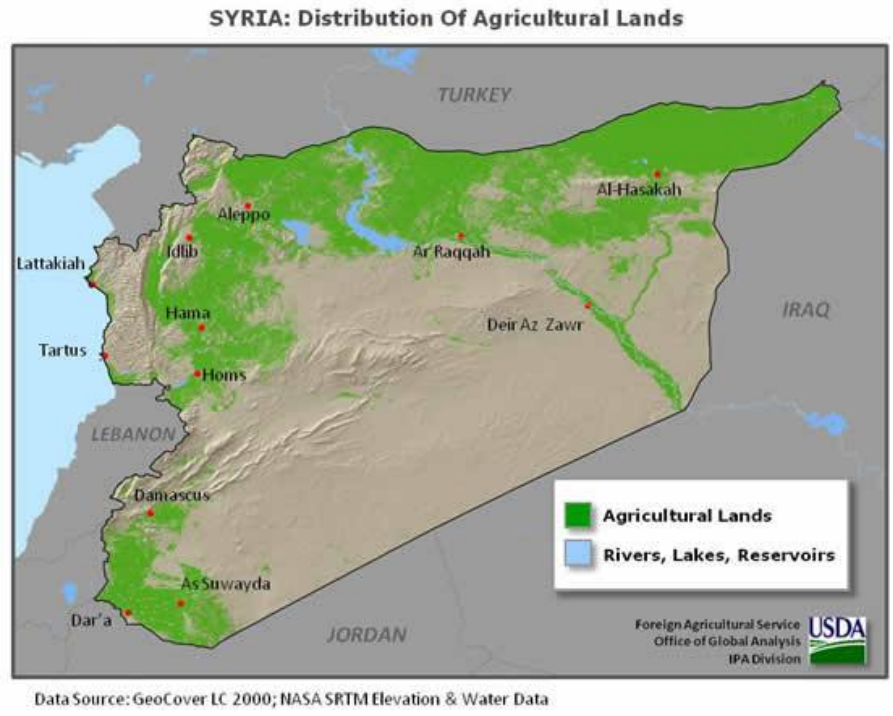

Figure 5. Distribution of agricultural land in Syria .

Syria has made treaties with its neighbors, Lebanon, Jordan, Iraq, and Turkey to ease managing shared water resources in the region. For the Euphrates River, shared between Turkey, Syria, and Iraq, Turkey agreed to release at least 500 m^3 /s to Syria. Syria will use only 42%, while the rest is released to Iraq [4].Two agreements were made with Lebanon. The first in 1994 concerned the Orontes River. The agreement states that Lebanon can use an annual amount of 80 MCM during years when the average river flow is more or equal to 400 MCM/ year and otherwise 20%.

The second agreement in 2002 was in the Al-Kabir Al-Janubi River with an average annual flow of 150 MCM. The agreement divided the water into 60% for Syria and 40% for Lebanon regardless of hydrological circumstances[5]. The total annual amount that enters Syria, according to these agreements, can thus be assumed to be 320 + 90 = 410 MCM.

2.3.Groundwater

The MoI estimated average annual spring flow at about 1350 MCM and the total annual amount of renewable groundwater at about 4811 MCM, which includes almost all springs and legal wills. For groundwater flow, on the other hand, about 1200 16 and 130 MCM annually enter Syria from Turkey and Lebanon, respectively. However, also about 90 and 250 MCM annually leave Syria to Jordan and the Occupied Lands, respectively[6].

3.THE CIVIL WAR AND ITS DEVELOPMENT

When we looked at the civil war and its development direction in Syria and Iraq, we can see that reaching regional stability will take time. But when the current chaos and civil war settle down it is highly probable that we will see a new political map of the region.It can be called the New Middle East . In this case the main and skillfull "international actor's name" of this "progress" is "ISIS".

ISIS was formed in April 2013, growing out of al-Qaeda in Iraq (AQI).It has since been disavowed by al-Qaeda, but has become one of the main jihadist groups fighting government forces in Syria and Iraq.Its precise size is unclear, but it is thought to include thousands of fighters, including many foreign jihadists.Prof Peter Neumann of King's College London estimates that about 80% of Western fighters in Syria have joined the group.IS claims to have fighters from the UK, France, Germany and other European countries, as well as the US, the Arab world and the Caucasus.

Unlike other rebel groups in Syria, IS is seen to be working towards an Islamic emirate that straddles Syria and Iraq.The group has seen considerable military success. In March 2013, it took over the Syrian city of Raqqa - the first provincial capital to fall under rebel control[19].

The group has gained a reputation for brutal rule in the areas that it controls. However, it was its conquest of Mosul and Musul Dam in June 2014 threatening floods with death and destruction that sent shockwaves around the world.

How much territory does IS control?

In September 2014, the director of the US National Counterterrorism Center said IS controlled much of the Tigris-Euphrates river basin - an area similar in size to the United Kingdom,.Seven

months later, the US military declared that IS had lost about a quarter of its territory in Iraq, but that its area of influence in Syria remained largely unchanged, with losses in some areas offset by gains in others.In fact in reality, IS militants exercise complete control over only a small part of that territory, which includes cities and towns, main roads, oil fields and military facilities.

They enjoy freedom of movement in the largely uninhabited areas outside what the Institute for the Study of War calls "control zones", but they would struggle to defend them.

Similarly, it is not entirely clear how many people are living under full or partial IS control across Syria and Iraq. In March 2015, the president of the International Committee of the Red Cross puts the figure at more than 10 million.

The territorial gains this summer by the Islamic State in Iraq and Syria (ISIS) in both showed that a new Middle East political map is coming true even if some experts have opposite idea.American bombing helped to turn back some of its recent gains in northern Iraq, but no one claims that ISIS has been defeated.

3.1.Regional Instability caused by ISIS

ISIS can be seen as an outgrowth of the new Middle East map. The root cause of this region-wide crisis is the failure of state authorities to be able to control their borders and their territories, to provide services to their populations and, ultimately, to forge a common political identity that could be the basis of the political community.

This collapse of normal state authority has not only occurred in large swathes of Syria and Iraq; it is also occurring in Lebanon, Yemen, Libya and perhaps even in parts of Egypt. In the absence of central government control, local forces emerge, based on sectarian, ethnic, tribal and regional identities, to fill the gap. The Kurdish Regional Government in Iraq, Hezbollah in Lebanon, the Huthi movement in Yemen and the various sectarian militias in Syria and Iraq are, in their different ways, similar manifestations of the failure of centralized governance in these countries.

Some experts say that ISIS is extremely well organized and disciplined. One of its great strengths at the propaganda level is that it is not the client of a foreign power [19].

3.2. How ISIS has turned the “Middle East Hydro Politics” upside down ?

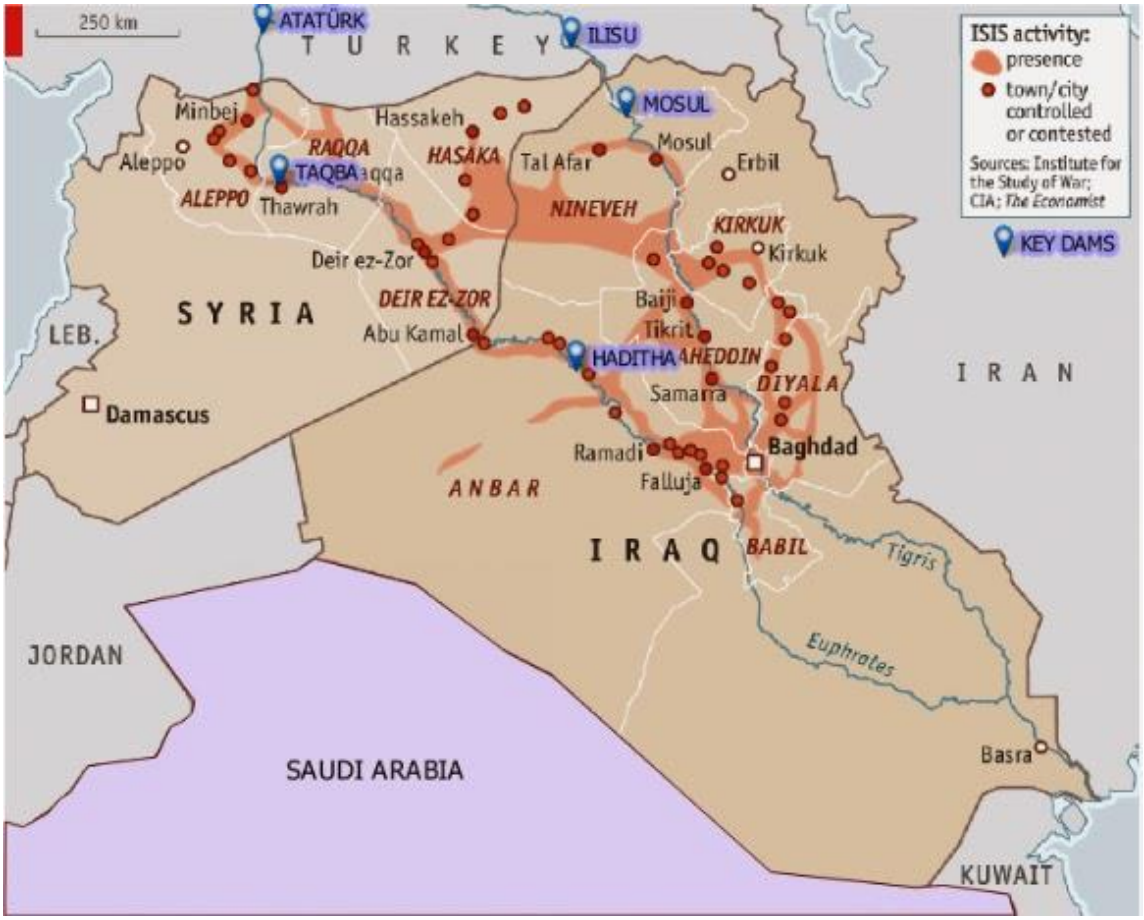

Figure 6. ISIS activity and control lands in the Euphrates and Tigris River Basin.

ISIS fighters have launched large amount of Syrian land as shown in Fig.1 as of July 28 2015 . As it is seen in the figure, the land under government control is surrounded in the western part of the country. ISIS has been controlling the most of the Euphrates and Tigris River basin as shown in Fig.6.

4. NEW MIDDLE EAST

4.1.Could an Alawite State be Established

It is not easy to say that yes. If reduce support of Russia and Iran, Assad may be lost Damascus, Al Assad for destruction of the civil war in 2011, started in establishing an Alawi state on the Mediterranean Coast. And was made a great humanitarian and military buildup in the region. In fact, as shown in Fig 1. This land has been already an Alawi state in terms of the majority of the ethnic population.

If Free Syrian Army conquered to Damascus, secular Sunnis and some Christians can come to this region and some of them can migrate to Lebanon.

If Russia and Iran don't give essential support for Assad to keep Damascus, but they will give a huge support to keep Nusayris. Because the region is in the hand of Assad's vital for Moscow and Tehran.Russia, for the Mediterranean Sea and Tehran for continued connection with Hizbullah wants to remain region in the hands of Assad.

Some experts claim, "Assad is guaranteeing the future Alawite state with a 60,000-strong militia." The Popular Defense Units have been set up not only in the Mediterranean belt, but in other regions, too. Those units are not made up solely of Alawites. The units are dominated by Sunnis in Sunni areas and by Alawites in Alawite areas. In Damascus and Hama, for instance, their majority is Sunni. It is vice versa in Latakia and Tarsus. Young people have assumed duty at checkpoints in their hometowns. Those in Damascus are more professional and take part in military operations alongside the army [1].

The most critical question here is that : ***Do the Alawites want an Alawite state?*** An Alawite from the region gave this answer[22]:

- *"The Alawites in Latakia, Tartus and Banias are absolutely against living by themselves. The Alawites who fled from Aleppo to Latakia remember their Sunni neighbors with gratitude. But if the jihadist Salafists come to power, the Alawites and the Christians will retreat to the coast as a last resort.*

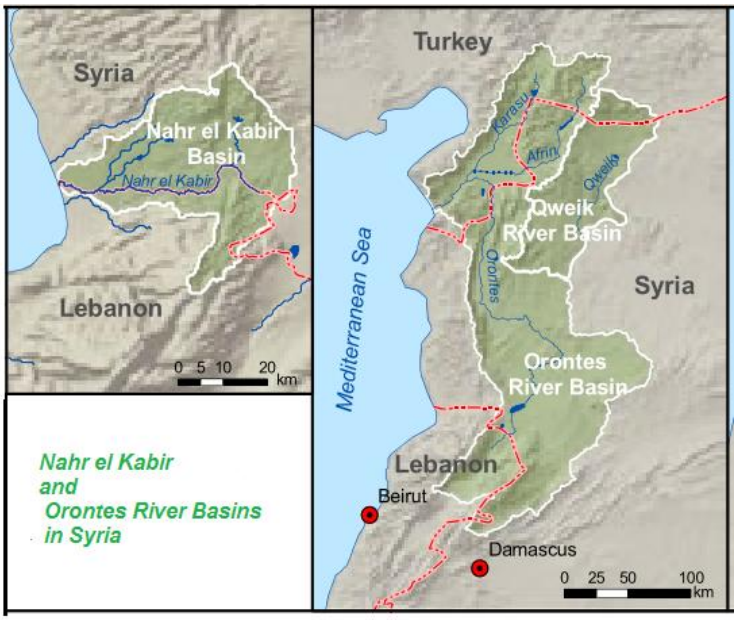

Figure 7. River basins in the land mostly controlled by governmental forces.

In fact the biggest fear of the Alawites is that they could be completely purged. Thus, the Latakia-Tartus-Banias belt could be considered the last way out of annihilation.It is obvious that

we cannot understand the civil war raging in Syria without understanding the Alawites community that became the most important power bloc in Syria after the 1970s.

The current situation map and development of the civil war show us former Syria regime can only reborn in the Eastern Mediterranean coasts of the country that has enough rainfall ,rivers and agricultural lands.(Fig.5,Fig.7).

The war has had little impact on life in Latakia and Tartus. Despite the tight control, daily life remains vibrant and the cafes are packed in the evenings. The bodies of more than 20,000 people have arrived in the region, but this is how things stand on the ground

4.2.What next?

But the most important question here is that "What next" ?. It seems that if an international strong agreement hasn't been reached under the guarantıe of Russia and Iran ,Al Assad can't be comfortable in this state for a long time of period.

Primarily opposition group will battle for Damascus and for that reason Assad will be relaxed for a period. On the other hand, the already fragile peace in Lebanon, after the great waves of immigration coming from Syria, which is completely transformed into a new phase of civil war. In summary, the Syrian-Iraqi civil war, the Middle East has already turned into a regional civil war situation.

Middle East regional civil war in this new stage can spread the next 10 years to structurally. That in itself risks includes, Israel will enter a long period of time to relieve.

If Russia and Iran would not support Assad , Assad will be drawn from Damascus , War comes to an end like this? But in this case the second phase of the war starts in Syria.

In fact the efforts to build an Alawi state will no doubt be supported by Iranian proxies and Alawi militias, who would have interests in the establishment of such a state. However, a retreat to an Alawi stronghold would represent a failure of the regime, and Assad has made it clear that he will live or die in Damascus[3].

Many analysts have argued that the Syrian regime has been setting the stage for a retreat to Syria's coastal mountains, the traditional homeland of President Bashar al-Assad's Alawi sect, and that sooner or later Assad will abandon Damascus for the coast[3,15].

If a new map of the Middle East will come true in this way ,this will totally change the Hydro-politics of the region.

4.3.Last Situation and Future

The situation in mid-2015 shows roughly who controlled which parts of Syria. The government dominated in the Alawite, Shi'a, Christian, Druze, and mixed Sunni areas in the west, with the

rebels holding much of the corridor along the Euphrates River and areas in the southwest of the country. The Kurds are defending the land in the north that has already been a zone in this area. At this point, a stalemate is very likely. The two sides are not strong enough to control all or even most of the country. If either side makes significant gains, the other is likely to be reinforced from abroad[22].

In February 2015, U.S. defense, intelligence officials assessed that the conflict was "trending in the Asad regime's favor," but predicted that pro-Asad forces would "continue to struggle and be unable to decisively defeat the opposition in 2015." [17].

Nevertheless, by mid-2015, U.S. defense officials were acknowledging rebels' subsequent gains, describing pro-Asad forces as "much weakened," and discussing the possibility that Asad could cede large areas of the country by withdrawing forces from some regions.

Some observers have argued that regime losses in confrontations with IS forces and with other opposition forces are creating public pressure on the government to improve military performance and leadership or to negotiate.

President Obama said in February 2015 that, in his view, "***The Syrian civil war will only end when there is an inclusive political transition and a government that serves Syrians of all ethnicities and religions."*** Formulation suggests that the current conflict could persist or evolve in response to any negotiated settlement seeking to replace the current Asad-led government with a government of national unity or other inclusive formulation.

