Eksplorium *p*-ISSN 0854-1418
Volume 45 No. 2, November 2024: 331–350 *e*-ISSN 2503-426X

Investigating Water Policies and Managing Hydro Politic Challenges in Border Areas as an Architectural Heritage with an Analytical View of Iran's Climate

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Article Received: 20 Sept 2024, Revised: 28 Oct 2024, Accepted: 10 Nov 2024

Abstract: Water is an element whose presence is essential for food production, economic development, and the survival of living organisms. The location of the Middle East region in the dry belt of the world has caused this region, despite having 5% of the world's population, to have only 1% of available fresh water, which has led to competitions and conflicts to use these limited resources as much as possible. has it. Massive water problems threaten many arid and semi-arid regions of the earth, and Iran is no exception. The integration of such problems with health, environmental, political, socio-economic and sustainability issues has greatly increased the demand for problem management. This research examines the ability of Iranians to manage society, develop and maintain their water resources in different periods. This study shows that in the modern era, the development of industry, consumerism culture and unprecedented urbanization along with drought and global warming have brought many problems to water sectors. Therefore, the tendency towards supply-oriented policies has prevailed and strategies such as drilling wells with deep pumps, building dams, and transferring water between the basins have been adopted to solve the problems. Excessive extraction of groundwater, soil-water degradation, shrinking and drying up of water bodies, intensifying flood risks, dust storms, agricultural and environmental damages, and the emptying of rural areas are among the direct and indirect evidences that this claim confirms

Keywords: Iran's climate, water boundaries, water policy, water management, hydro politics.

Introduction

The hydro politics of border rivers in the Middle East is an important problem in the relations between governments and nations. Due to this issue, the investigation of the upcoming crises caused by the lack of water has become one of the topics of interest in political geography, especially hydro politics. In other words, hydro politics is one of the subsets of the science of political geography, which examines the role of water in political behavior at different scales. Due to the increasing consumption of water in the future and the increase in the consumption of the countries upstream of the rivers in the exploitation of these resources, hydro political disputes between nations can be seen.

The type of interaction between nations in the exploitation of these common water resources includes a wide range of compatibility and full cooperation to incompatibility and war, and usually in different approaches about hydro politics on factors such as conflict and cooperation, acting by governments and presence in The international watershed is emphasized; Therefore, some geo politicians consider the current century as the hydro political century and believe that most of the conflicts and regional wars in the world will be due to the crisis arising from the lack of water]2[.

Water is an important natural resource that will be the factor of development in the next 50 years, as well as an important factor in agriculture, industry, domestic use and use in electric power plants. In many countries around the Pacific Ocean, especially in water-scarce areas, water reserves are decreasing, and therefore it has become a source of conflict and conflict between countries]3[. Water has been a challenging issue since the distant past, especially in the world. Today, it has emerged as a decisive issue in the relations between governments, and new tensions are emerging in the countries of the world over the issue of water resource appropriation. Basically, the world is moving towards a water scarcity crisis. In the meantime, the Middle East region is located on the dry belt of the world, and on the other hand, it is facing an explosion of population, and providing the required water is one of the main concerns of the politicians of the countries of this region, it is one of the sources of access to water. Newly, rivers are for human use. Rivers of every region are considered as vital arteries and donate life to their border regions]3[.

In the Middle East, water plays an important role in improving the quality of life and socio-economic development]119[. Water is not only necessary for life, but also for the development of civilization. There are some factors and areas such as climate changes and the occurrence of long periods of drought. , the development of agricultural and industrial activities, the increase of the urban population and the prevalence of excessive consumption of water resources, the excessive use of water in the upstream countries, the different priorities and needs of countries in the exploitation of common water resources, etc. have caused that the common water resources and In particular, border rivers become an important source of tension and conflict in many regions of the world]30[. Iran, one of the oldest cradles of civilization in the world, has long made many efforts to effectively manage water resources. Water delivery, water balance, water storage, water quality, water protection, saving water consumption, waste water control, risk reduction and adaptation are the most important challenges that Iranians have faced.

The development and management of water resources in Iran by several researchers, including English]42[, Foltz]53[, Ardakanian]11,12[, Madani Larijani]89, Semsar Yazdi and Askarzadeh]136[, Gholikandi et al.]60[, Madani et al.]88[, Zargan and Vaez Mousavi]157[have been mentioned. Most of these studies are limited to describing past or present water problems. Nevertheless, a comprehensive study of Iran's water management requires an in-depth study of the past several thousand years. In this research, after collecting, sourcing, labeling and coding data and documents (in Persian and English languages), a database is prepared and then evaluated by historical study of Iranian activities in the field of planning, development and distribution.

The existence of some factors and areas such as climate changes and the occurrence of long periods of drought, the development of agricultural and industrial activities, the increase in the urban population and the prevalence of excessive consumption of water resources, excessive use of water in upstream countries, the different priorities and needs of countries in exploiting Common water resources and... have caused that common water resources and especially border rivers have become an important source of tension and conflict in many regions of the world.