But a big threshold here is the new election of Presidency in USA. If the democrats are not continuing in the power, expectations and projections will be different and the formula might be changed drastically.

Rand Cooperation Report[18] says that *"Syria's civil war is about whether Bashar al-Assad will continue to lead Syria's government, but the war increas- ingly reflects broader sectarian undercurrents that divide the country and the region. This is a central pathology of the Syrian conflict. It will impede its resolution".*

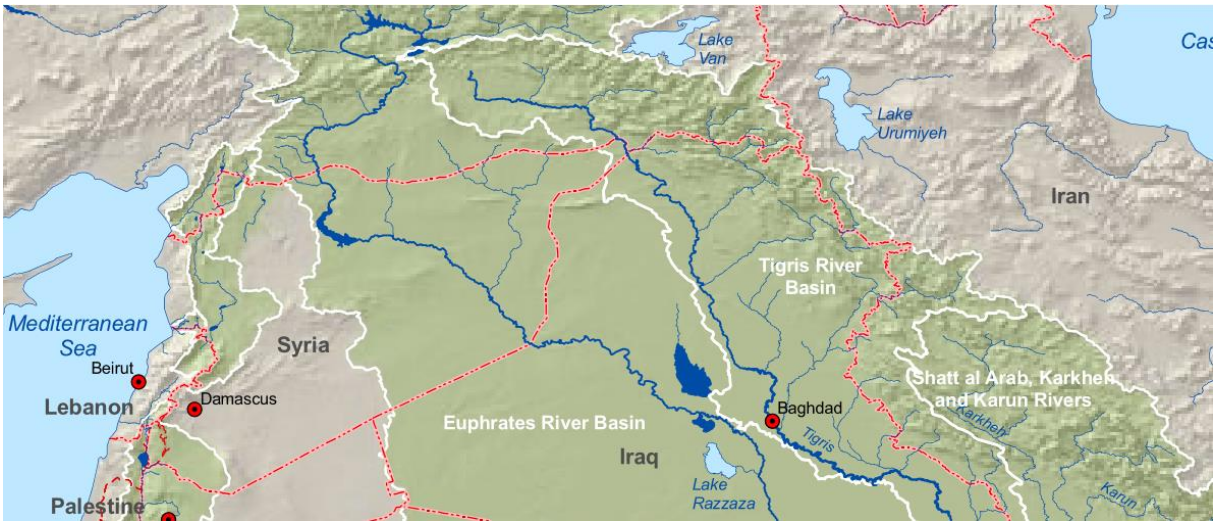

Figure8. Physical Map of Iraq and Syria

According to Al Monitor [22] western officials see the equation as follows:

"Russia and Iran are providing full support for the regime, and Moscow may raise its support after the events of Ukraine. There are no indicators that Tehran's policy will change. The regime is regaining control over areas in the Damascus countryside and is linking them with the coast. It is also increasing its grip on Damascus and closing the supply corridors from Lebanon. The military opposition is divided on the north between moderates and Islamists and between Islamists and jihadists and between the northern and southern fronts. The political opposition is facing challenges. The terrorist threat in northern Syria is rising, while it is limited in the south, and there are indicators that it is expanding in the Golan Heights."

5.CONCLUSIONS

Conflict in Syria enters its fourth year with high uncertainty regarding the circumstances on the ground, potential outcomes, and long-term consequences that need continual comprehensive analysis in many respects.

The conflict seems to be an existential struggle for all concerned, so not even the fall of Assad will bring an end to the violence. As of 2015, more than 4 million of the Syrian population is living as refugees, which will exacerbate existing sectarian tensions in neighboring countries that is very much important for future international relationship.

Uncertainty is unavoidable in the region and there is much that we do not know to make a stronger prediction Even if there is a long term international coalition strategy about the region ,it is not certain what will happen next in short . We may describe the situation as event-driven. It has changed dramatically during the past four years and is likely to continue to change. These continuing changes and instability could bring a disaster with the climate change effects in foreseeable future .Therefore stability in soon will be vital not only the countries but also whole region including Eastern Mediterranean.

But on the other hand ,instability in Syria is a platform for allowing all players to have their chance at furthering their agenda.Therefore It is not easy to predict future of Syria .
Some experts say "The most likely scenario is a continuing armed conflict lasting many years."But in the end , The outcome could result in a more traditional single power ruling Syria, a hybrid of the current array of players, or a regional free-for-all.

According to some experts the Syria conflict could easily last another decade.If the longer the war goes on in Syria , the more likely country breaks up will happen.

Whichever scenario came true we should be aware of that civil war has already turned the "Iraq ,Syria and Regional Hydro Politics" upside down. This changing will also be effective for future of the region. It is still effected on the lack of the international relations between riparian. If currently disintegrated political system is changed like federation, confederation or independent states in Syria , this new state not only will be influenced from existing water resources but also it will change the hydropolitics of the region. For instance, if there will be an independent Alawi state in mostly governmental controlled land, this new state will be an upstream country with it's only river of Orontes as controversial to the Syrian's downstream situation in the past.(Fig.8).

We should be aware of that Syria's problem is not as simple as Assad's presence in power; removing his regime would not by itself harmonize the interests embedded in the country's patchwork quilt of ethnic and sectarian identities. Syria may be unique, but the problems of governing a multi-ethnic country are not A far more sustained and thoughtful consideration of Syria's future, and how the country will be governed democratically, is needed.But Confederal, federal,independent all or a bicameral parliament and highly decentralized provincial structures, whatsoever the type of New Syrian System will be , there will be transboundary water issues that is more confused than before .

Undoubtedly, global warming and climate change will only exacerbate the Middle East's water problem. UN studies project that, by 2025, seven additional Middle Eastern states (Egypt, Ethiopia, Iran, Libya, Morocco, Oman and Syria) will be added to the existing 11 nations already experiencing water shortages (Algeria, Bahrain, Israel/Palestine, Jordan, Kuwait, Qatar, Saudi Arabia, Somalia, Tunisia, United Arab Emirates and Yemen).

These dynamics formed the background for the warning issued, in the not-so-distant past, by UN Secretary-General Boutros Boutros-Ghali to the effect that the next wars in the region will be over water.

Hydropolitics gives great cause for concern for the future of the region. But the picture need not be so dire and bleak. They say that "desperation is sometimes as powerful an inspirer as genius." In fact, collective dependence on scarce water resources represents a great opportunity for the region to work collectively toward the establishment of a regional cooperative regime – to begin with, through schemes of cooperation on the regulation of water usage, water sanitation and water management.

Water is not priority issue in the current civil war situation for the time being. The first things to be done is to stop the war and to avoid the civil war's worst situation in the region. But when tidel waves of the civil war lessen in short or long term, the sustainable peace and stability of the region will mostly be depend on new hydropolitics.

New Hydropolitics' footsteps in the Middle East.

The Hydropolitics will be more explosive issue in the Middle East in the near future .Water is prone to become a highly politicized issue with the new political systems or long term instability .It seems highly unlikely that , political stability of the region cannot be accomplished in soon. Therefore, different from 1915 it is obvious that water will play a more important role than oil in redesigning and stabilization of the region.

Over the next decade, the region is sure to experience great changes, not only political, but also hydropolitical,climatological,environmental.

IS fighters control most of the upper areas of the Tigris and Euphrates rivers, which flow from Turkey in the north to the Gulf in the south. All of Iraq and a large part of Syria rely on these rivers for food, water and industry. This is itself a considerable change in domestic hydro policies in Iraq. Civil war period has been a long term lack of improvement of water management system in Iraq as well as Syria. This period also represents the lack of trust building in Hydropolitics Relations between riparian countries.

In addition to this we will see that future uncerainity and drastically changing hydropolitics will play more important role in the future of the Region.

Contrary to some news and analyses, we think that IS' attempts to control certain water resources would somehow change current water policies an water managamnt , but wouldn't lead to a water crisis in the region.But in the long run, ISIS and other anti governmental forces began to change the hydropolitics and create a new water equation of the region. In fact , looking at the current situation and possible political future alternatives , we could say that the hydropolitics of the region has already been turned upside down.

It is so much important for the region because of that **"no peace without water, no water without peace" in the Middle East**

[1]Biography

Dursun Yıldız is a hydropolitics expert and Director of the Hydropolitics Academy Association located in Ankara-Turkey .He is a civil engineer and used to be Deputy Director at State Hydraulic Works in Turkey; completed hydroinformatics post graduate course at the IHE in Delft,Technical training programme in USBR-USA and a master`s degree in Hydropolitics at the Hacettepe University-Turkey. He has over 5 years of teaching experiences in some Turkish Universities and now works as head of his own Hydro Energy & Strategy consulting company

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Natural Diminishing Trend of the Tigris and Euphrates Streamflows is Alarming for the Middle East Future

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ABSTRACT

Over the last decade, numerous studies have appeared in books and journals addressing the climate change impacts on water quantity and quality of the Euphrates and Tigris River Basins .When one focused to these studies it can be seen that several studies link the Syrian uprising and subsequent outbreak of civil war to the drought. it also seems that when the current civil war is over , the most important need will be implementation of a basin wide sustainable water management policy. Therefore this requires more cmprehensive studies on current situation and future threats of the basin.

Some of the researches have stated in their recently published articles that ", a severe drought occurred by human-induced climate change and a mass migration of drought-affected farmers fled to Syria's,then the influx of migrants exacerbated unemployment and inequality in the cities, contributing to civic unrest over a nonresponsive government".Most researchers agree that climate change contributed to the drought in Syria and civil unrest crisis.

Recent studies have also noted that there has been an natural declining trend in Tigris and Euphrates Streamflows That means that changes in flow are more closely related to natural diplomacy features than with human interventions in Tigris and Euphrates Basins.

All this abovementioned results are alarming invitations to all riparian states in the Middle East to create a new hydro diplomacy .

Keywords: Middle East water, Climate change, drought, water shortage, transboundary rivers. Tigris and Euphrates

INTRODUCTION

Experience gained in the past indicated that result oriented transboundary rivers collaboration need more than some tight cooperation activities. In other words ,increasing threats on water including climate change force 21 Century Hydro Diplomacy paradigm different than that of cold war era in the 20 th Century.

Despite the great size of the Middle East, there are only three rivers that can be classified as large by world standards-the Nile, the Euphrates, and the Tigris. The watersheds of both the Euphrates and the Tigris are situated within the Middle East, predominantly in the countries of Turkey, Syria, and Iraq

The Tigris and Euphrates Rivers are the most important surface water resource for Turkey, Syria and Iraq . They are also important essential to life, socioeconomic development, and political stability in the Middle East.

Historically, development was limited to the semi-arid and arid zones of the lower reaches of the Tigris and Euphrates. The valleys of the two rivers encompass the northern portion of the famous "Fertile Crescent," the birthplace of the Mesopotamian civilizations. Owing to salt accumulation, waterlogging, and poor management of the canal system, the irrigated lands were progressively abandoned and the old civilizations declined

Experience gained in the past indicated that result oriented transboundary river management policies need stronger innovative approach than some tight cooperation activities . In other words , increased threats on water including climate change force 21 Century Hydro Diplomacy paradigm to be different than that of cold war era in the 20 th Century.

Figure 1 . The Tigris and Euphrates Basin

WATER POTENTIAL OF EUPHRATES-TIGRIS BASIN

The Euphrates-Tigris basin is by far the most important transboundary watercourse in Turkey, because 56 km^3/y originating from Turkey represents about 4/5th of the total domestic transboundary water potential (Bilen 1996).

WATER POTENTIAL OF EUPHRATES-TIGRIS BASIN

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The average water potential of Euphrates is around 32 km^3/y, that of Tigris around 24 km^3 /y in Turkey, the upstream country of both rivers, including tributaries flowing directly to downstream countries (Baran et al., 1995). (Fig.1). The total water potential of Euphrates is in the order of 37 km^3 /y, when 4 km^3 /y contributed by Syria and 1 km^3 /y from Iraq is added (there is virtually no contribution from Saudi Arabia); that of Tigris is in the order of 57 km^3 /y, where 10 km^3 /y from Iran and 23 km^3 /y from Iraq are added, neglecting the very small contribution from Syria; excluding Karkeh and Karun in Iran (Öziş, et al., 1997). Thus, for the entire Mesopotamian basin of Euphrates-Tigris, the total water potential is in the order of 94 km^3 /y.

In various publications dealing with the middle-eastern water conflict, the figures for the total water potential of Euphrates varied from 29 to 37 km^3 /y, those of Tigris from 42 to 58 km^3 /y. The differences between 37 and 29 km^3 /y, thus up to 8 km^3 /y for Euphrates on one hand, between 58 and 42 km^3 /y, up to 16 km^3 /y for Tigris on the other hand, were due to classified observations, lack of information, data bias and disinformation. These discrepancies should definitely be clarified and the accurate long-term water potential of the Euphrates-Tigris basin has to be determined, by contribution of all parties involved, before entering the discussions on any water allocation agreement. This corresponds basically to the first stage of the "three-stage plan" proposed by Turkey to her neighbors since 1980's, related to the development of the Euphrates-Tigris water and land resources.

The flows of the Tigris and Euphrates in Iraq are largely dependent on the discharges in Turkey. Much of the discharge of the Tigris results from the melting snow accumulated during the winter in Turkey. However, winter rains, which are common in late winter and early spring, falling on a ripe snowpack in the highlands, can greatly augment the flow of the main stream and its tributaries, giving rise to the violent floods for which the Tigris is notorious. The period of greatest discharge for the Tigris system as a whole is from March through May and accounts for 53% of the mean annual flow. The highest mean monthly discharge takes place during April.

Minimum flow conditions are experienced from August through October and make up 7% of the annual discharge.

The total flow of the Euphrates is not as great as that of the Tigris, although the river regimes are similar. It, too, rises in the highlands of Turkey and is fed by melting snows, to an even greater extent than the Tigris, but it lacks the major tributaries which the Tigris has. In Iraq, the period of maximum flow on the Euphrates is shorter and later than that of the Tigris and is usually confined to the months of April and May. Discharge during the two months accounts for 42% of the annual total. Minimum flows occur from August through October and contribute only 8.5% of the total discharge. The mean annual runoff of the Euphrates is 35.2×10^9 m^3 at its confluence with the Tigris (Shahin 1989; Beaumont et al. 1988).

These mean values, however, conceal the fluctuations in discharge that can occur from year to year, for it must be remembered that both floods and drought are themselves of variable magnitude.

DEVELOPMENT OF EUPHRATES-TIGRIS RIVER

The development of the Lower Euphrates in Turkey, within the context of G.A.P., together with Western and Central Tigris, serve as the driving force of the socio-economic development of the region. Hence, Turkey will regulate the flows for flood control, irrigation and/or energy production, as well as certain urban and industrial water supply schemes. About 1.8 million hectares of agricultural land will be irrigated in the context of G.A.P., two-thirds in Lower Euphrates and one third in Western and Central Tigris. 18 hydroelectric power plants with 20 TWh/y in Lower Euphrates, 12 plants with 8 TWh/y in Western and Central Tigris in Turkey are anticipated. Outside the scope of the G.A.P., 22 dams and 30 hydroelectric schemes with 9 TWh/y are planned on Eastern Tigris tributaries in Turkey. Keban -Karakaya - Atatürk - Birecik - Karkamış Dams and power plants form a continuous series of reservoirs on the Euphrates main river, down to the border with Syria. Among the major dams of the Upper Tigris, the Kralkızı, Dicle and Batman Dams are in operation.

DEVELOPMENT IN SYRI AND IRAQ

Three dams are located on the mainstream Euphrates in Syria; these are Teshreen with the maximal reservoir level reaching the Turkish border; At-Thawra (Tabqa) as the key dam for irrigation, energy production and urban water supply to Aleppo; Al-Baath to regulate the discharge of the former dam. Turkey's proposal to set up jointly a high dam (Yusufpaşa) using the head of Teshreen Dam in Syria and Karkamış Dam in Turkey, which will be more beneficial to both countries, has not been received favorably by her downstream neighbour. Three dams for irrigation (Saab, Taaf, Shuhey) are located on Khabur and two tributaries in Syria, originating as Cirçip & Zerkan and Çağçağ tributaries of Euphrates in Turkey (Kolars & Mitchel 1991; Karadamur & Hadid 1992;Bilen 1996).

Syria anticipates to irrigate 800,000 ha of land; however various factors, especially the soil quality appears to limit it to 300,000-400,000 ha. The application of the second stage of the "three-stage-plan" proposed by Turkey would have clarified this critical issue. Turkey's proposal to heighten and shift the location of the Cizre Dam towards the end of the Turkish-Syrian border formed by Tigris, in order to divert part of Tigris waters to supplement Syria's irrigation needs in Khabur region, has also not been received favorably by her neighbor. Hadithia Dam is located upstream of the Hit stream-gaging station on Euphrates in Iraq; followed by Ramadi weir, Habbaniyah off-stream reservoir, Hindiyah and Nassiriyah weirs near Kerbela, all supplying irrigation systems (Hadithi 1978; Bilen 1996; Altınbilek 2004). No significant water scheme is apparently possible nor anticipated on the ephemeral dry creeks at the south-west regions of the Lower Euphrates in Saudi Arabia.

The hydroelectric potential of the upper stretches of certain eastern tributaries of Tigris in Iran could eventually be harnessed by high-head diversion plants, diverted either by weirs or partly regulated by dams. There is no accurate information about such hydroelectric schemes; however, their operation might not cause serious problems, as long as the diverted discharges flow back to the same basin. Mossul (formerly Saddam) Dam, Fattah and Samarra weirs are located on the main River Tigris in Iraq. On eastern tributaries of Tigris in Iraq are located, some equipped with power plants, Bekme Dam on Greater Zap, Dokan and Dibbis Dams on Lesser Zap, Derbendikhan and Hamreen Dams, Adheim and Diyala weirs on Diyala; south of Baghdad on Lower Tigris in Iraq are located Kut, Dibban and Gharraf weirs; all supplying irrigation systems (Yussif 1983; Bilen 1996).

The Thartar closed basin in northwestern Iraq is used to store excess flood waters of Tigris; it is also linked with Euphrates, and might be used among other options, to transfer water from Tigris to Euphrates for irrigation along its banks (Kolars & Michell 1991; Beaumont 1992). The link between the two canals can better be directly established, bypassing the turbid waters of the Thartar Lake and avoiding excessive evaporation losses. Between Euphrates and Tigris in Iraq a long canal, called also the "Third river", was built to provide an efficient collection of the drainage systems. In this context, the marshlands of the Shatt-al-arab's delta have been significantly reduced; thus, environmental concerns of the "environmentalists", that the dams in Turkey cause significant reduction of the Shatt-al-arab marshlands, is substantially lacking evidence.

HYDRAULIC CIVILIZATION

The term "hydraulic civilization" has been used to describe societies similar to those in the alluvial lowlands of Iraq, which required large scale management of water supplies by the bureaucracies of central governments for widespread agriculture to be feasible.

Although the agricultural recovery of the Tigris-Euphrates lowlands began during the late nineteenth century, with the rehabilitation of a number of the ancient canals, it was not until the

early part of the twentieth century that the first modern river-control work, the Al-Hindiyah barrage (1909-1913) was constructed on the Euphrates. Its original function was to divert water into the Al-Hillah channel, which was running dry, but later, following reconstruction in the 1920s, it was also used to supply other canals. Between the two world wars, considerable attention was given to the Euphrates canal system, and many new channels were constructed and new control works established. Development on the Tigris tended to come later. The building of the Al-Kut barrage began in 1934 but was not completed until 1943, while on the Diyala, a tributary of the Tigris, a weir was constructed in 1927-1928 to replace a temporary earth dam that had to be rebuilt each year following the winter flood. The weir allowed six canals to be supplied with water throughout the year.

Following the Second World War, river-control schemes tended to concentrate on the problems of flood control. Two of the earliest projects, completed in the mid-1950s, were situated towards the upper part of the alluvial valley. The Samarra barrage was constructed on the Tigris River with the objective of diverting flood waters into the Tharthar depression to provide a storage capacity of 30×10^9 m³. A similar scheme was also built on the Euphrates, where harthar depression to the Al-Ramadi barrage diverted flood waters into the Habbaniyah reservoir and the Abu Dibis depression. It had been hoped that stored water from these two projects might be used for irrigation during the summer months, but it was discovered that the very large evaporation losses, together with the dissolution of salts from the soils of the depressions, seriously diminished water quality and rendered it unsuitable for irrigation purposes. In conjunction with the barrages on the main streams themselves, two major dams were constructed on tributaries of the Tigris. The Dukan dam, with a reservoir storage capacity of 6.3×10^9 m³, was completed on the Lesser Zab River in 1959, while further south, on the Diyala River, the Darbandikhan dam, with 3.25×10^9 m³ of storage, was opened in 1961.

Before Turkey began building large dams on the Euphrates, the river's average annual flow at the Turkish-Syrian border was about 30×10^9 m³. To this, a further 1.8×10^9 m³ is added in Syria from the Khabur River (Beaumont 1988).

LONG TERM DECLINING TREND IN THE EUPHRATES RIVER

Recent studies key findings on reasons of negative trend in the Euphrates Flow

When we do a comprehensive literature survey on the Euphrates flow's variation flowing to Syria and Iraq by the years , we can see belowementioned key findings in some articles ,books and reports;

- "Since Turkish and Syrian dams came into operation in the 1970s, the flow into Iraq has dropped dramatically – from 700 m^3/s to the current level of 260 m^3 /s." This is according to the agreements regulating the flow between Turkey and Syria (1987), and between Syria and Iraq (1990), respectively (Shamout, at all 2015.)
- ***" A comparison of the hydrographs in Figure 9 illustrates the alarming fact that <u>the river has lost 40–45 per cent</u> of its flow since the early 1970s, when most of the major dam infrastructure was established. This drop is a result of the huge storage facilities that have been built along the river***." (Shamout, at all 2015)

- "The natural flow regime of the Euphrates has changed entirely over the last 40 years, mostly due to human interventions, as exemplified by the water development programmes along the upper Euphrates (ESCWA-2013 the Euphrates River Basin Chapter 1 P.58).
- The annual reduction of the flow of the River Euphrates was 0.245 km^3 /year was 0.1335 km^3 /year . The reduction of flow in the Tigris River is less than that of the River Euphrates by 0.1115 km^3 /year. This is due to the fact that there are many dams constructed on the River Euphrates within Syria and Turkey (Al Ansari ,Knutsson 2011,Al Ansari 2013)
- With the construction of many dams in Turkey and Syria, the quantities of water that enter Iraq have decreased, and with the execution of an ambitious water management plan for Turkey (GAP), the quantities of water will decrease more and more (Al Bomola, Ahmed Hussein. 2012).

IS WATER REGULATION NECESSERY IN THE EUPHRATES RIVER?

The flow in the Euphrates River depends on snow-melt in the highlands of Turkey. Thus, the flow is highly seasonal, with high precipitation of snow during the winter resulting in peak flow in the river during the spring.

The availability of water through Euphrates River is not coinciding with irrigation requirements of the river basin in terms quantity and time.The peak river flow occurs in April and May due to the combined action of snow melt and rainfall, while the low season flow occurs during the period from July to December. The lowest flows occur in August and September when water is most needed to irrigate the land for winter crops (Fletcher, 2007).

For this reason, all riparian states have decieded to increase water storage capacities by building new dams, water diversion projects, and reservoirs, which use their storage water for irrigation and electrical power production .

Euphrates River has almost a yearly regular regime, characterized by two months of high discharge, which are the months of April and May, with maximum floods occurring between mid-April and early May under the combined effect of melting snow and rains .The river flow during just these two months is approximately 42% of the total annual flow (Kolars, 1994). This period is followed by eight dry months from July to February, and the flow in the river is decreasing after June reaching its minimum values around September to October. It is also worth to note that the annual flow of Euphrates varies considerably from year to year.

Negative trend in the Mean Annual Euphrates Flow (ESCWA-2013)

Iventory of Shared Water Resources in Western Asia is a very comprehensive recent study including a Euphrates River Basin Chapter. In this chapter ,Decrease in mean annual flow of the Euphrates at the Syrian-Turkish border (Jarablus) and Reasons of the negative trend were explained as follows;

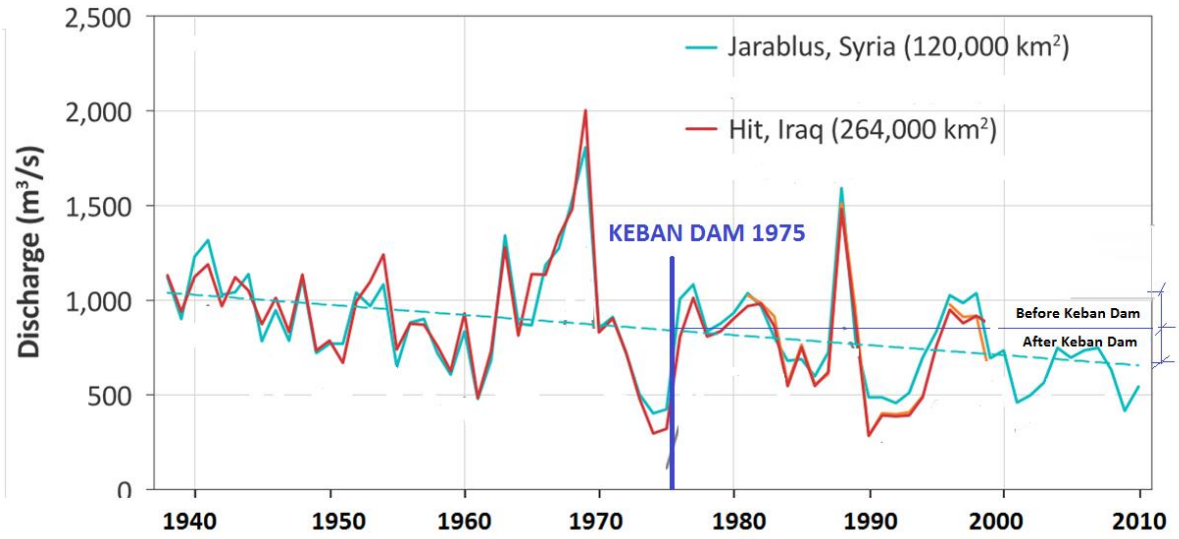

Figure 2. Mean annual discharge anomaly time series of the Euphrates River (1937-2010) (ESCWA 2013)

- *" Figure 2 shows a statistically significant negative trend for the period of record (1937-2010) on the Euphrates at Jarablus indicating a decrease in mean annual discharge. Before 1973, the mean annual flow of the Euphrates at the Syrian-Turkish border (Jarablus) was around 30 BCM, but this figure dropped to 25.1 BCM after 1974 and fell to 22.8 BCM after 1990 . <u>This is most likely due to climate variability and more frequent drought periods, and the construction of large dams in Turkey as part of the Southeastern Anatolia Project (GAP).</u>*
- *The construction of a series of dams in Syria and downstream Iraq since the 1960s has further impacted flow volumes due to regulation and increased evaporation losses.Even though a significant long-term trend could only be detected at Jarablus, all stations show lower mean annual flow volumes after 1973, most likely due to stream regulation through water abstractions and storage .*
- The Euphrates River Basin Chapter of The INVENTORY UN –ESCWA-2013 says that "The natural flow regime of the Euphrates has changed entirely over the last 40 years, mostly due to human interventions, as exemplified by the water development programmes along the upper Euphrates. **However, not all changes are negative as regulation of the Euphrates can protect downstream countries from destructive floods and droughts, provided that reservoir water is released"**

- Increased regulation of the naturally snow-melt-driven flow regime of the Euphrates resulted in less pronounced seasonal flow variation (1973 to 1998)
- Inventory says "The maximum storage capacity of the major dams and reservoirs (>144 BCM) on the Euphrates exceeds" .But as of 2015 ,Euphrates river has the total dam reservoir capacity in Turkey is 88.24 km^3 and it's only 35,3 km^3 is active storage capacity.
- Inventory says "The natural flow regime of the Euphrates has changed entirely over the last 40 years, mostly due to human interventions" Large Storage Dam Construction has changed the natural flow regime of the Euphrates .But in the same chapter it is accepted that the flow regime must have been changed because of needed Euphrates flow regulation . It is said that" However, not all changes are negative as regulation of the Euphrates can protect downstream countries from destructive water floods and droughts, provided that reservoir water is released"
- As it is indicated in the Inventory, Flow regulation is necessery in the Euphrates River . It is clear that upper part of the euphrates river is the most suitable (climatogically,and topoghraphically) region to be regulated the flow with smaller reservoir surface area and less evaporation as well as high storage capacity .
- The reason of the Regulating Seasonal Variability of the Euphrates River is described as follows in the Inventory; *"The seasonal variability of the Euphrates is not suitable to meet crop needs. Water for winter crops is most needed during the low-flow season in September and October. The flood season with frequent inundations in spring puts the harvest at risk. Engineering works have therefore prioritized Euphrates stream-flow regulation in order to provide irrigation water in the low-flow season."*
- The Euphrates river flow regime before 1973 can be considered near natural as there was limited water regulation in the runoff-generating area in Turkey.

The construction and operation of the Keban Dam in Turkey in 1974 and the Tabqa Dam in Syria in 1975 led to a shift in the Euphrates flow regime. The water discharged during the high-flow period from March to July was mainly stored to fill the reservoirs and released later. Therefore it is beter to say that Euphrates flows is not restricted but regulated for all riparian countries use . By this regulation of the naturally snow-melt-driven flow regime of the Euphrates resulted in more steady regulated flow .

For instance ;If we compare with the mean monthly flow regime before and after regulation we can see that releasing mean monthly flow at the Jerablus(Turkey –Syria border) is higher and steady in the period of 1974-1998 . In details, the flow measured at the Jerablus in the mounths of June ,July,August ,September,October,November, December,January February, is higher then the period of unregulated flow between 1938-1973.

In addition that the mean monthly flow measured at the Jerablus shows that flow is only 3 months lower then unregulated period .These months are March,April and May that measured at Jerablus about 1000 m^3/s as mean monthly discharge

CHANGES IN THE HYDRO-CLIMATE OF THE TIGRIS AND EUPHRATES BASIN.

Some of the publications stated a substantial changes in the hydro-climate of the Tigris and Euphrates Basin. Hydro-climatic effects of future climate change in the Euphrates–Tigris Basin are investigated by Bozkurt and Sen (Bozkurt and Sen 2013).They obtained a broad agreement amongst the simulations in terms of the winter precipitation decrease in the highlands and northern parts and increase in the southern parts of the Tigris and Euphrates Basin. They also found a statistically significant declines (25– Syria Iraq 55%) for the annual surface runoff of the main headwaters area(Bozkurt and Sen 2013).

Bozkurt and Sen concluded that projected annual surface runoff changes in all simulations suggest that the territories of Turkey and Syria within the basin are most vulnerable to climate change as they will experience significant decreases in the annual surface runoff.

It is highly probable that this trend will increase the challenges associated with the management of dam reservoirs and hydropower plants in the Upper Tigris and Euphrates basin.Bozkurt and Sen stated that the territory of Turkey will likely experience more adverse direct effects of the climate change compared to the territories of the other countries in the basin. The annual surface runoff is projected to decrease by 26– 57% in the territory of Turkey by the end of the present century. Because much of the headwaters are located in this territory, all other countries in the basin are expected to feel the stress for the diminishing waters during the twenty first century

The most likely adverse impact of the climate change in the Euphrates–Tigris Basin will be the decreased water availability.

SYRIAN CIVIL WAR AND WATER AND CLIMATE CHANGE RELATED FACTORS

Gleick, P. H (2014). stated that " The Syrian conflict that began in 2012 has many roots, including long-standing political, religious, and social ideological disputes; economic dislocations from both global and regional factors; and worsening environmental conditions". He argued that key environmental factors include both direct and indirect consequences of water shortages, ineffective watershed management, and the impacts of climate variability and change on regional hydrology.

Gleick also (2014). pointed out that severe multiyear drought contributed to the displacement of large populations from rural to urban centers , increased unemployment—with subsequent effects on political stability.

It seems that drought, water and agricultural management, and climatic conditions are factors in the syrian conflict and all these water-related factors are likely to produce even greater risks of

local and regional political instability.In order to reduce water insecurity in the region there is an urgent need to declare a political will for collaboration on transboundary water issues. Even if current limited political relation wont help to improve cooperation on water issues, this can draw attention to the issues and create an awaranes on the political agenda to be ready for emergency.

In the current civil war, some analysts have argued that factors related to drought, including agricultural failure,watershortages,and water mismanagement, have played an important role in contributing to the deterioration of social structures and spurring violence (Femia and Werrell 2013; FAO2012; Mhanna2013).

Some analysts have also argued that water withdrawals upstream by Turkey for its own agricultural production in the southern Anatolia region, and broader changes in regional hydrology have further contributed to a reduction in surface flows inside of Syria . All of these factors added to growing economic and political uncertainty. For instance Martin Hoerling, one of the study authors, stated, ‘‘The magnitude and frequency of the drying that has occurred is too great to be explained by natural variability alone’’ (NOAA 2013).

Fond (2016)from Circle of Blue mentioned about some studies concluded some relations between Syrian uprising that began in 2011 and severe drought. Fond stated that in March 2015, a study published in the *Proceedings of the National Academy of Sciences* laid out an argument for a climate-conflict link in Syria. This study found that precipitation during the winter months, when Syria receives most of its rainfall, was a third less in 2007 than the century-long average. The study also noted that the entire Fertile Crescent region (Traditionally the area between Tigris and Euphrates Rivers has been defined by scienticst as Fertile Crescent) in the eastern Mediterranean has seen a 13 percent reduction in winter rainfall since 1931 as shown in Figure 3 (Fond 2016). The boxes represents multi year droughts ,which are defined as three or more consecutive years when precipitation is belowe the century long avarage.