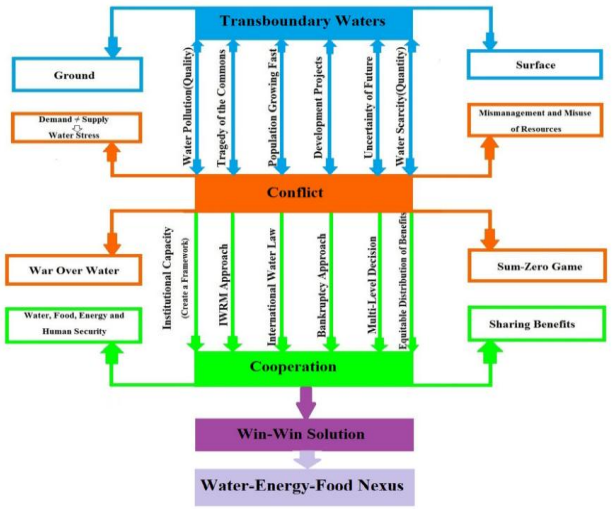


Figure 1: Summary of proper water resource development and management to prevent water stress

Literature review

Geographically, Iran is located in the Middle East between 44°20" and 63°20" east longitude and 25°03" and 39°46" north latitude. The geographical distribution of water throughout the country is very uneven, so that about 99 27% of the country's surface is land and 73.0% is water. Almost 12% of Iran's area is arable (compared to Egypt 8.2%, Iraq 5.11%, Turkey 8.26% and Syria 4.25%)]144[. About 35% of Iran's dry land is pastures used for grazing and small fodder production. About 35% of the earth's area consists of bare Rocky Mountains, salt plains and bare Rocky Mountains and deserts. Forests and forests make up 11%. And about 7% is used for cities, towns, villages, industrial areas, roads, railways and related fields]100[.
Iran has a diverse and complex weather pattern due to its size, geographical location and topographic diversity. Most of the area is dry to semi-arid. In general, 5.35% of the country is super-arid, 29% is dry, 1.20% is semi-arid, 5% is Mediterranean and the rest has a humid and super-humid climate]9[.

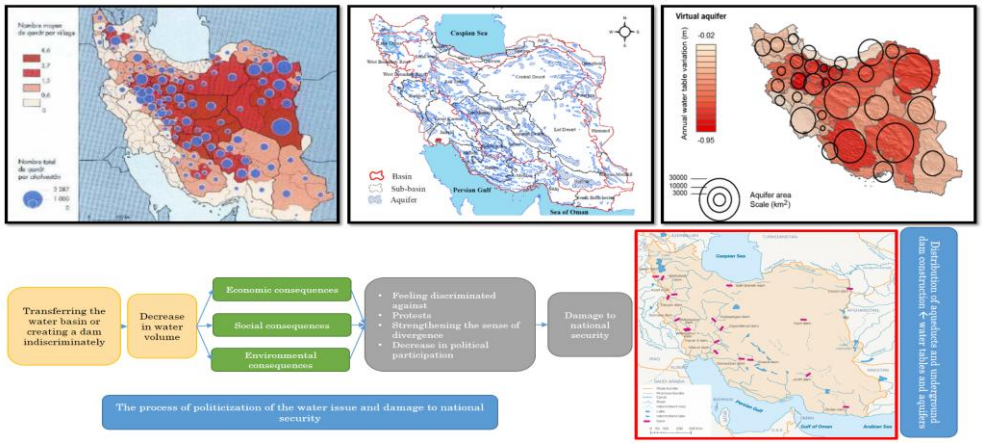
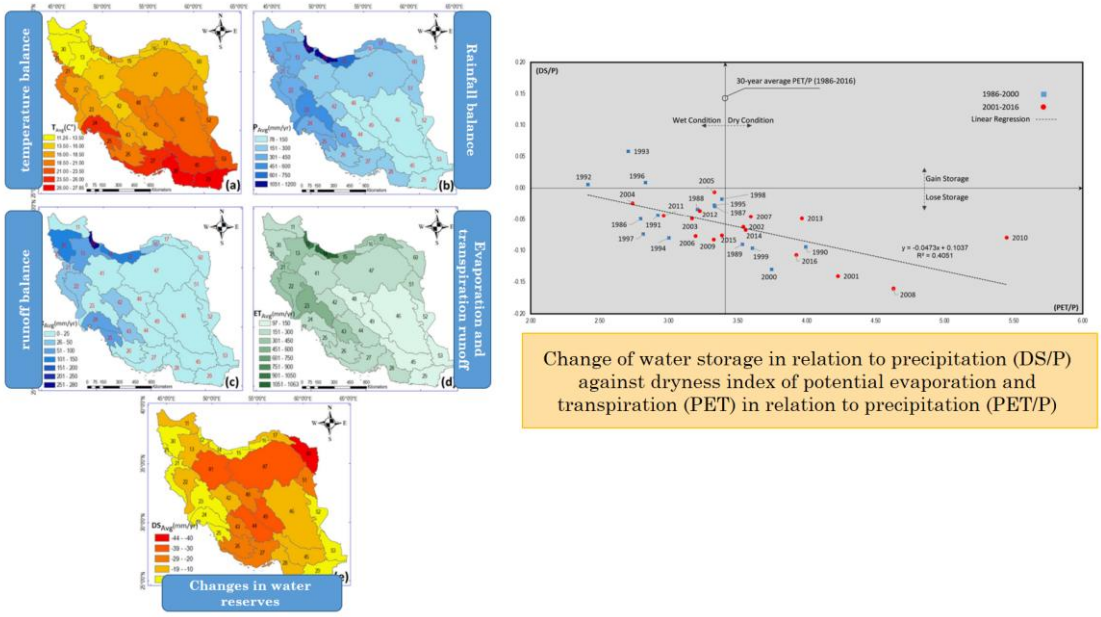


Figure 2: Distribution of resources and rivers and the causes of damage to national security in Iran

Rainfall is very seasonal. About 50% of precipitation occurs in winter (at the time of the lowest water demand), 23% in the spring, 23% in the fall and 4% in the summer (at the time of the highest water demand). Iran's average annual rainfall is estimated to be 228 mm (about one-third of the global average), while the evaporation rate is more than three times that. In Iran, the rate of evaporation is between 1500 and 2000 mm, which is three times the world average. With an average annual rainfall of 414 billion cubic meters (BCM), an estimated amount of about 68% (282 BCM) evaporates before reaching surface and underground water reservoirs]80[.