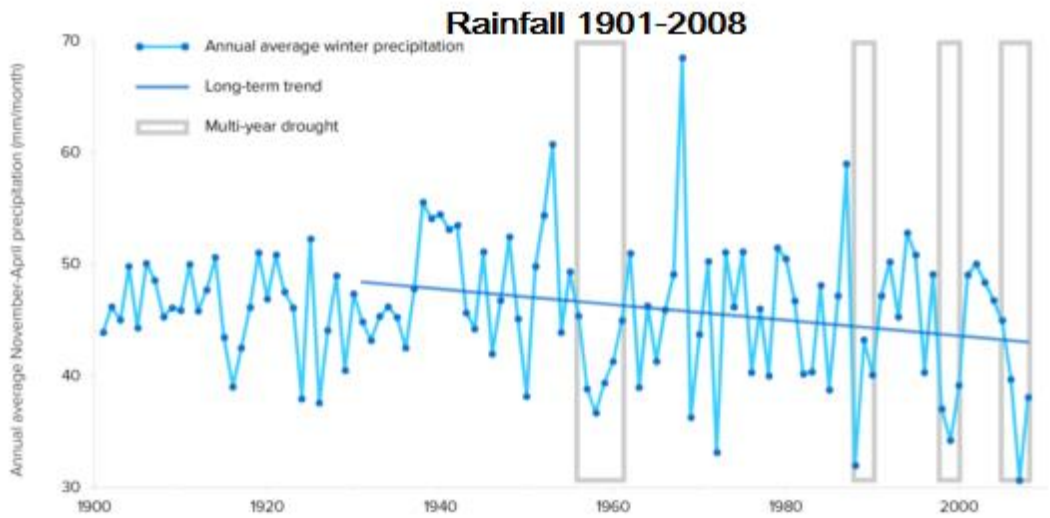

Figure 3 .Long term precipitation trend in the Fertile Crescent (Fond 2016).

Temperature has shown a long term increasing trend in the Fertile Crescent .Every year from 1994 through 2009 was warmer than the century-long avarage for the region (Figure 4).

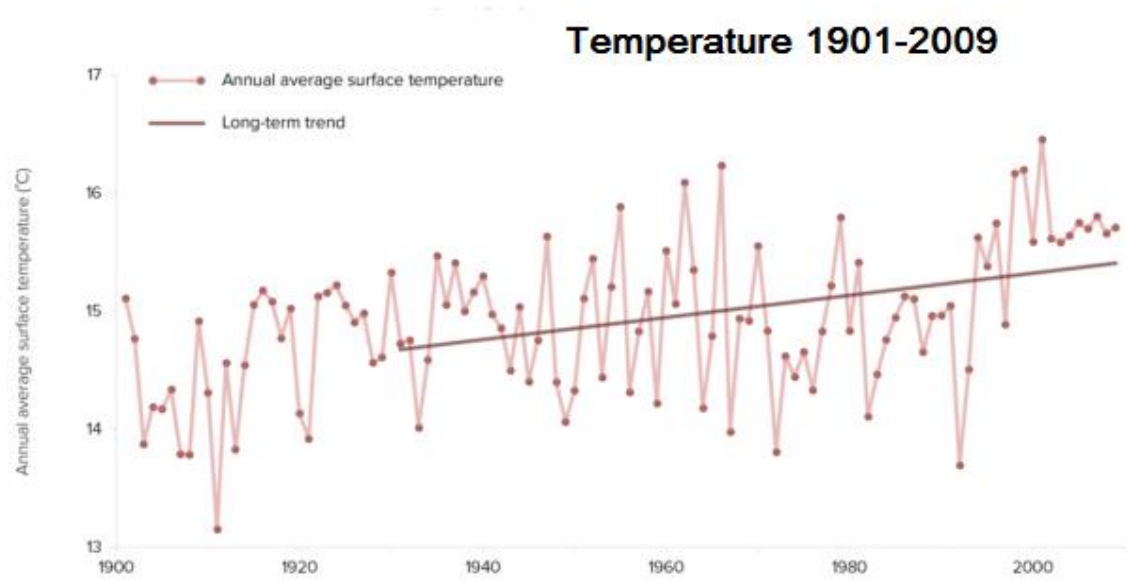

Figure 4 .Long term temperature trend in the Fertile Crescent (Fond 2016).

Another study published recently in the *Journal of Geophysical Research: Atmospheres* found that the 15-year period between 1998 and 2012 was likely the driest in the last 900 years in the region of the eastern Mediterranean that encompasses Syria (Fond 2016).

Kelley at all (2015) also stated obviously that "There is evidence that the 2007−2010 drought contributed to the conflict in Syria " He argued the drought had a catalytic effect, contributing to political unrest. Kelley et all(2015) estimates of the number of people internally displaced by the drought are as high as 1.5 million (IRIN 2009, Solh 2010, Massoud 2014). Most migrated to the peripheries of Syria's cities and the influx of an estimated 1.2–1.5 million Iraqi refugees between 2003 and 2007, many of whom arrived toward the tail end of this time frame at the beginning of the drought and remained in Syria (UNHC 2010).

Kelley et all (2015) stated that "By 2010, internally displaced persons (IDPs) and Iraqi refugees made up roughly 20% of Syria's urban population. The total urban population of Syria in 2002 was 8.9 million but, by the end of 2010, had grown to 13.8 million, a more than 50% increase in only 8 years, a far greater rate than for the Syrian population as a whole(US 2014). The population shock to Syria's urban areas further increased the strain on its resources (Erian 2011).

Most of the researchers agree the drought in Syria and it's contrubution of the displacement of large populations from rural to urban centers.This can take an evidence to asses the role of transboundary water managementin the region.

PREDICTION OF FUTURE CLIMATE CHANGE IMPACT ON WATER.

Smiatek et al. analysed the potential effects of climate change on water availability in the region using regional climate models (2013). The analyses focused on differences in annual spring discharge between second half of the 20th Century climate and climate until 2050 . The results showed potentially serious reductions in water availability from increased evapotranspiration demand and decreased precipitation (Gleick, 2014).

The relative change in mean discharge for the climate ensemble showed a decrease during the peak flow from March to May of up to 220% in the period 2021–50 and almost 250% in the period 2069–98, compared to the past climatic mean. Decreases of this magnitude would have dramatic effects on local water availability. A broader climate assessment for theTigris–Euphrates River basins evaluated the hydrologic impacts of climate changes (Bozkurt and Lutfi Sen 2013).

All simulations resulted in higher temperatures and variable precipitation changes .In all the simulations, decreases in snowfall due to higher temperatures were noted, consistent with many other studies of the impacts of climate change on mountain hydrology. Statistically significant reductions of 25%–55% in annual surface runoff from the headwaters regions of the Euphrates–Tigris watersheds were seen in all simulations. Bozkurt and Sen noted that these runoff changes ''suggest that the territories of Turkey and Syria within the basin are most vulnerable to climate

change as they will experience significant decreases in the annual surface runoff. (Bozkurt and Lutfi Sen 2013, p. 149).

HOW TO REDUCE CLIMATE AND WATER-RELATED CONFLICT RISKS

Reducing the risks of water-related conflicts requires reducing the pressures on water resources.Local economies and employment heavily depends on agricultural production .

Climate change and growing demands will make it progressively more difficult to reach agreements over time. As a further complication, few international water agreements include mechanisms for addressing changing social, economic, or climatic conditions.

The region firstly needs social and economical stability which is not likely to be seen in near future.But there should be something during this transition period to stability like creating awareness and if possible establishing some technical joint study committees. A new hydropolitics approach is also needed to improve present situation using gained experinces. Negotiations over the allocation of theTigris and Euphrates Rivers, for example, could include adjustable allocations strategies,response strategies for extreme events such as droughts and floods, amendment and review procedures in the event of disputes, and joint management institutions (Cooley and Gleick 2011).

Water in the Middle East is a complex issue that needs much more attention anymote .For instance Jessica(2009) is one of experts pointed out a new orientation in the geopolitical studies of water in the Middle East. Rather than continuing focus on the international dimension of water conflict in the region, which has received extensive attention in the literature, there is a need for more examination of political dynamics surrounding water use within the countries of the region.

PAST PRESENT AND FUTURE OF THE MIDDLE EAST TRANSBOUNDARY ISSUES

It is unfortunate that there have been no inclusive agreements over exactly how the water is to be managed between riparian state. Previous negotiations haven't led to significant steps forward to define and implement a framework for technical cooperation.

Turkey being the upper riparian has developed it's water potential in South Eastern Anatolian Project without any meaningful basin shared agreement.

At present, Syria and Iraq are suffering from serious security and social problems. It is also clear that thousands of people and farmers are suffering from water shortage problems and threat is increasing. Half of the Syria populationa has already immigrated .

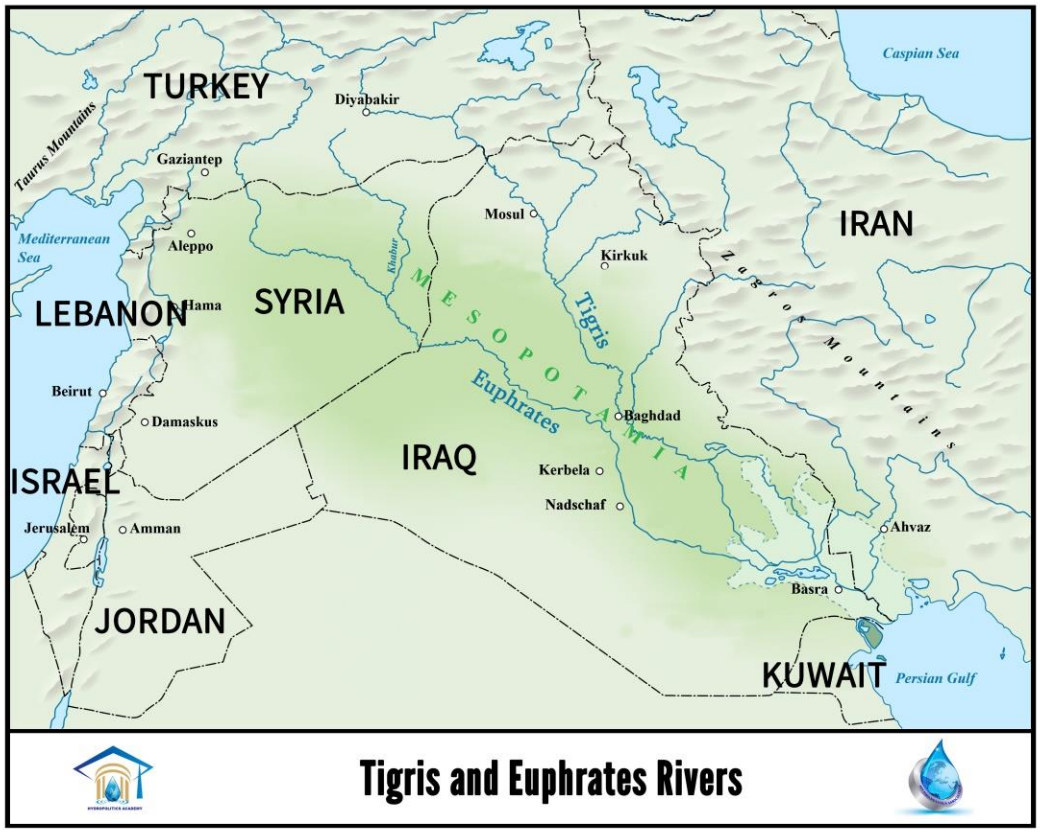

Figure 5 . Tigris and Euphrates Rivers Basins

Climate change forced water-related factors are likely to produce even greater risks of local and regional political instability especially if the region has limited political cooperation on water issues(Figure 5). This case has been mentioned in some of the most recent publication. For instance one of them (Kelley at all. 2015) indicate that "There is evidence that the 2007−2010 drought contributed to the conflict in Syria. It was the worst drought in the instrumental record, causing widespread crop failure and a mass migration of farming families to urban centers. Century-long observed trends in precipitation, temperature, and sea-level pressure, supported by climate model results, strongly suggest that anthropogenic forcing has increased the probability of severe and persistent droughts in this region, and made the occurrence of a 3-year drought as severe as that of 2007−2010 2 to 3 times more likely than by natural variability alone. We conclude that human influences on the climate system are implicated in the current Syrian conflict".

Gleick stated in his article (Glieck 2014) that "In the current civil war, some analysts have argued that factors related to drought, including agricultural failure, watershortages and water mismanagement have played an important role in contributing to the deterioration of social structures and spurring violence (Femia and Werrell 2013; FAO2012; Mhanna2013).

In the article(Glieck 2014 a) Gleick also stated that *"Water withdrawals upstream by Turkey for its own agricultural production in thesouthern Anatolia region, and broader changes in regional hydrology have further contributed to a reduction in surface flows inside of Syria . All of these factors added to growing economic and political uncertainty. The early warnings were prescient: some ofthe earliest political unrest began around the town of Dara'a, which saw a particularly large influx of farmers and young unemployed men displaced off their lands by crop failures."*

Gleick (2014 b) stated that Water use and the construction of large water infrastructure upstream by Turkey have also decreased surface water supplies flowing into Syria (see Figure 6).He also stated that "there is evidence that climate changes are already beginning to influence droughts in the area by reducing winter rainfall and increasing evapotranspiration"(*Gleick 2014 b)*

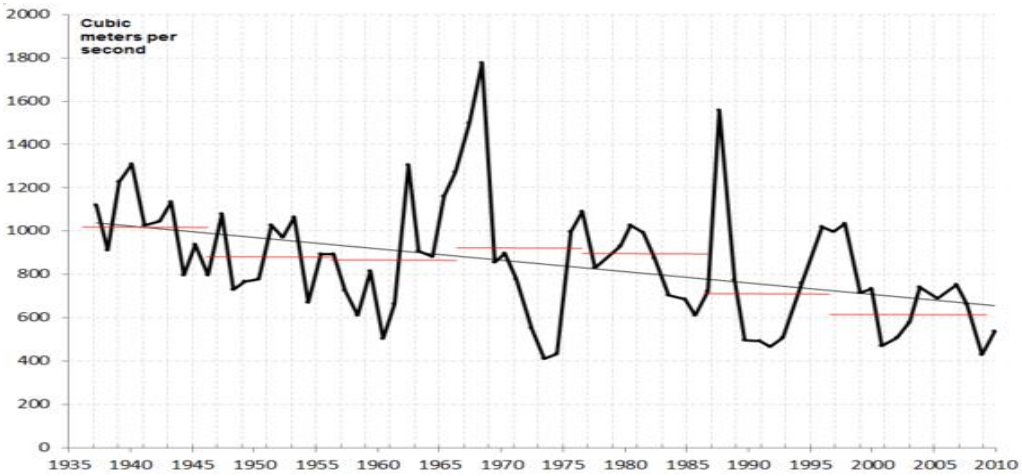

Figure 6 Discharge of the Euphrates River measured at Jarablus, Syria from the mid-1930s to around 2010. Red lines show the decadal averages. The long-term linear trend is also shown. Data from the United Nations Economic and Social Commission for Western Asia, 2013. (*Gleick 2014 b)*

Saleeby(2012), argued that ''*the regime's failure to put in place economic measures to alleviate the effects of drought was a critical driver in propelling such massive mobilizations of dissent*.''

Gleick(Glieck 2014) concluded that *"Severe multiyear drought beginning in the mid-2000s, combined with inefficient and often unmodernized irrigation systems and water abstractions by other parties in the eastern Mediterranean, including especially Syria, contributed to the displacement of large populations from rural to urban centers, food insecurity for more than a million people, and increased unemployment—with subsequent effects on political stability"*

Because of Syria and Iraq are too much involved in civil war , water shortage problems, lack of water management since last 5 years growing climate change threats are not of prime importance now .

But it is obvious that sooner or later, both countries will try to get their water requirements. Turkey is not seriously concerned to negotiate with Syria and Iraq and it might continue to negotiate to avoid any negative criticism from international community and it will lose nothing by agreeing to meet. Turkey will take the advantage of the present weak status of Syria and Iraq and continue to control the water of the Euphrates and Tigris Rivers according to its plans. All predictions models suggest that future water resources of the area are gloomier.

This implies that the conflict between the riparian countries must be solved as soon as possible and replaced by cooperation to overcome the problem. This can be achieved by a strong and influential mediator that can bring all the parties to the negotiation table. In the negotiations other maters can be discussed like the possibility of Syria and Iraq supplying Turkey with gas and oil in reduced prices. This can be an incentive for Turkey to cooperate. In addition, all countries (Turkey, Syria and Iraq) should set a long term strategic plan for the management of their water resources. This plan may be based on the ***"Natural Resources Interdependency Approach"*** that is based on unity of effort to regional development and interdependency on water ,food energy security.

All simulations resulted in higher temperatures and evaporative demand in the basins, with the greatest increases in the highland areas, where precipitation is greatest. Precipitation changes were variable, with decreases inthe northern portions of the watersheds and increases in the southern portions. In all the simulations, decreases in snowfall due to higher temperatures were noted, consistent with many other studies of the impacts of climate change on mountain hydrology. Statistically significant reductions of 25%–55% in annual surface runoff from the headwaters regions of the Euphrates Tigris watersheds were seen in all simulations, along with a shift in the timing of runoff.

The authors noted that these runoff changes ‘‘suggest that the territories of Turkey and Syria within the basin are most vulnerable to climate change as they will experience significant decreases in the annual surface runoff. Eventually, however, the downstream countries, especially Iraq, may suffer more as they rely primarily on the water released by the upstream countries’’ (Bozkurt and Lutfi Sen 2013, p. 149).

CONCLUSIONS

The Tigris and Euphrates Rivers are the most important surface water resource for Turkey, Syria and Iraq . They are also important essential to life, socioeconomic development, and political stability in the Middle East.Even the rivers are so much important , these states haven't reached yet a multileteral agreement to these transboundary rivers management. Tigris and Euphrates rivers are the %31 total water potential of Turkey and also vitally important for Syria and Iraq .

Therefore Turkey and Syria began to develope Euphrates in the mid's of 1970's. Turkey began to develope Tigris River late 199's. These development projects are not only important for Turkey but also necesserry to Syria and Iraq's water regulation need for agricultural production.

Because of riparian states hadn't reached to an agreement before construction of the projects these projects created high tension and conflicts between riparian states.

After modern exploitation projects the river's flow system has changed from a snow-melt system to a regulated-flow system. But in some articles, it is stated that *"the alarming fact that the river has lost 40–45 per cent of its flow since the early 1970s, when most of the major dam infrastructure was established. This drop is a result of the huge storage facilities that have been built along the river*."

In fact the alarming fact in the region is not regulating the flow (not losting 45 % of the flow) . but climate change effects on water resources and droughts that has influenced the civil unrest in Syria. It is estimated that by 2016, millions of Syrians had lost their livelihoods, with hundreds of thousands migrating to cities and other countries.

Several studies link the Syrian uprising and subsequent outbreak of civil war to this drought and how poorly it was managed. And weather extremes add to the challenges. In 2012 Baghdad suffered its worstrecorded foods in 30 years, and Damascus was paralysed by snowstorms in December 2013. The winter of 2014/15 has brought torrential rain and fooding to both Turkey and Syria.

Regional studies conducted by the Turkish Water Foundation suggests that by 2020 the river flow in Turkey will have dropped by 15–20 per cent compared with 'normal levels' established in the second half of the 20th century. A fall in precipitation has already been recorded at weather stations across the Euphrates basin. One result is that the Euphrates tributaries inTurkey and Syria now contribute much less to the main river flow than in the past, with their total contribution having gradually dropped since 1930's.

Experience gained in the past indicated that we are in need of a new innovative Hydropolitics approach. Increased different and stronger threats on transboundary water resources including climate change force a new Hydro Diplomacy paradigm.

For instance;previous negotiations couldn't reach any satisfactory basin management agreement.At present Syria and Iraq are involved civil unrest crisis and water shortages is not of prime importance now till they reach the stability. But in the long run they will meet their water problems. Turkey should be seriously concerned to this situation and never think to be taken the advantage of the present weak status of Syria and Iraq.Opposite to this approach Turkey should make some preperation to emergency management plan of the Euphrates and Tigris Rivers. Turkey has implemented a training study for engineers and technicians from Iraq for efficient irrigation water management last year.

Turkey should have known that if a water related conflict occurs in the region this certainelly will create instability and Turkey will seriously be influenced from this unstable situation . Turkey gained bed enough experience about the border security and regional instability till now.Therefore each riparian state has no luxary to create water management conflict under the effect of climate change and svereal threats increasing.Opposite to this they should have more responsibility to open the closed doors to improve cooperation.

New hydropolitical and commercial matters can be discussed like the possibility of Syria and Iraq supplying Turkey with gas and oil in reduced prices. This can be an incentive for Turkey to

cooperate in joint water project.Energy security and Food Security of the States can be taken into account with an innovative approach. For instance all new or old riparian states should be ready to set a new water management strategic plan based on the "Resources Dependence Theory".

Because the recent studies showed that changes in flow are more closely related to natural features than with human interventions in Tigris and Euphrates basins.This is an clear warning and alert invitation to all riparian states to set up an innovative hydro diplomacy in soon.

This alarming fact was argued and confirmed in the recently published articles including the ESCWA Inventory that had already showed diminishing in flow in the 'natural period' before dam constructions.Some other studies including made by Hydropolitics Academy showed that the diminishing trend has been continued till now and likely to be the same trend in future.

We as the Hydropolitics Academy aim to study to improve understanding of the real situation on water related issues in the Middle East for regional peace and stability.This article is a part of the study and also offers some independent support for recent studies concluding that climate change has had a significant influence on the present situation in the Region and will influence the future of the region.

Biography
Dursun Yıldız is a hydropolitics expert and Director of the Hydropolitics Academy Association located in Ankara-Turkey .He is a civil engineer and used to be Deputy Director at State Hydraulic Works in Turkey; completed hydroinformatics post graduate course at the IHE in Delft,Technical training programme in USBR-USA and a master degree in Hydropolitics at the Hacettepe University-Turkey. He has over 5 years of teaching experiences in some Turkish Üniversities and now works as head of his own Hydro Energy & Strategy consulting company located in Ankara. He has published severel inernational articles and 13 Books. He recieved Most Succesful Reseracher Award on International Water Issues from Turkish Agricultural Association in 2008. He is also President of Hydropolitics Association in Turkey. dyildiz@hidropolitikakademi.org.

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New Security Concept and Analytical-Transdisciplinary Approaches to Hydro Politics

Dursun YILDIZ[4], Dogan YILDIZ[5], Mehmet Samil GUNES[6]

Abstract—

Sustainable water management in transboundary river basins have gained more importancy related with climate change induced uncertainty that have increased since last 30 years. It is obvious that beside of water shortage, uncertainty also can create more tension between neighbouring countries in near future. Because the current status of governance of transboundary basins shows that 60% of transboundary basins do not have any agreements. One can also see that 80% of existing agreements are bilateral .Beside of this situation many agreements don't provide for regular data-sharing/ notification. They also don't establish water allocation&benefit-sharing criteria/processes. They don't contain dispute prevention/settlement rules and don't apply to entire river basin / aquifer system, etc. It seems that a new generation of literature will have somehow different hydropolitics definition to cover the new security concept that is differenet than that of cold war era security.This will influence the hydro diplomacy concepts in international relationships in the 21 st Century. In an attempt to help to clarify a new hydro politics concept, the article proposes an analytical-transdisciplinary approach to Hydro Politics Research. But this study does not attempt to have the final say or an exact definition on new hydropolitics concept. The philosphy behind this study is try to identify the hydropolitcs in connection with new world order and new security concept of 21st Century. In this Century Climate change related Water, Energy, Food, Environment security and their interrelations will play more important role for national and regional security issues.

Index Terms— Analytical Approach, Improved Hydropolitics, New Hydropolitics, New Water Diplomacy, Paradigm Shift, Transdisciplinary Research

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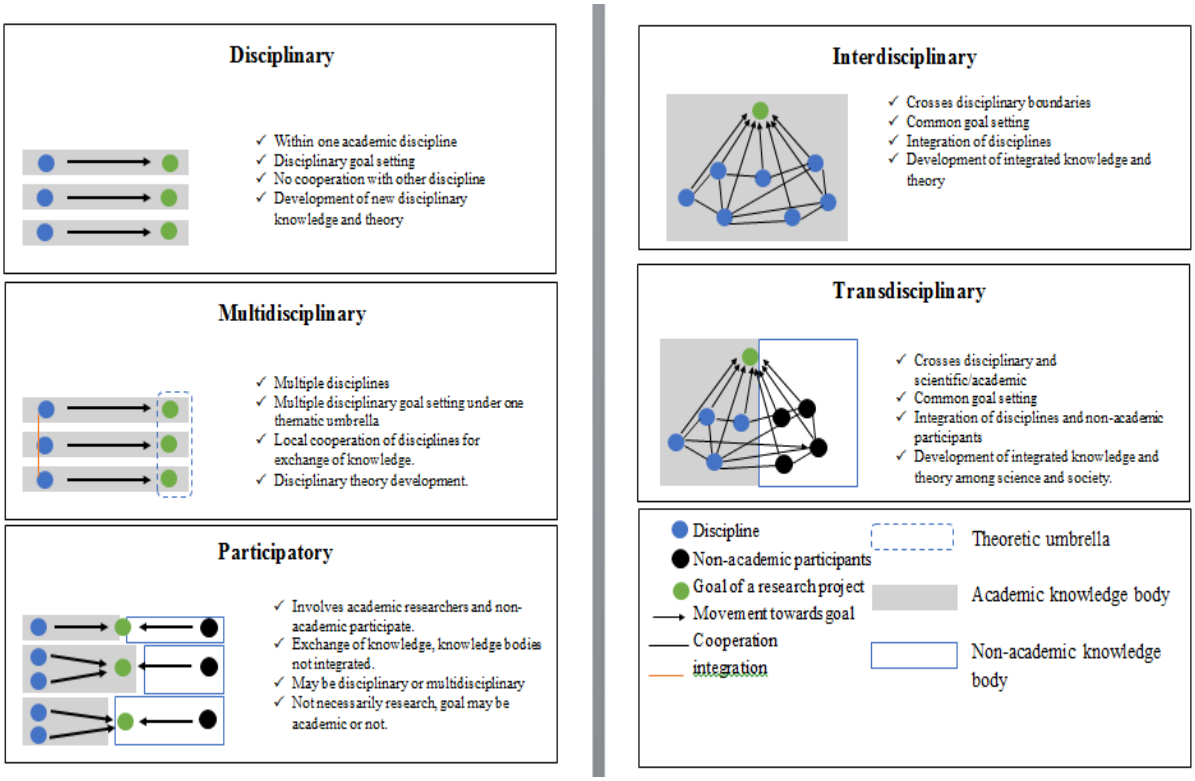
1 Introduction

There has been little advancement in the development of applicable and effective frameworks for realistic international water cooperation during last 60 years. But the world population lives in transboundary river basins has increased and reached approximately 45% of the total population during this period. Growing threats and the reality of global change calls for "**Innovative Hydro Diplomacy"** The new terms of hydro politics like improved hydro politics, innovative hydro politics, upgrade hydro politics, anthropocentric hydro politics [12] in the recent studies can be considered as a need of a paradigm shift to a new hydropolitics approach. UN General Assembly call for 'preliminary studies on the legal problems relating to the utilisation and use of international rivers in 1959. Text developed by International Law Commission, in collaboration with UN Member States between 1970 –1994. Even there hasn't been expected advancement in the development of transboundary river basins management, two main agreements came into force on transboundary waters are 1997 UN Watercourses Convention in 2014 and UNECE 1992 Water Convention in 1996 (EU), in 2013(Global).



2 Analytical Approach

An analytical approach can be defined as the use of an appropriate process to break a problem down into the smaller pieces necessary to solve it. In this case each piece becomes a smaller and easier problem to solve [9]. The problem solving prosess can be taken as a puzzle solving effort. This needs firstly understanding the systems and key pieces of the puzzle.

In the definition of analytical approach, the key words are "*fit and appropriate."* If your problem solving process is not appropriate and doesn't fit the problem, you can execute the process to the highest quality possible and still not solve the problem. This is the reason most people fail to solve difficult problems.They're using an inappropriate approach without realizing it. The process doesn't fit the problem [9].

If you are not using an appropriate analytical approach, you will never find enough pieces of the puzzle to solve a difficult problem.

In other words analysis means separating a problem into its constituent elements. If we can do that we reduce complex issues to their simplest terms. Mostly we usually focuse on the solution giving inadequate attention to alternative solutions.This might direct us to discuss and think hard expending a lot of energy but going nowhere.

Analytical means the use of analysis to solve problems.Analysis is breaking a problem down into smaller problems so they can be solved individually.For instance ; transboundary issues individual solutions of the total problem should be linked each other creating spill over effect to solve other easy but blocked problems.

A process is a repeatable series of steps to achieve a goal.That's why an analytical approach is the use of an appropriate process to break a problem down into the elements necessary to solve it. Each element becomes a smaller and easier problem to solve.

2.1 Appropriate Analytical Approach at Non Basin Scales

Transboundary water issues are also large and complex issues that requires appropriate process to break a problem down into the elements.

Smaller-scale transboundary frameworks, tailored to specific issues, may constitute a fit-for-purpose approach that helps achieve practical progress in the context of broader basin-level approaches.In fact instead of entire basin-scale focus , basin-scale with a focus on scales inside the basin is an innovative and goal oriented method to reach solutions [8]. Transboundary water management is widely advocated to be implemented at the basin level, and a growing body of basin-level institutions have been formed in transboundary waters.

However, transboundary water cooperation has also occurred at a range of non-basin scales. Ultimately, there may be a need to complement basin-scale focus with focus on scales inside the basin. Solutions to certain water issues may be effectively delimited at geographies other than the full basin [8].

An appropriate analitical approach to breake a problem down into smaller problems can be taken as a focus on scales inside the basin. This can make the water problems solution easier which is not directly related with the entire basin. For instance solutions to certain water issues (e.g., dam operation, flood prevention, pollution control, conservation works) may be effectively delimited at geographies other than the full basin. Accordingly, there may be a need for innovative water policy to create transboundary water rules and regulations that are tailored to suit such geographies.

In fact it is not easy to sustainable implementation of the partial agreements because of the hydro hegemony politics between riparians. But even so focus on a selective part of a basin may constitute more achievable or ‘second best’ forms of water management that may foster practical progress. The classical cooperation at a full basin scale, in recent decades has been softer, more politicized and arguably more precarious cooperation.Most of the river basin organisations have faced several difficuluties and strugguled to secure riparian funding.

It seems that practically oriented water cooperation occurs at more local scales. Accordingly build on momentum at the local level should receive the attention it deserves.

An analytical approach would go all the way down to the root causes. We should create a concept of root cause resolution with analytical approach When analysing the problem if dont analyze the matters we dont reach the root of the problems. In this case we only analyze the "proper practices" necessary to solve the symptoms of the problem, like renewable energy, reuse and recycle, cooperation. This so called analysis only deals with the superficial layer of the problem [17].

If we can not create a step forward except for exchanging data copperation in transboundary basins it means that we are still dealing with the superficial layer of the problem, so this step can be called as a superficial symptomatic solution step.

2.2The Understanding of Power and Power Relations

Recent political developments may reflect significant changes in the balance of bargaining power among the riparian states. There is evidence that over the last decade the upstream riparians have made increasing use of bargaining tools to influence negotiations [4]. Experinces gained till now showed that the understanding of power and power relations has given greater nuance to why and how conflict and cooperation occur in international trans-boundary river basins.

3.Hydropolitics! Multidisciplinary or (and) Transdisciplinary ?

Hydropolitics, a term developed in the 1990's, deals mainly with the politics of international water resources. It tends to be multidisciplinary and includes a political, technical, economic, social and legal approach to analysing international water issues.

In general it has been defined as a multi-disciplinary research and it is not only reflects the growing interest and concern over international water issues, but also the complexity of these same issues [3]. But as the years go by it has been in the scope of transdisciplinary research.

Therefore definition of the hydropolitics term as a multidisciplinary or transdisciplinary approach requires more detailed study on the base of the identifications given by Tress and Fry [2].Tress and Fry [2] define the concepts and the process of knowledge production in integrative research. They identified Disciplinarity, Multi-disciplinarity, Participatory, Interdisciplinarity and Transdisciplinarity.

Tress and Fry stated that "disciplinary, multidisciplinary and participatory studies (involving one, several academic disciplines and also non-academic participants, respectively), approaches the research one theme, but in a parallel manner.Interdisciplinary and transdisciplinary studies on the other hand are defined as being integrative studies, projects that involve several unrelated academic disciplines and, in the latter case, non-academic participants, researching a common goal by crossing subject boundaries to create new knowledge [2].

We need a transdisciplinary research, if there is a socially relevant problem field, where those involved have a major stake in the issue, if there is societal interest in improving the situation and the issue is under dispute [15].