Change of water storage in relation to precipitation (DS/P) against dryness index of potential evaporation and transpiration (PET) in relation to precipitation (PET/P)

Figure 3: Comparison of precipitation, evaporation and temperature on a global scale

In addition to evaporation rate, the spatial variability of rainfall in Iran is a key control in water supply. The spatial distribution of rainfall in Iran is unbalanced, because 52% of the total rainfall is in 25% of the entire country]78[. Most parts of the country (about 65%) receive less than 100 mm of annual rainfall. In high latitude areas, especially in dry mountainous basins, snowmelt is the primary source of surface water and groundwater feeding in spring and early summer]125[.

Although the spatial and temporal determination of snow characteristics such as snow depth, density, water equivalent and surface cover is a difficult task, the available data show that about 60% of surface water and 57% of groundwater supply in mountain basins come from melting. Snow is provided.]140,151[. Unlike some countries in the Middle East such as Iraq, Pakistan, Bahrain, Kuwait and Syria, this country has a favorable level of water self-sufficiency of 92%, which shows that most of the country relies on internal renewable water sources]27[.

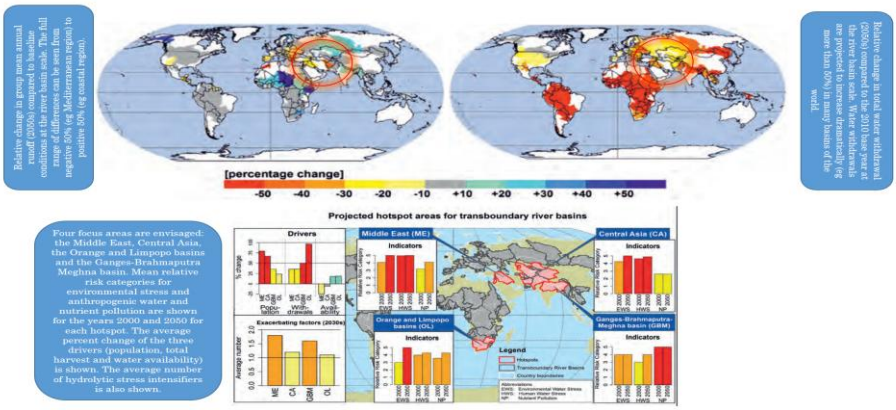


Figure 4: Comparison of relative changes in average runoff and water withdrawal at the global level

The internal amount of renewable water resources of the country (long-term average of river flow and groundwater recharge resulting from the country's atmospheric precipitation in one year) is estimated to be 124 billion square meters, of which about 73 billion square meters are surface runoff and about 51 BCM to natural resources. Groundwater seeps in.

In the Middle East region, the highest water withdrawal is observed in Iran, Iraq and Turkey, about 34, 24 and 15% of the total water withdrawal in the region, respectively. In Arab countries, groundwater is the main source of fresh water, accounting for 84% of total fresh water, while in Turkey, surface water accounts for 73% of total fresh water withdrawal. In Iran and Jordan, groundwater withdrawal is approximately 60%]50[.

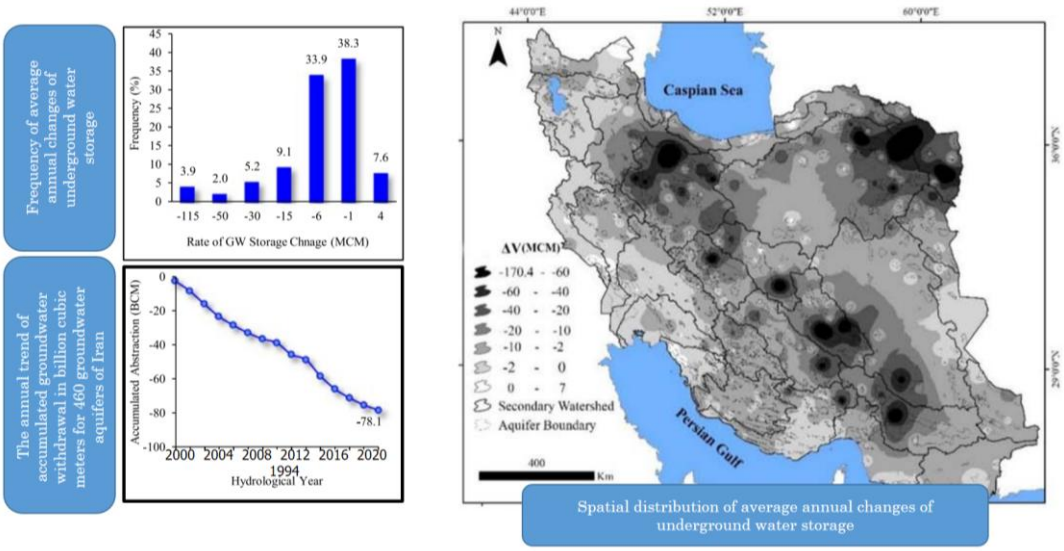


Figure 5: Frequency diagram of average changes in water resource reserves in Iran

Iran's total water consumption is more than 5.88 µm square meter]7[. Meanwhile, 2.92% of the available fresh water withdrawal equal to 67.80 BCM is used for agricultural activities, which is on average the world's agricultural water consumption. 70 percent) and the Middle East (83 percent) and the rest is used by the domestic sector 6.6% equal to 78.5 BCM and the industrial sector 2.1% equal to 05.1 BCM]75[.