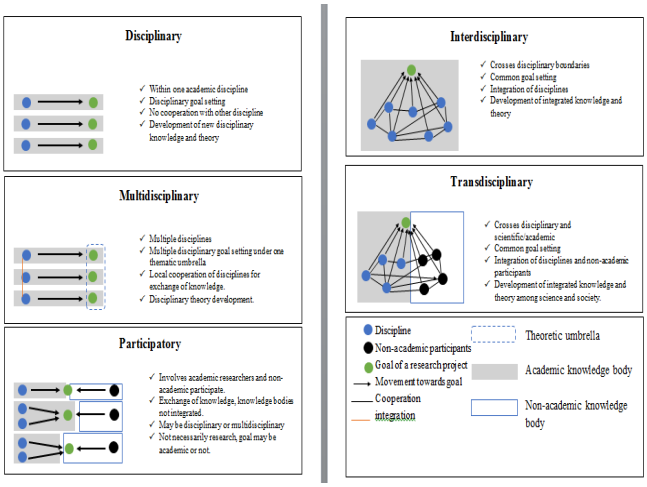


Fig 1. Disciplinary Research Types.[13]

Pohl and Hadorn also stated that "Transdisciplinary research develops descriptive, normative and practice-oriented knowledge in order to help solve, mitigate or prevent life-world problems"The transdisciplinary research process consists of three phases: problem identification and structuring; problem analysis; bringing results to fruition [15].

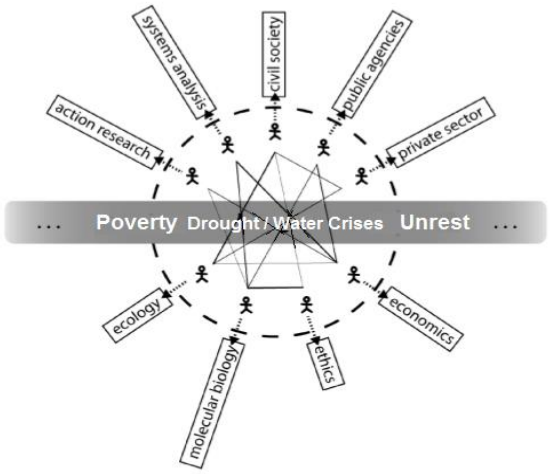


Fig 2. In transdisciplinary research, scientific disciplines (represented by individual researchers) and sectors of the life-world (represented by individual actors) are getting interrelated and transformed through a problem field. A transdisciplinary research project is the system build by the collaborative research process. [15].

Figure 2 describes the structure of a transdisciplinary research project as a system. The elements of the system are: the problem field, researchers from particular disciplines and actors of governmental and other public institutions, the private sector, the civil society or another sector of society [15]. Considering abovementioned information it can be said that Hydropolitics Research is closer to transdisciplinary research than multidisciplinary.

3.1 The Hydropolitıcal Security

In general most states define their security relations in regional rather than global terms and that when they confront global issues there is a tendency to see these as determined by the regional context. In effect the region dominates the perception of security"[6]. This approach can be taken as a major departure from the traditional military-state approach to security studies and is an important tool that allows us to put water at the centre of a security (and therefore foreign policy) analysis between riparian states.

3.2 What Is Hydro-diplomacy

According to Three elements are at the heart of hydro-diplomacy, which align closely with the principal objectives of the UN Charter, include the following:

1. The preventive nature of diplomacy in maintaining peace and security;

2. The need for dialogue in which traditional bilateral diplomacy is complemented by multilateral and multilevel diplomacy;

3. The notion of collective responsibility of the international community.

Water governance in a transboundary water resources context requires the meaningful engagement of a vast array of stakeholders through operational and functional mechanisms (formal and informal) but there is no one formula that works in all situations.

3.3 Bargaining Power

Power plays a significant role in influencing transboundary water relations and allocative outcomes, and must therefore be incorporated into any analysis. In this approach, hydropolitics are also considered to be characterized by hegemonic configurations, wherein the most powerful riparian states have an

advantage over their riparian neighbours to influence the allocation of the resources. Notably, the power available to the 'basin hegemon' assumes different forms – material, bargaining and ideational.

Bargaining power refers to the capability of actors to control the rules of the game and set agendas, in the sense of their ability to define the political parameters of an agenda [1]. Importantly, however, bargaining power is not the exclusive possession of the hegemon. It is bargaining power that makes the weaker actors in a given basin not as weak as they may be perceived [5]. By leveraging bargaining power, the non-hegemons can in theory improve their negotiating position vis-à-vis the hegemon(s), counterbalance their weaknesses in other fields of power, and eventually contribute to change the hydropolitical configuration. As such, bargaining power is a key element of any counter-hegemonic strategy [4].

The civil war in Syria and Iraq showed that if there is a war and unstability just near the border of a country this war can badly influence to the neighbouring countries creating somehow unstability like we have experienced in Turkey.

Therefore Syria and Iraq unrest and civil war has been an important example to defend not only national peace but also regional peace and security in some critical region. This means that bargaining powerful countries in a basin must consider this last Syrian example not to exert power hegemony that can create unstability in the region. This approach should especially be taken into account on transboundary water management issues. In other words we need shifting paradigm and conceptional change to regional stability and peace.

3.4 Shifting Paradigm and Conceptıonal Change

Conceptualizing conflict and cooperation in a linear fashion is not a solution-oriented approach. It is very hard to achieve transboundary water cooperation with normative assumptions starting from existing conflicted water issues.

Therefore it needs a new conceptual approach. It may be productive to focus on the analyses of rapid changing which brought new areas to collaborate between basin states rather than taking discrete events related to transboundary water interactions. We can say that "Traditional Water Conflict or Cooperation" concept ends with integrated approach with an emphasis on increased diversity and flexibility is needed. It is because of that numerous challenges are involved in water management. These various challenges call for multifaceted, more flexible hydro policy processes.

We need to shift the transboundary water management approach from Water Cooperation to Collaboration to achieve one step ahead to water related goals and security issues as soon as possible.

Concerns over transboundary water "cooperation" has to shift away from absolute water quantity to applicable

benefit sharing collaboration on water supply. If collaboration is essential in sustainable transboundary water management, a mutually beneficial way can help built this collaboration in appropriate transboundary river basins [19]. Most of the developments including climate change and nexus water, energy, food and ecosystem showed that a vital need is growing to get innovative approaches to transboundary water governance. We should develop very innovative approach to transboundary water governance in various basins of the World.

First of all we should downscale the concepts and principles of international treaties and regulations on water to a very local level. We should take into account that multilevel governance considering the balance between them. If building trust between the riparian countries is a must. Then we should find a new and innovative approach and more interdependent relationship apart from classical "cooperation"approach to built dependable and sustainable trust [20]. Muttualy beneficial interdependency is the only way to build it.

3.5 Why Hydroplitics Needs a Paradigm Shıft From Multidisciplinary Research

Sustainability challenges under climate change require new ways of knowledge production and decision-making for transboundary water management and related issues.

Transboundary rivers water is under the threat of climate change effects. Uncertainity is the most difficult parameter to define to adapt climate change. Therefore instead of multidisciplinary research, transdisciplinary research which the involvement of actors from outside academia into the research process is essential. This need is not only for collecting the best available knowledge but also create ownership for problems and solution options. Lang at all [10] suggested that " Transdisciplinary, community-based, interactive, or participatory research approaches are often suggested as appropriate means to meet both the requirements posed by real-world problems as well as the goals of sustainability science as a transformational scientific field."

Transdisciplinary approach realize the importance of local cultural, social, and economic factors in determining effective base, integrating knowledge from different disciplines related to these factors as well as experiential knowledge from actors in the cases under investigation.

We conclude that a new paradigm is essential and future research needed to further enhance the practice of transdisciplinary research for transboundary hydropolitics [14].

3.6 Why Transboundary Rivers Needs a Transdisciplinary research

Multidisciplinary research needs multiply disciplinary goal setting under one thematic umbrella. It also requires local cooperation of disciplines for exchange of knowledge. It is also needed disciplinary theory development.

But transdisciplinary research crosses disciplinary and scientific. It requires common goal setting instead of multiple disciplinary goal setting under one thematic umbrella.

Transdisciplinary research requires integration of disciplines and non-academic participants instead of local cooperation of discipilines for exchange of knowledge. Multidisciplinary developes Disciplinary theory as Transdisciplinary develops integrated knowledge and theory among science and society.Lang at all [10] defined one of the key principle of transdisciplinary research as“(re-) integration of the generated knowledge into scientific and societal practice”.

On one hand, while real-world implementation of the solution options to the sustainability problem is critically important, on the other hand to integrate the generated knowledge into the existing body of scientific knowledge is equally important.

In fact, mutual learning among the different transboundary basin commisions needs to be established and learning processes beyond the boundaries of individual projects must take place.

3.7 What To Do Achıeve Meanıngful Collaboratıon

In order to achieve meaningful collaboration win win is the best model in many case. It should be used a gradational levels of cooperation on water issues. It would be wise to focuse on the establishment of a joint committee. This committee can serve as a platform for data exchange and research on the issues of flooding. After a confidence building time the commite agenda can be extended to work on aquatic weed management and rules for navigation. When the committee reach a mutually agreement to take further step for adoptation, this could be second phase of the gradually varied establishment of the collaboration. In this stage to reach an agreement on a joint taxation and maintenance program for navigation could be possible. Next step would be an action stage that focuse on on the construction, operation and maintenance of joint infrastructure work.

During this muttualy understanding period, an acceptable and applicable cost sharing model should be negosiated for any infrastructure or river maintenance programs. It is important to find ways for riparian countries to satisfy each other’s interests for mutual benefit instead of zero sum result. For example, upstream areas of Malawi could incorporate downstream areas of Mozambique more concretely into flood planning and management activities. In return, Mozambique could offer concessions to Malawian vessels that wish to navigate from Nsanje to the Indian Ocean (and vice versa) [8].

As for specific, constructive ways forward in the Shire catchment, it can be started with small steps and low intensity. After a certain period of time, confidence building can identify the best opportunity for upscaling. Respective riparian advantages and interests can be a

cataliser to reach muttualy benefical collaboration point. After this stage it can be utilized adaptive approaches to find most appropirate way of application.

The mechanism will be used through all stages diverge from conventional approaches often used. Main goal is to reach an active collaboration on water related issues with spill over effects on different sectors [18] .Global norms can supply theoretical very large frames but contextual realities may lie at scales other than the basin wide or regional wide approaches.

4 Conclusion

Gained experiences have shown that there is a lot to do in transboundary surface and groundwater basin management. Radical change in way of thinking is a must in transboundary basin management. Therefore what to do first is simply accepting that “It needs more then cooperation” anymore. There is also a need to move from the global analysis (which is very useful to quantify the problem) to localized and contextualized solutions that involve local partners. One solution definitely does not fit all.

During the past years there has been positive progress in awareness, knowledge and tools development but there is still a need to advance on policy coherence and sectorial planning. Climate change progressively became a security issue for the countries, leading to a necessary change of water policies as well as their behavior to transboundary water management. It should therefore be a priority to promote deeper cooperation, comprehensive collaboration on transboundary water management in assessing climate change and its impacts on these strategical water resources.

In fact, classical cooperation approach between co-riparian states wouldn’t be enough to manage the Transboundary Rivers and transboundary aquifers under the effects of climate change as well as new international relationships and new geopolitics. Besides the Transboundary Rivers, the proper governance of transboundary aquifers requires particularly high levels of international collaboration. Sustainable transboundary water management need greater political and diplomatic engagement that can’t be achieved only classical cooperative approach on water issues. It requires shared vision, shared goal and unity of effort which means a real collaborative approach on the basis of new Hydro-diplomacy approach instead of tight classical cooperative one. International water issues need more then Cooperation.

Instead of entire basin-scale focus, basin-scale with a focus on scales inside the basin is an innovative and goal oriented method to reach solutions.

Solutions to certain water issues such as dam operation, flood prevention, pollution control may be easier other than the full basin management. Management frameworks at scales within basins

may no doubt need to be navigated carefully. Nonetheless, focus on a selective part of a basin may constitute more achievable or 'second best' forms of water management that may foster practical progress. As it is stated in IWMI Water Policy Brief No: 39, we shouldn't overlook focus on practical issues to achieve practical progress.

In conclusion, it would seem that a full basin scale cooperation, in recent decades has been more politicized and arguably more precarious cooperation. This has been reflected in the number of River Basin Organisations struggling to secure riparian funding.

It seems that meaningful, practically oriented water cooperation occurs at more local scales and building on momentum at the local level deserves more attention in order to improve relations on transboundary water management. Developing science and technology has been brought new opportunities to solve the problems. For instance; newly developed climate change models and many statistical models with reliable data will help to identify the future threats more precisely. Accordingly obtaining and implementation of the best solutions will be easier than before. But all these require improved water politics.

Transboundary Rivers requires transdisciplinary research that crosses disciplinary and scientific. It requires common goal setting instead of multiple disciplinary goal setting under one thematic umbrella.

New security concept requires an analytical-transdisciplinary approaches to 21 st Century Hydro Politics that is under the effect of serious climate change.

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Comparison Of The Long Term Natural Streamflows Trend Of The Upper Tigris River

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Abstract: *The Tigres River is a transboundary river that plays very important role on security, peace and stability in the Middle East. This paper presents trends computed for the forty-year period of yearly streamflows obtained from Upper Tigris Basin in Turkey. Because of the review of major trend studies for this region and the fact of streamflow being a privileged variable, a streamflow trend analysis study in the Euphrates and Tigris River seemed to be an important necessity.*

Simple linear regression model is adopted in this study. This paper mainly focuses on naturally changing trend in long term Tigris streamflows. Long term streamflow data obtained from the flow measurement stations located on the Tigris River. Measured data had some regulation effects of dams and irrigation projects were developed during some part of the measurements period. Therefore it is needed to find the most suitable sub basins with longest and most natural flow data of the Upper Tigris River Basin. These data from the sub basins were used to obtain natural trend of long term upper Tigris River flows. Best suited one with the main upper Tigris streamflows trend was choosen to be used to predict the rest of the natural streamflow trend of the upper Tigris River.

Mean annual flow data was obtained measured monthly data were used in statistical regression and Taylor diagram. We observed that natural factors are effective on declining trend of the mean annual natural flow of the Upper Tigris River. This key finding can be taken as a vital invitation to

Introduction

The Tigris is a transboundary river and of critical importance for water, food and energy security in the region. Therefore this river increasingly plays very important role on security architecture, peace and stability in the region. Therefore changes in the hydro-climate is also of importance for the region.

Sadik and Barghouti [1] emphasized that the extent of the problem is so severe that "the future challenges in meeting the growing demands for water are beyond the capabilities of individual countries". Mitigating supply shortfalls could be achieved by re-allocation of current agricultural supplies [2]. Future predictions suggest more shortages [3,4,5] and depletion of groundwater resources [6]. Present situation is very complex in Syria and Iraq. Future prospects are not better where showed that Iraq, Syria and Turkey will be among the most likely to be water-stressed in 2040. Iraq, Syria and Turkey were ranked 21, 25 and 27 respectively [7].

In some recent publications a substantial changes in the hydro-climate of the Tigris and Euphrates Basin has been mentioned and hydro-climatic effects of future climate change in the Euphrates–Tigris Basin are

investigated by some scientists. Bozkurt and Sen obtained a broad agreement amongst the simulations in terms of the winter precipitation decrease in the highlands and northern parts and increase in the southern parts of the Tigris and Euphrates Basin. They also found that the annual total surface runoff will decrease about 25–55% in the eastern Anatolian mountains (main headwaters of the basin) by the end of the 21st century. Bozkurt and Sen concluded that projected annual surface runoff changes in all simulations suggest that the territories of Turkey and Syria within the basin are most vulnerable to climate change as they will experience significant decreases in the annual surface runoff [8].

Most of the previous studies regarding trends in surface climatic variables in Turkey [9, 10] concentrated on temperature and precipitation patterns.

Burn and Elnur [11] indicated the similarities in trends and patterns in the hydrological variables and in meteorological variables. However, Lettenmaier [12] stressed that the trend in streamflow are not fully parallel to the changes in precipitation and temperature due to a combination of climate and water management effects.

Kahya and Kalaycı [13] strongly stressed the importance of trend analysis of hydrologic variables and presented trends computed for the long term monthly streamflows data in Turkey. They found the direction of trends is, in general, downward.

Zhang [14] study showed that under certain geomorphic conditions, the nature of river reflects the integrated watershed response to climatic forcing. Cayan and Peterson [15] and Kahya and Dracup [16] were also previously noted this point by in searching teleconnections between surface hydroclimatic variables and the large-scale atmospheric circulation.

Since the Tigris River is mostly fed by snow melt. Number of snow measurement stations have been increasing in the region but it is unfortunate that long enough snow measurement data is still not available to predict change in long term streamflow trend. Therefore to predict streamflow trends in related to trends in precipitation and temperature changes would be difficult. Because of that, change in the long term streamflow trend obtained by using natural flow data from stable, unregulated watersheds in statistical analyses can be considered as more reliable result.

The importance of trend analysis of hydrologic variables is obvious. In fact, streamflow is the most attracting variable to study on trend analyses of a streamflows in a watershed which is assumed not to be exposed to anthropogenic influences.

Consequently hydrologic variables are suitable to be used to detect long term streamflow trend and monitor climate change.

Therefore we try to define mean annual streamflows trend with a particular emphasis on natural flow regime characteristics (i.e. annual, monthly flows). In the study special emphasis is given to changes in streamflows measured at the most suitable water measurement stations. The main objective of this study is to define the long term tendency of the Upper Tigris natural streamflows using three tirubitaries mean annual data in the stastistical analyses.

Role of transboundary water management has gained vital importance especially in the region under the climate change effects like Central Asia and Middle East [17].

Therefore, climate change threat, adaptation measures and collaboration necessity might be a driving force to reach improved transboundary water diplomacy in 21st century [18].When we consider the climate, social and security threats

concerning with water management, the Middle East needs this new hydro diplomacy much more than before.

The Upper Tigris River

The Tigris River rises in eastern Turkey near Lake Hazar in Elazig Province and flows 1,840 kilometers until it joins the Euphrates. The Tigris is fed by several tributaries in Turkey. Such as Batman, Ilisu, Botan and Garzan. According to the figures of the Cizre Observation Station at the border, the Tigris has an average annual flow of 16,2 BCM. We identifiy this part of the Tigris River as the Upper Tigris in the study. The Tigris River river forms the boundary between Turkey and Syria for about 30 kilometers and then enters Iraq. On its journey through Iraq numerous tributaries enter the left bank of the Tigris from the Zagros Mountains to the east. Among these tributaries are the Greater Zab, the Lesser Zab, the Adheim, and the Diyala. The contribution of these tributaries is around 31,4 BCM. The Greater Zab has its sources in Turkey and joins the Tigris in Iraq. Hence the total contribution of Turkey to the Tigris reaches 21,3 BCM. With 21,3 BCM coming from Turkey, the Tigris reaches a water potential of 52,7 BCM near Quarna in Southern Iraq, ther Tigris and Euphrates join and continue as the Shatt al-Arab for the remaining 179 Km to the Gulf.

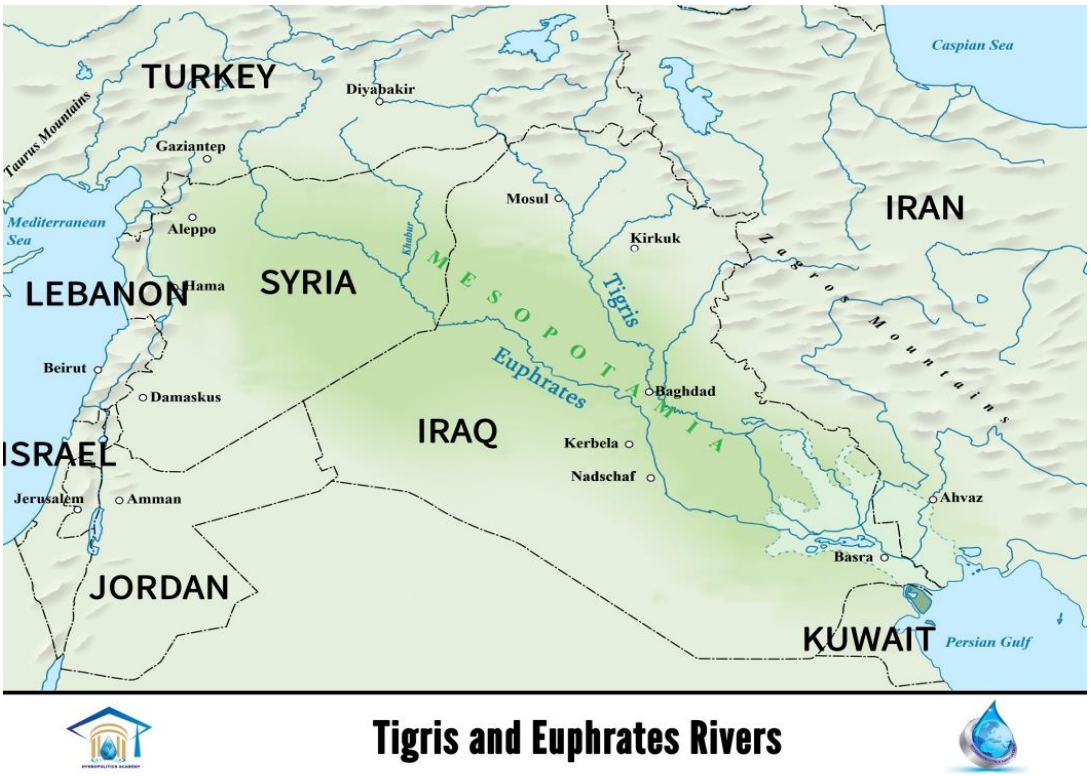

Figure 1: Tigris and Euphrates Rivers

Development of Upper Tigris River in Turkey

The Tigris is the second largest river in southwest Asia and rises in the Anti-Taurus Mountains of southeastern Turkey from Lake Hazar (elevation 1150m). Impounded by the Kralkizi and Dicle dams in its headwaters, the Tigris flows southeast crossing the agriculturally important Diyarbakir province of Turkey. It is fed by a number of smaller tributaries with the Batman and Botan Rivers being the two largest. Downstream of the Turkish city Cizre, the Tigris flows along the border between Turkey and Syria for 32 km and receives the waters of (Little) Khabur at the border with Iraq. Approximately 50 km northwest of Mosul, The Mosul Dam banks the river and forms the largest reservoir in the region. Downstream of Mosul, the Tigris flows south and the two largest tributaries join the Tigris on its left bank: the Greater Zab and Lesser Zab Rivers that originate from the Turkish and Iranian Zagros Mountains, respectively.24 On the Tigris, existing storage totals more than double (116,5 BCM) the average annual flow (52 BCM) of the river. Both Turkey and Iraq still have plans to build large dams on the Tigris. The Ilisu Dam Project of Turkey, which has been under construction has a storage capacity of 10,4 BCM and with hydropower capacity of 1,200 MW. The Project also includes the planned downstream Cizre Dam, which will work in parallel with the Ilisu Dam.

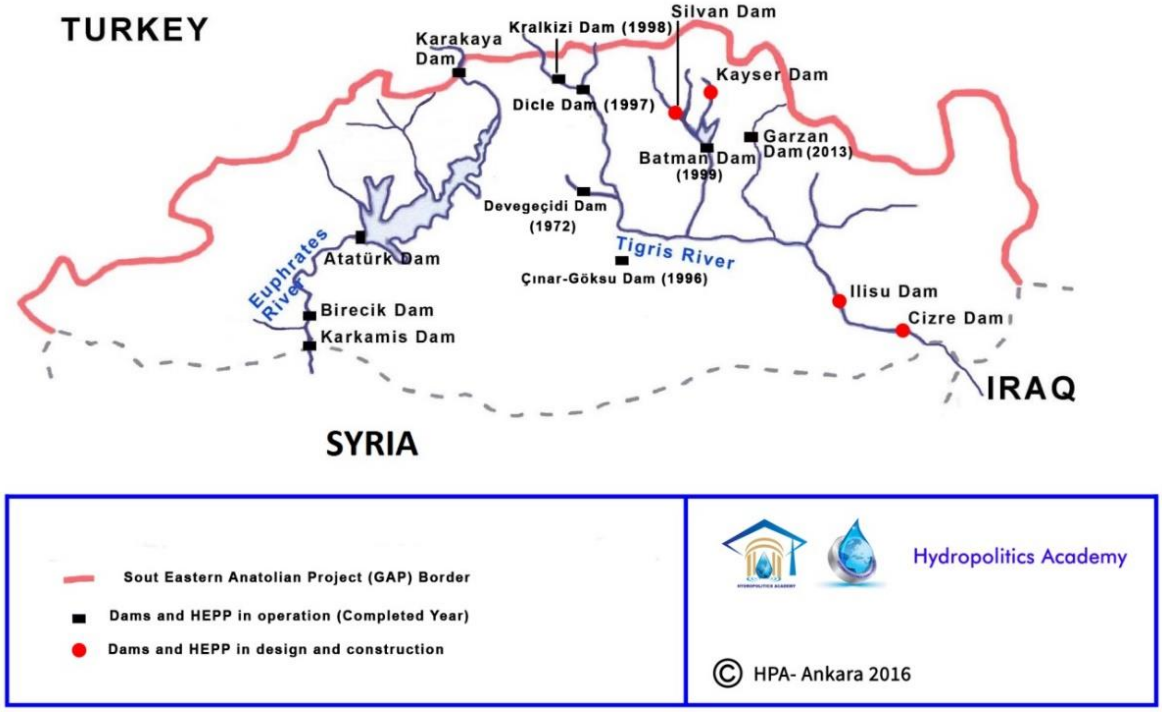

Figure 2. Operated and planned dams in the Upper Tigris Basin.

Data Description

In this study, monthly mean streamflow records compiled by EIE (General Directorate of Electrical Power Resources Survey and Development Administration) that is the most experienced state organisations related with flow measurement entire Turkey are used to get mean annual streamflow records.

In most hydroclimatologic studies, a completely natural streamflow data set can be rarely obtanied. Measured data can be influenced by regulation or diversion in upstream of the Flow Measurement Stations. Thus, the common practice in most cases is to put forward reasonable criteria for measured flow data to be used.

Measured flow at Cizre Water Measurement station had no regulation and withdrawal effect came from development of dams and large irrigation projects on the river until 1996, The First completed large dams were the Dicle Dam and Kralkızı Dam on the upstream part of the main river in 1997 and 1998 respectively. Therefore quantitiy of measured flow at Cizre Flow Measurement Station at near to border, has started to change from natural flow to regulated after middle of the 1990's.

Even there has been some developed non licenced small irrigation projects in the upper basin before middle of the 1990's, flow measured between 1969-1993 period might be taken as the near-natural flow of the main river. In order to obtain significant result on long run tendency of the Tigris flows, we need to study with the most suitable tributaries which represents the entire upper Tigris Basin natural flow characteristics.

Descriptive statistics for each sub-river basin stations are given in Table 1. The higher value for mean belong to Cizre sub-river basin station with 538,35 mm^3/sn. From the Table 1 coefficient of variations for each station are highly compatible with eachother. Therefore, the results from variation coefficients indicate that long term streamflow for each station has a similar characteristics. This is a significant point that affect prediction models will be created in this study.

In order to define long term naturally changing trend in the quantity of the Tigris Flows, we try to obtain the longest measured flow data in tributaries without regulation and irrigation use effects. We searched three subbasins with limited water regulation in the runoff-generating area.

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variation
GARZAN	49	82,48	15,45	97,93	50,4096	18,81518	0,373
CIZRE	25	819,55	267,70	1087,24	538,3553	210,88528	0,391
BITLIS	53	30,82	7,50	38,31	18,4839	6,99708	0,378
MALABADI	34	158,17	50,90	209,07	124,8468	41,29338	0,330

N: Number of Units (Belong to Certain Station)
Mean: The Average Annual Flow
Range: Difference Between Minimum and Maximum Value (Belongs to Particular Station)

Table 1. Descriptive statistics of Tigris River Basin stations.

These natural flow data from tributaries were used to define their own long term flow trend. The most suitable trend to main Tigris Flow trend were chosen to be used to predict natural flow trend of the Upper Tigris River.

Statistical Normalization used for the station dataset. Statistical Normalization is a technique used in the discipline of Statistical Data Processing, such as Data Mining. The main purpose of method is to deal with data in a one-scale in case of the being of variety of data. Another utilization of the method is to compare the data in different scales with each other. The main target here is to transfer the data in different systems to a common system and make them comparable to each other, by using mathematical functions.

Standardized data of annual mean flow for the each station is given Figure 3. As shown in Figure 3, annual mean flow variation is very similar among Cizre, Malabadi, Bitlis and Garzan FMS catchment areas. The flows of the sub-rivers, Malabadi, Bitlis and Garzan, considered as continuation of main tributary, Cizre strengthens the prediction as seen in the graph. The question whether the sub-rivers can represent the main tributary is investigated by means of regression and Taylor models.

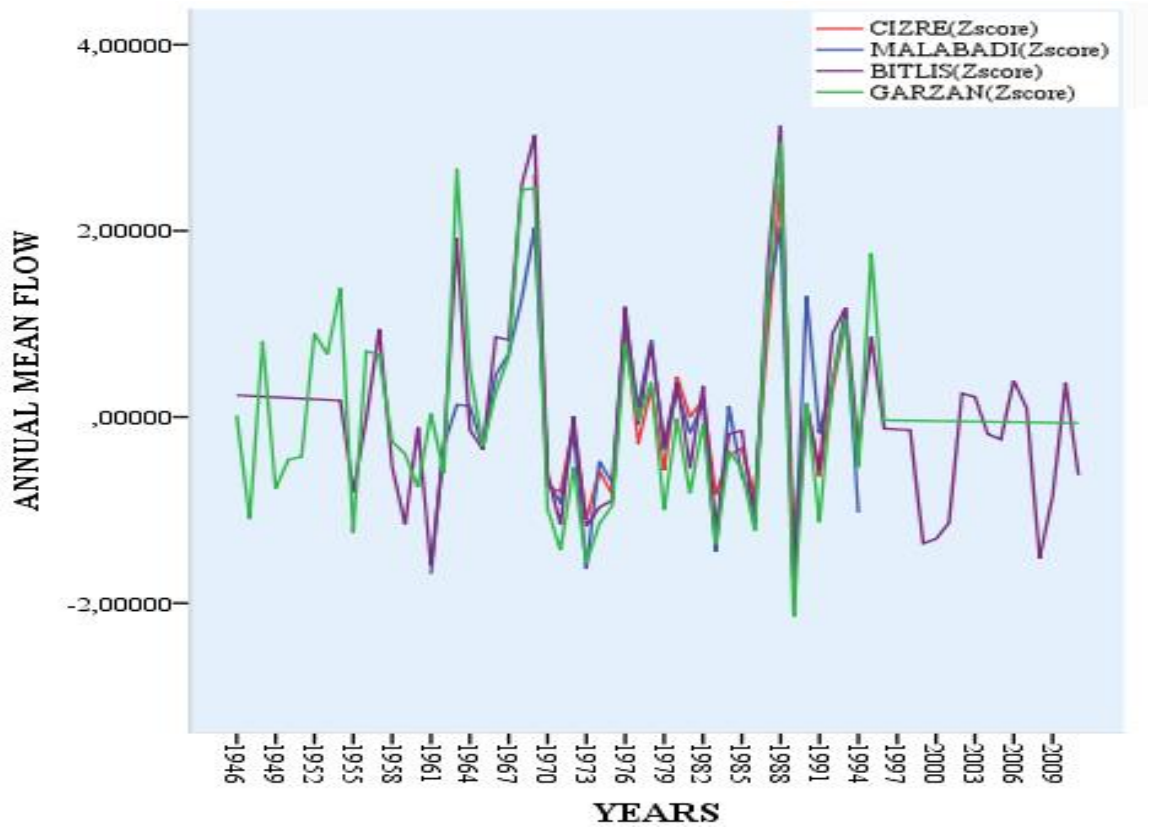

Figure 3. Comparison of four sub-river basin station with normalization technique.

Garzan sub basin, Bitlis sub basin and Batman sub basin (Figure 4) are selected and investigated that if there has been any developed energy or irrigation projects in the upstream of the FMS during used data measurement period.

Garzan Sub basin: Flow measurements data of Garzan FMS (data gathered between 1946-1995) hasn't been effected by any considerable reservoir regulation as well as considerable irrigation water consumption in the upper basin.

Bitlis Sub basin: There hasn't been any hydropower and or considerable irrigation development project upstream of the Bitlis FMS during the used data period between 1955-2011. (Figure 2) Therefore there hasn't been any regulation and irrigation effect to Bitlis FMS flow measurments.

Batman Sub basin: There hasn't been any hydropower and/or irrigation development project upstream of the Batman Malabadi FMS during the used data period between 1961-1999 (Figure 2). In the Sub basin, the only dam in operation is the Batman Dam completed in 1999. Therefore this dam hadn't given any regulation effect to Batman Malabadi FMS flow measurments between 1961-1999. Silvan Dam and Kayser Dam Projects, located in the upper part of the basin, haven't completed yet.

Long term naturally changing trend in the Tigris streamflows has been investigated by using statistical analyses. Long term data of the main Tigris River near the border is available from Cizre FMS. Tigris river has 38280 km^2 catchment area at the Cizre FMS. After a few dams and irrigation project developed in the river basin, the Main Upper Tigris flow reached to Turkey Syrian, Iraq border as regulated flow. Therefore in order to obtain main natural streamflows trend we decieded to use most suitable tirbutaries having natural long term flow measurement data.

Using these most suitable natural long term flow measurement data we obtained long term streamflow trend of the tributaries that feed to Main River. We compare each of these streamflows trends with main river streamflows trend that is obtained from Cizre WMS.

We chosed the best suitable one to use prediction of the long term natural streamflows trend of the Upper Tigres River.

Tigris River total drenage area is about 38 280 km^2 at the Cizre Flow Measurement station nearby of the Turkey, Syria, Iraq Border. Two tributaries of the Upper Tigris River are used to statistical analyses of the main Tigris River flows long term trend. Each of the used in analyses has their own flow measurement stations having different drenage areas at different elevations(asl).These tributaries has total 3090 km^2 drenage area at the Flow Measurment Stations (Figure 4).