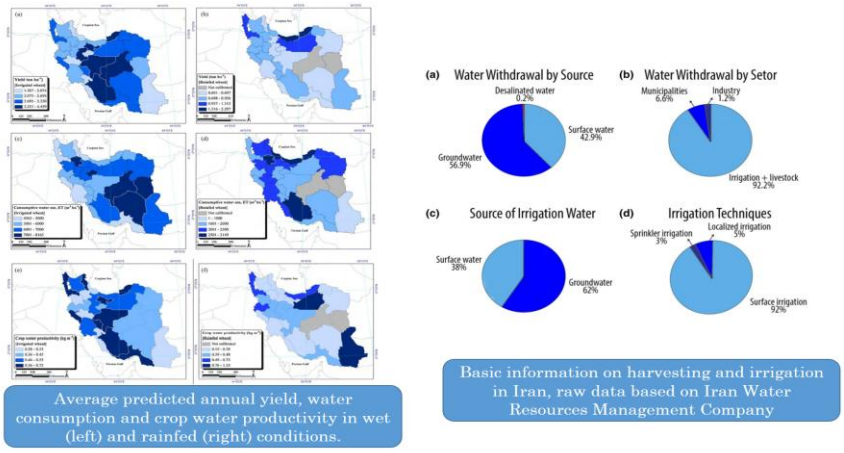


Figure 6: Diagram of harvesting and water consumption and product productivity in Iran's water conditions

According to the critical ratio (CR) index]5,122[, the ratio of total water consumption to total available water resources shows that Iran is in the category of water stressed areas. In addition to the CR index, the Falkenmark index]47[can be used to evaluate the degree of tension and water shortage in Iran. Currently, the annual renewable water per capita is about 1479 cubic meters, which is much lower than the per capita in 1956 and the global average of 7000 cubic meters]29[. Taking into account the population growth rate, the annual availability of renewable water will decrease from 100 cubic meters to 1300 cubic meters in 2021 and 2025, respectively. According to the Falkenmark threshold, countries with annual renewable water availability between 1000 and 1700 cubic meters are under stress. water will be placed and those who have access to less than 1000 cubic meters will be exposed to water shortage]47[.

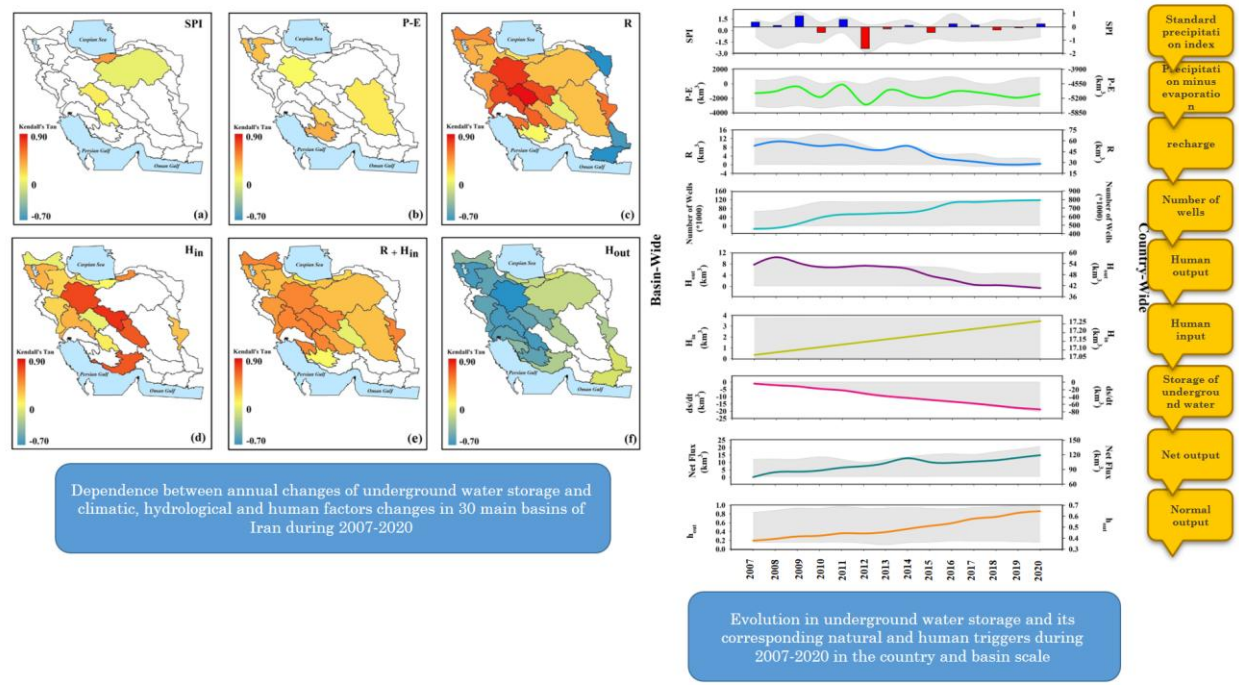
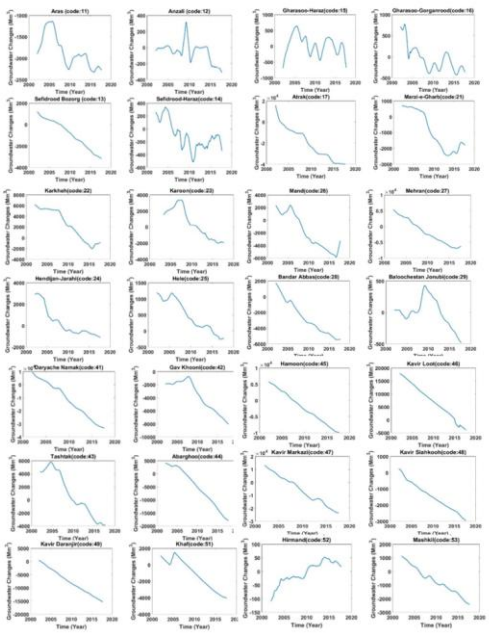
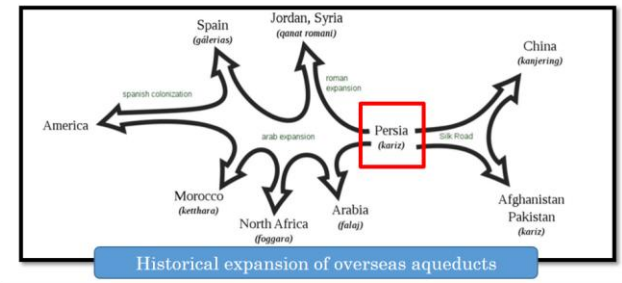