Garzan River: Drenage area of the tributary is 2450 km^2 at the Garzan – Beşiri Flow Measurement station numbered EIE 2603. It is based at elevation of 545 m(asl).

Bitlis River**:** Drenage area of the tributary is 640 km^2 at the Bitlis Baykan Flow Measurement station numbered EIE 2610. It is based at elevation of 910 m(asl) and near Bitlis Baykan town.

Batman River: Drenage area of the tributary is 4105 km^2 at the Batman Malabadi Flow Measurement station numbered EIE 2612. It is based at elevation of 597 m(asl) and near Bitlis Baykan town.

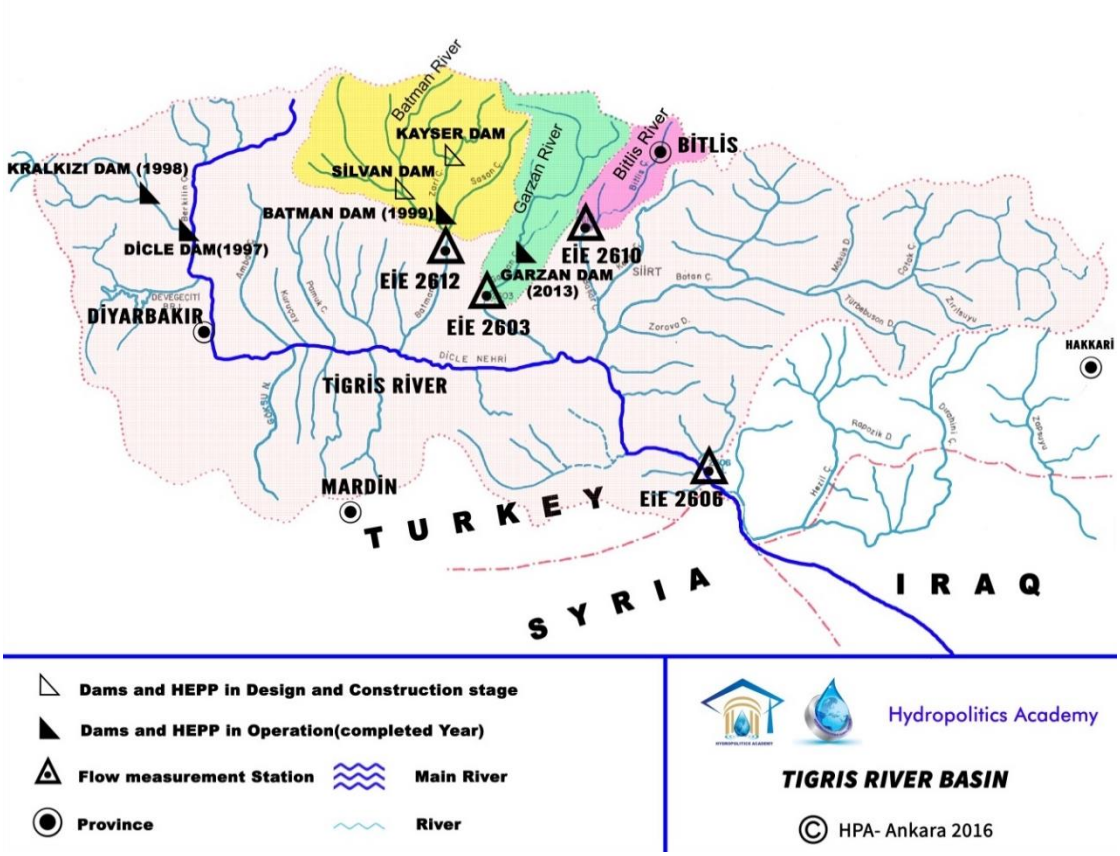

Figure 4. Flow measurment stations and their drainage basins used in the model.

METHODS

Univariate Regression

Univariate regression works the linear relationship between the dependent variable Y and a independent variable X. The linear regression model depict the dependent variable with a line that is showed by the equation Y = a + bX, where a is the y-intersect of the line, and b is its slope. Prior to, the parameters a and b of the regression model are estimated from the values of the dependent variable Y and the independent variable X with the purpose of statistical analysis. The regression line shows one to describe the value of the dependent variable Y from that of the independent variable X [19].

The slope b of the regression line is called the regression coefficient. It gives us a measure of the contribution of the independent variable X toward explaining the dependent variable Y. If the independent variable is continuous then the regression coefficient represents the change in the dependent variable per unit of change in the independent variable [19].

Model Description	Dependent Variable	Independent Variable
Model 1	CIZRE	BITLIS
Model 2	CIZRE	GARZAN
Model 3	CIZRE	MALABADI

Table 2. Model variable definition for regression.

Table 2 shows dependent and independent variables.

Regression Models		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R	R^2
		B	Std. Error	Beta				
Model 1	Constant	37,064	24,889		1,489	,015	0,976	0,953
	Bitlis	26,220	1,208	,976	21,71	**,000**		
Model 2	Constant	62,387	25,820		2,416	,024	0,972	0,946
	Garzan	10,260	,513	,972	20,00	**,000**		
Model 3	Constant	-24,086	52,778		-,456		0,920	0,846
	Malabadi	4,464	,397	,920	11,24	**,000**		

Table 3. Regression analysis outputs.

It is concluded that when each model taken individually, parameters of each model is significant and fairly high coefficient of determination has been observed. From the Table 3 It is observed that most significant model is the first model when we evaluated through this coefficient. As we have seen before from Figure 3 the stations in the region of Tigris basin had a same characteristics.

It is assumed that the approach will be more accurate if each sub-basin modelling evaluates separately because of multicolinearity. However, in this case, the situation will be reappraisal with Taylor Diagram and we will decide which model more convenient for the this study.

Taylor Diagram

Taylor diagram gives us a way of graphically describing how closely a pattern meets observations. The similarity between two model is quantified in terms of their correlation, their centered root-mean-square difference and with the standard deviations. Taylor visualizations are especially functional in considering multiple aspects of complex models or in measuring the relative ability of many different models [20].

Generally, the Taylor diagram describes the statistical relationship between two fields, a "test" area and a "reference" area. The Taylor Diagram defines the centered pattern error. This diagram of the most broadly used methodologies in climate works for introducing the evaluations of various models and/or variables or comparison of various between data sets[21, 22].

The reason that each point in the two-dimensional space of the Taylor diagram shows three different statistics simultaneously (i.e. the centered RMS difference, the correlation, and the standard deviation) is that these statistics are related by the following Figure 5 and formula:

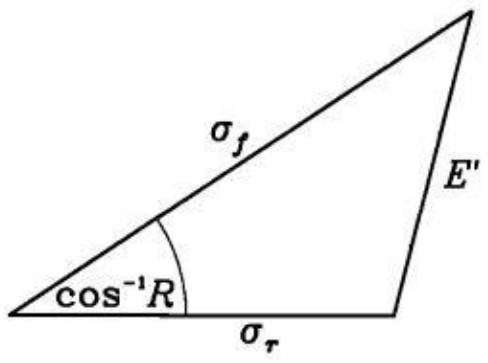

Figure 5. Geometric relationship between the correlation coefficient R, the centered pattern RMS error E', and the standardeviations σ_f and σ_r of the test and reference fields, respectively.

$$E'^2 = \sigma_f^2 + \sigma_r^2 - 2\sigma_f \sigma_r R, \qquad (1)$$

where R is the correlation coefficient between the test and reference fields, *E'* is the centered RMS difference between the fields, and σ_f and $\sigma_{r\ 2}$ are the variances of the test and reference fields, respectively. The structure of the Taylor diagram is set on the similarity of the Equation 1 and the Law of Cosines (2)[20]:

$$c^2 = a^2 + b^2 - 2ab\cos\phi \qquad (2)$$

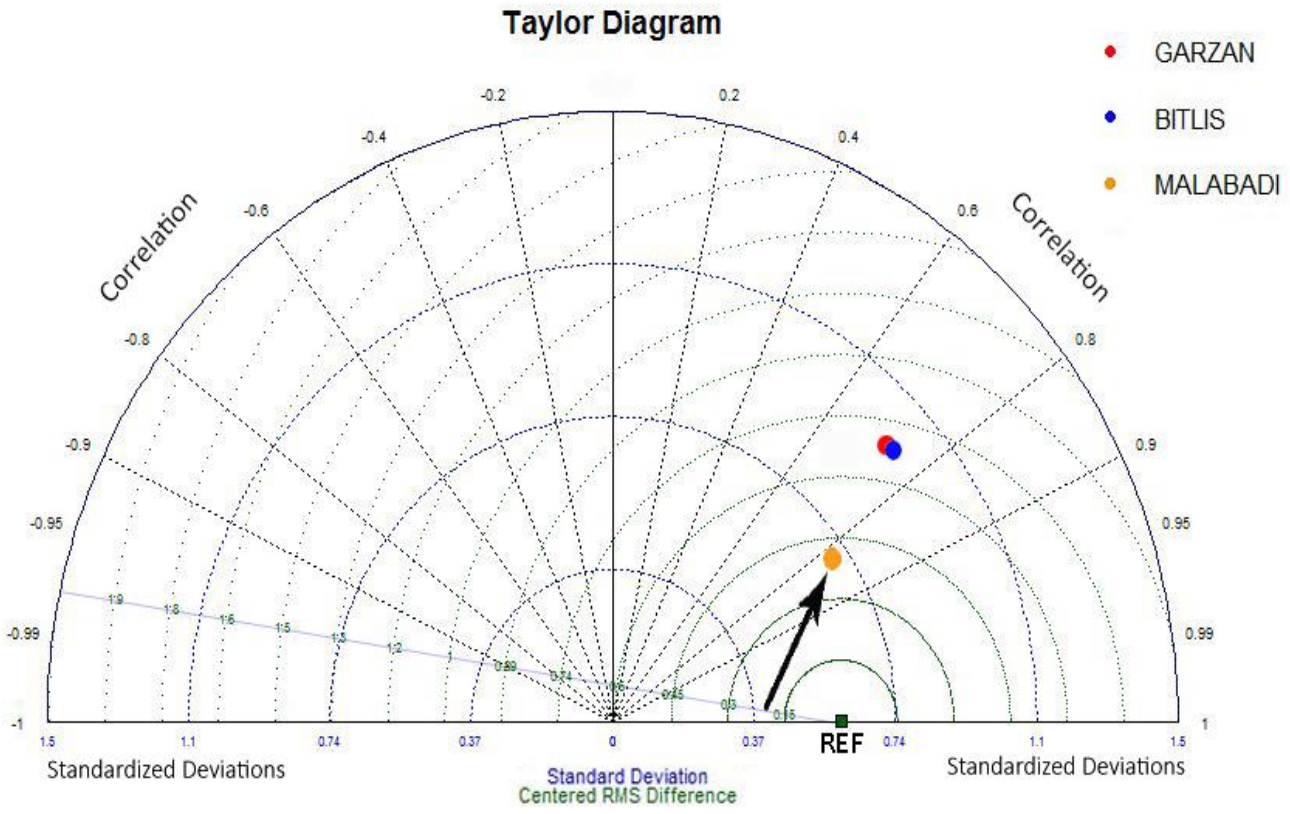

Figure 6. Taylor diagram shows a statistical comparison with observations of three model estimates of the pattern of annual mean flow.

Figure 6 shows us variations in the annual mean flow properties represented by the three empirical datasets using the Taylor Diagrams and the data set group as the

reference (REF point in the Figure 6)[23]. The observed data group names Malabadi(Batman), Garzan, Bitlis with reference model Cizre.

The distances from the reference data (Cizre dataset) at the point defined by a **REF** point to separate data sets are similar to those for their annual mean flow variability for GARZAN and BITLIS, indicating a similar levels and these data sets in representing annual mean flow in the Upper Tigris region. Regarding the Reference Line(REF) from Figure 6, compared the distances between MALABADI and Reference Line much smaller than GARZAN and BITLIS. Comparison of distances from those models to Reference Line gives us larger or smaller uncertanities in the linear trend.

It is concluded that for the MALABADI Sub-river Station has a smaller uncertanities than GARZAN and BITLIS. This means we can say that most suitable model for reference model CIZRE is MALABADI(Batman) Sub-river Station.

Results and Discussion

The study needed a long term Upper Tigres natural streamflows data that has not been effected by dams and large irrigation projects. In fact development of the large irrigation projects in the Upper Tigris basin in Turkey has began in late 1990's. Therefore It has reached only about 67 000 ha untill now. This brought us an opportunity to get long enough natural streamflow data.

The average annual natural flow data was obtained from different FMS located in the most suitable sub basins. They were used to predict the long term natural flow trend of the Upper Tigris at the Syria-Iraq Border. Three most suitable tributary flow measurement stations data (EIE 2610, 2612, 2613) were chosen and used to predict natural annual flow trend of the Main Upper Tigres River at the near border(Figure 3).

Among the models given in Table 3, It can be seen that the best suitable model to identify Cizre streamflow data is Model 1.But if this relationship is evaluated together with the Taylor Diagramme Malabadi FMS seems to be the best suited model with Cizre FMS streamflow data. This can be seen in Figure 6. One variable structure of the Regression Analyses does not give any opportunity to better identify of the model. The Taylor Graphs is more suitable and presents advantages to be used on hydrological and climatological data.

The variability can be relatively compared using standart deviation, correlation and RMS among the models in Taylor Graph. This makes the Taylor graph method more relaible than that of one variable regression analyses for evaluation.

In this contexts it can be said that according to the Taylor Graph, trend obtained from Malabadi FMS data is the best suited one to match streamflows trend obtained from Cizre FMS. This very close match can help us to identify Upper Tigris Basin characteristics with higher reliability.

In the study three main tributairies of the Upper Tigris River were used in the statistical model. Used Flow Measurement Stations (FMS) in the each subbasins were choosen having the longest data representing natural flow characteristics during the measurement period. Three subbasins have been found fulfilling these requirements properly.

Apart from large irrigation projects, it is obvious that along the river little amount of irrigation water can be drawn by farmers from the river. But because of lack of data we can't consider this amount of water in the statistical analyses. In fact, in our statistical analyses we don't consider seasional effects on the annual avarage flow figures. We aim to define general

streamflow tendency of the Tigris River using avarage annual flow data. Therefore we think that a few small sessional irrigation water withdrawing effects wouldn't be strongly effective on changing the long term general tendency of the streamflows.

The results showed that the diminishing trend is prone to continue and streamflow reduction is steadily continuoing with time for Upper Tigris River.

It is concluded that there has been a reduction in the streamflow of the Tigris River as the years go by. The declining trend and statistical model results indicate that river flows likely to continue declining naturally and hydrologically.

Conclusion

Security has been a multidimensional issue and water security has become a central feature of the global policy agenda since the beginning of the 21st Century The 21st century has started to experience the field of security with a paradigm shift [24].This brought to need more comprehensive studies on security issues including water security.

The purpose of this study is to provide the long term natural streamflow trend of the Upper Tigris River, with a particular emphasis on natural flow characteristics (i.e. annual, monthly flows). The data set of annual and monthly flows adopted in this project and considerable effort has been made to ensure the data are free of major errors and the streamflows are not impacted by major water withdrawals nor by reservoirs upstream.

As a result of the statistical analyses described in this paper we present the following points.

It is observed a gradually varied and regularly decreasing natural flow in the Upper Tigris Basin. That means that mean annual flow of the river has naturally slightly decreased and it seems this naturally declining tendency will continue.

Even this naturally and hydrologically declining streamflow trend is obvious, there certainly would be some other factors like irrigation development, rising evaporation, rising water leekage from the reservoirs, reservoir operation etc. that decreased river flow as years entering to Syria, Iraq.

We conclude that natural factors are effective on declining trend of the mean annual natural flow of the Upper Tigris River. Key findings of the study supports the definitions on decreasing tendency that was explained by Kelley [25] in Climate Change effects.

Bozkurt and Sen [8] also stated that the most likely adverse impact of the climate change in the Euphrates–Tigris Basin will be the decreased water availability.

The application of trend analyses techniques to Upper Tigris basin has resulted in the identification of gradually varied diminishing streamflow trend. The result can also be considered as the reflection of changes in climate.

Coupling streamflow processes with the models based on precipitation and temperature patterns could be a significant method to investigate the nature of streamflow trends in large scale basins.

We have studied recently the headwater region and obtained the same trend in the Upper Euphrates Basin. Therefore all the results show that the need for policy coordination between the riparian states has gained vital importance. But Institutional capacity has been depleted by conflict in Syria and Iraq, and there remains no mechanism for information sharing or emergency response across the river basin. In fact Tigris river needs real time measurements network accepted by riparian states. This could be the first step

to collaborate and identify real condition in the Tigris River Basin. But it is unfortunate that it couldn't be possible mainly due to political reasons between riparian. Even if it is not so easy to establish in this chaotic situation, we must be aware of that present behaviours will shape the future of the Middle East.

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