Figure 7: The graph of the dependence between the annual changes of underground reserves and the amount of exploitation of resources

From a regional point of view, the comparison of water stress conditions in Iran and neighboring countries confirms that the entire region suffers from moderate to severe water shortage. Countries like Saudi Arabia, Palestine, Yemen, Bahrain, Qatar, Jordan, United Arab Emirates, Oman and Kuwait are facing water shortage. Similar to Iran, Iraq, Syria, Lebanon, Afghanistan and Pakistan are classified as countries with water stress. Turkey is one of the most water-rich countries in the Middle East, but it is vulnerable to water shortages due to population growth, industrialization, and climate change]50[. From the hydrological point of view, Iran includes six main basins and 30 sub-basins. The Caspian Sea basin includes seven sub-basins in the north, the Gharaqom (fern basin) in the northeast, the Hamoon basin includes three sub-basins in the east, the Central Plateau basin includes 9 sub-basins that extend from the northwest. In the southeast of the country, the basin of the Persian Gulf and the Sea of Oman includes 9 sub-basins in the south and the Urmia lake basin in the northwest is about 1,250,000 km. The rest is covered by deserts, swamps, lakes, cities, etc.]74[. In Iran, about 50% of water is supplied from 609 aquifers]87[. According to nutrition and exploitation, about 67 aquifers are in critical conditions (the aquifer is very depleted and long-term management is needed to revive the aquifer), 203 aquifers in Prohibited conditions (with proper management, debit in short and medium term). It can be equal to water supply, and 339 in standard conditions (the maximum amount of water discharge in a certain period is equal to water supply)]16,59[. Considering the quality conditions, the number of critical underground aquifers is expected to increase.





Historical expansion of overseas aqueducts

Sub-Basins	Code	Trend (Mm^3/yr)	Sub-Basins	Code	Trend (Mm^3/yr)
Aras	11	−63.107	Urmieh	30	−535.362
Anzali	12	−13.873	Daryache Namak	41	−2881.360
Sefidrood Bozorg	13	−281.418	Gav khooni	42	−465.545
Sefidrood-Haraz	14	−31.955	Tashtak	43	−695.810
Gharasoo-Haraz	15	−16.708	Abarghoo	44	−1521.080
Gharasoo-Gorganrood	16	−50.125	Hamoon	45	−1039.140
Atrak	17	−3867	Kavir loot	46	−1399.170
Marzi-e-Gharb	21	−240.328	Kavir Markazi	47	−4502.970
Karkheh	22	−591.728	Kavir Siahkooh	48	−185.784
Karoon	23	34.798	Kavir Daranjir	49	−933.010
Hendijan-Jarahi	24	−247.809	Khaf	51	−368.318
Hele	25	−100.770	Hirmand	52	7.842
Mand	26	−567.042	Mashkil	53	−209.970
Mehran	27	−830.647	Ghareghome	60	−2178.660
Bandar Abbas	28	−441.877			
Baloochestan Jonubi	29	−20.909			

Long-term monthly values of groundwater storage in different sub-basins

Figure 8: Showing the expansion of rivers and the formation of the main basins and sub-basins in Iran

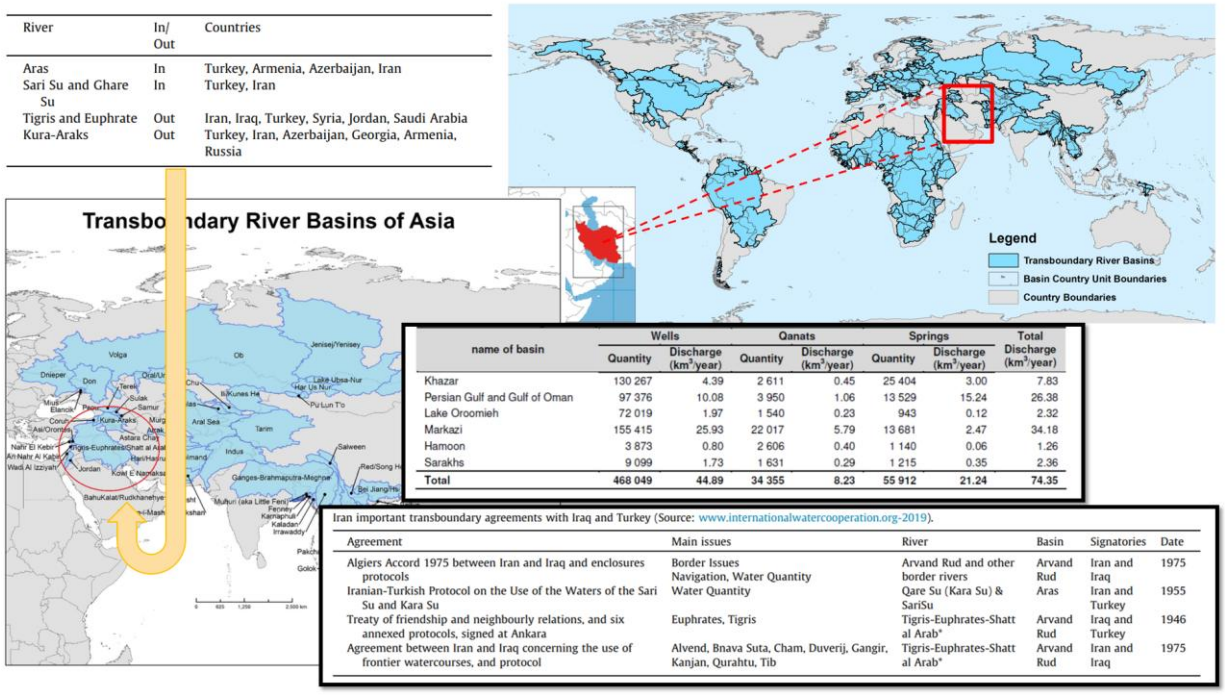
Materials and Methods

The current research has a descriptive-analytical nature in terms of methodology. Collecting the information needed in this research is in a documentary way, using sources and articles available on the Internet and scientific reports. This research is considered practical in terms of its purpose, because it uses the available information to classify the disputes of the border rivers of the Middle East. The main question of this research is, what are the most important natural, economic, social, and political factors and grounds for the emergence and intensification of hydro political disputes in border rivers? The assumption of this research is that various natural and human factors such as climate change, involvement of regional and extra-regional powers, incorrect management policies, high population growth, single-product agriculture in the region, extensive dam constructions to produce hydroelectricity, etc. One of the most important reasons for the differences in the Middle East, especially Iran.

Discussion

Iran has faced many periods of severe drought in recent decades. The most severe multi-year droughts along with the warming trend started in the early 1950s, which significantly jeopardized the access to water in all sectors]78,38[.

Despite some cooling, the latest warming trend (from the early 1990s onwards) has continued in recent years and is expected to continue throughout this century as well]38,9[. The study of climate changes in Iran by considering the parameters of precipitation, temperature and relative humidity of synoptic stations during a period of 55 years (1951-2005) shows that the average relative humidity in arid and semi-arid regions has a general decreasing trend. On the other hand, the increasing trend in the minimum and average annual temperature, especially during the last few years until the year 2000]83,84[. Also, the spatial and temporal trend analysis of 145 rainfall stations in Iran shows that the amount of annual rainfall is decreasing in 67% of the stations and the maximum 24-hour rainfall is increasing in 50% of the stations]101[. Temporal and spatial analysis shows the occurrence of drought using Standardized Rainfall Index (SPI) and Standardized Precipitation-Evaporation and Transpiration Index (SPEI) during a long-term period. In 1985 and 1990, most of the regions of Iran have experienced severe drought conditions in late 2010, 2007, 2001, 2001, 2000, 1999, 1998]78[.



River	In/ Out	Countries
Aras	In	Turkey, Armenia, Azerbaijan, Iran
Sari Su and Ghare Su	In	Turkey, Iran
Tigris and Euphrate	Out	Iran, Iraq, Turkey, Syria, Jordan, Saudi Arabia
Kura-Araks	Out	Turkey, Iran, Azerbaijan, Georgia, Armenia, Russia

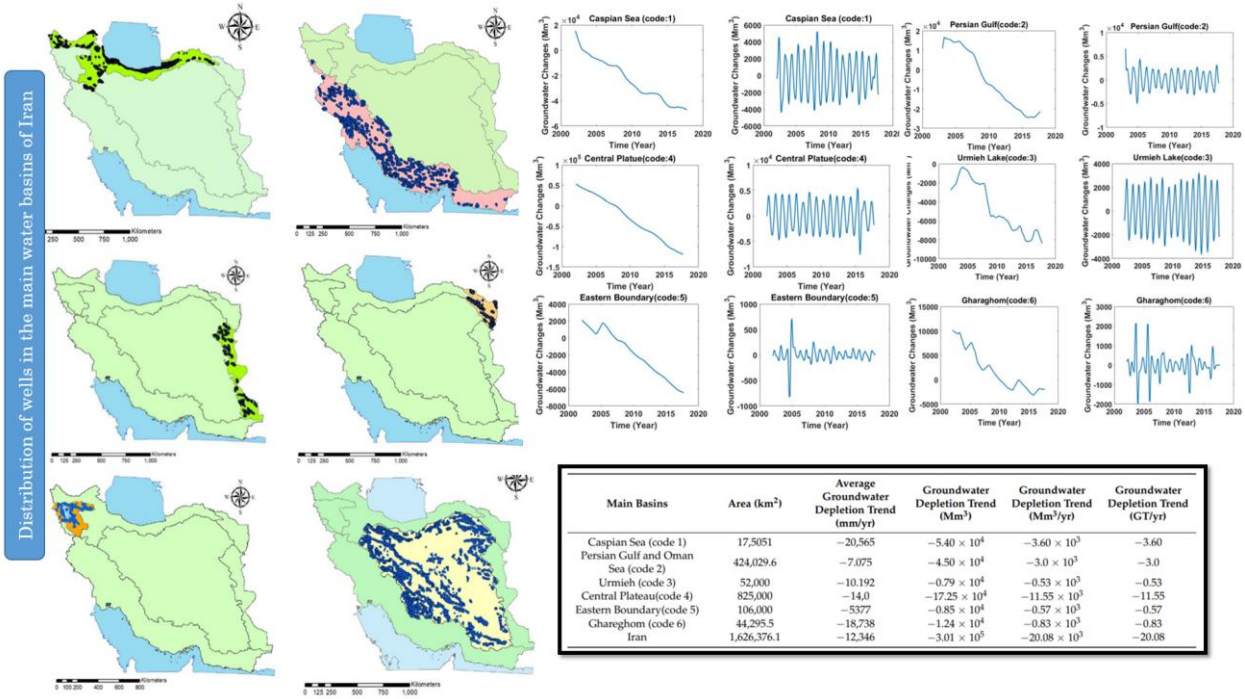
name of basin	Wells		Qanats		Springs		Total
	Quantity	Discharge (km^3/year)	Quantity	Discharge (km^3/year)	Quantity	Discharge (km^3/year)	Discharge (km^3/year)
Khazar	130 267	4.39	2 611	0.45	25 404	3.00	7.83
Persian Gulf and Gulf of Oman	97 376	10.08	3 950	1.06	13 529	15.24	26.38
Lake Oroomieh	72 019	1.97	1 540	0.23	943	0.12	2.32
Markazi	155 415	25.93	22 017	5.79	13 681	2.47	34.18
Hamoon	3 873	0.80	2 606	0.40	1 140	0.06	1.26
Sarakhs	9 099	1.73	1 631	0.29	1 215	0.35	2.36
Total	**468 049**	**44.89**	**34 355**	**8.23**	**55 912**	**21.24**	**74.35**

Iran important transboundary agreements with Iraq and Turkey (Source: www.internationalwatercooperation.org-2019).

Agreement	Main issues	River	Basin	Signatories	Date
Algiers Accord 1975 between Iran and Iraq and enclosures protocols	Border Issues Navigation, Water Quantity	Arvand Rud and other border rivers	Arvand Rud	Iran and Iraq	1975
Iranian-Turkish Protocol on the Use of the Waters of the Sari Su and Kara Su	Water Quantity	Qare Su (Kara Su) & SariSu	Aras	Iran and Turkey	1955
Treaty of friendship and neighbourly relations, and six annexed protocols, signed at Ankara	Euphrates, Tigris	Tigris-Euphrates-Shatt al Arab*	Arvand Rud	Iraq and Turkey	1946
Agreement between Iran and Iraq concerning the use of frontier watercourses, and protocol	Alvend, Bnava Suta, Cham, Duverij, Gangir, Kanjan, Qurahtu, Tib	Tigris-Euphrates-Shatt al Arab*	Arvand Rud	Iran and Iraq	1975

Figure 9: Transboundary and national river basins

In 2018, Iran experienced one of the worst droughts that affected most of the country and rainfall reached its lowest level in more than a century. In response to the drought, a decrease in normal rainfall up to 30, 40, 37, 43, 54 and 52% has been reported in the Caspian Sea, Urmia Lake, Gharaqom (Sarakhs basin), Hamoon, etc. During the drought of 2018, a total of 334 cities were considered at risk of water insecurity in the basins of the central plateau, the Persian Gulf, and the Oman Sea, respectively. Drought has effects such as a drop in water level, dams (for example, Latian, Karaj, Zayandeh Rood, Minab, Golpayegan, 15 Khordad and Lar dams), lakes (for example, Maharlo, Bakhtigan, Ziribar, Urmia, and Teshk). lakes and wetlands (such as Gavkhoni, Shadegan, Joze Morian and Howeyza wetlands), and the drying of pastures has been widely observed in most regions. About 65% of the country's area (for example, the provinces of Sistan and Baluchistan, Hormozgan, Kerman, South Khorasan, Yazd, Fars and Bushehr) are covered by super-arid and dry climates, which show a very high vulnerability to drought. It will also be invulnerable to very wet and humid areas. Although currently a small area of the country is covered.



Main Basins	Area (km²)	Average Groundwater Depletion Trend (mm/yr)	Groundwater Depletion Trend (Mm³)	Groundwater Depletion Trend (Mm³/yr)	Groundwater Depletion Trend (GT/yr)
Caspian Sea (code 1)	17,5051	−20,565	-5.40×10^4	-3.60×10^3	−3.60
Persian Gulf and Oman Sea (code 2)	424,029.6	−7.075	-4.50×10^4	-3.0×10^3	−3.0
Urmieh (code 3)	52,000	−10.192	-0.79×10^4	-0.53×10^3	−0.53
Central Plateau(code 4)	825,000	−14,0	-17.25×10^4	-11.55×10^3	−11.55
Eastern Boundary(code 5)	106,000	−5377	-0.85×10^4	-0.57×10^3	−0.57
Ghareghom (code 6)	44,295.5	−18,738	-1.24×10^4	-0.83×10^3	−0.83
Iran	1,626,376.1	−12,346	-3.01×10^5	-20.08×10^3	−20.08

Figure 10: Long-term and short-term monthly values of underground water storage in the main basins in Iran

Climate models also predict that climate change will have a profound effect on the future distribution of extreme drought in Iran]105,61,146,158[. Consequently, water scarcity and related problems are expected to worsen under projected climate change conditions. In this regard, flood is one of the hazards related to water, which can be related to the physiological, meteorological, geological and land use characteristics of the region]138[.

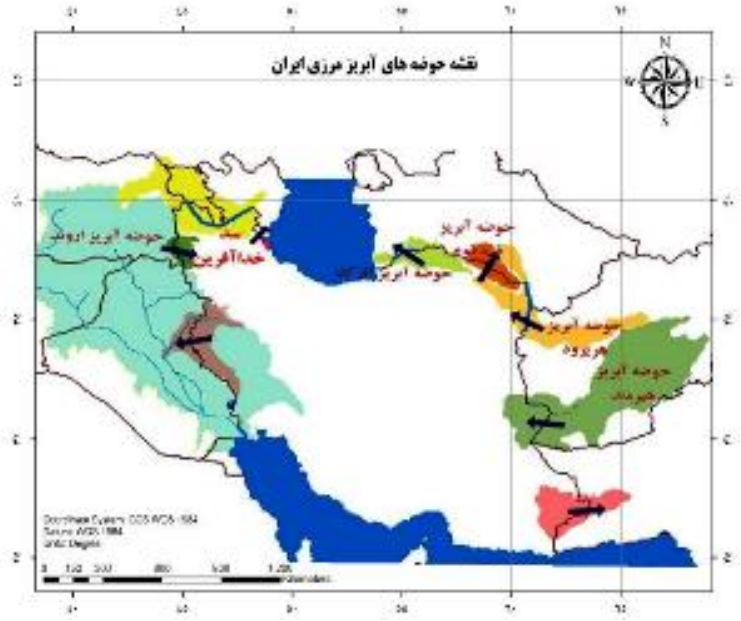


Figure 11: Representation of Iran's border rivers and watersheds

Changes in precipitation and evaporation patterns, soil moisture, runoff volume, and river discharge are among the factors affecting the intensity of silage during the return period]145[. The intensity of daily rainfall shows an increasing trend since the 1960s, which indicates the occurrence of frequent and more intense floods in some parts of Iran, especially in humid areas such as East Azerbaijan, West Azerbaijan, Golestan, Mazandaran and Gilan provinces]2[. Although geography and climate are the main drivers of floods, some human activities such as land

use or land cover change, deforestation, urbanization and inappropriate agricultural practices (especially near rivers) can affect the occurrence and frequency of floods]139,114,126[.

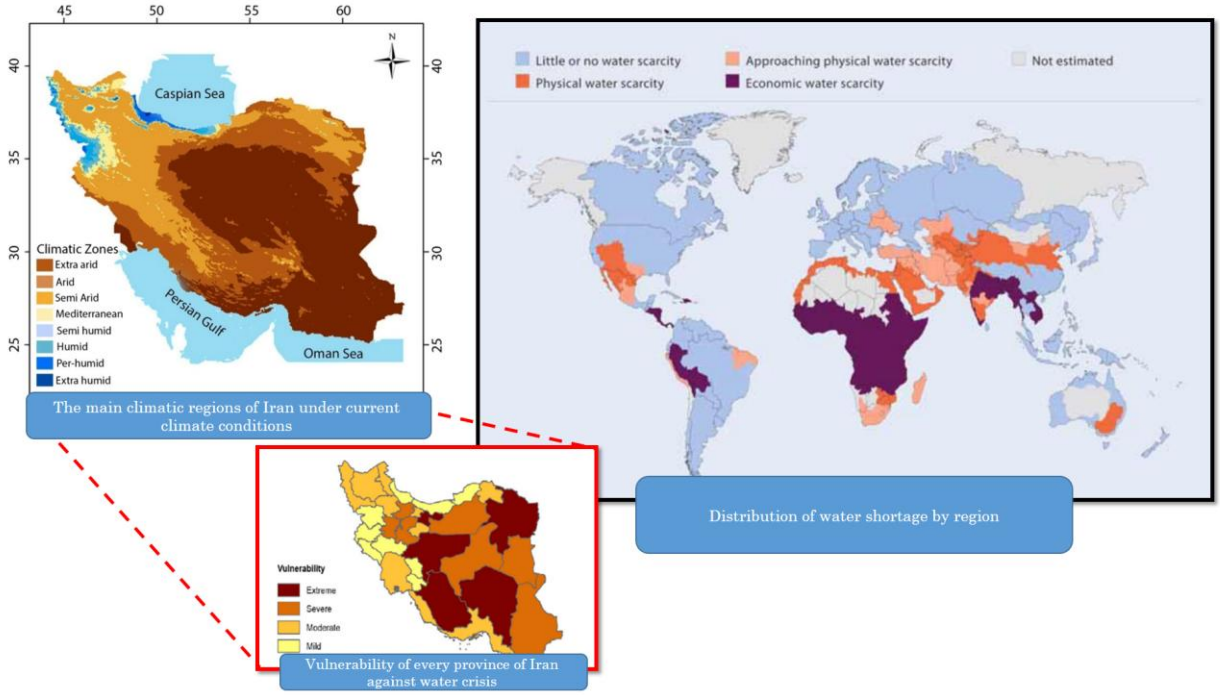


Figure 12: Vulnerability of Iranian provinces against water crisis

Addressing governance challenges is crucial for managing water resources and solving water crisis problems in Iran. According to the statement of the Second World Water Forum, "the water crisis is largely a governance crisis. In some water-scarce areas, there is enough water, but people living in these areas suffer from severe water-related problems caused by mismanagement and water governance crisis]111[.

In terms of water governance in Iran, dispersion of responsibilities in organizations, mismatch between executive and functional institutions, ambiguity in laws and policies governing water rights, implementation and budget challenges are the main characteristics of weak water governance.

Also, the concept of sustainability has not been seriously considered in the country's development strategies. Although sustainable development still does not have a proper place in strategic planning and management, Iran seeks to achieve sustainable development through a series of environmentally friendly projects. For this reason, Iran has recently implemented many programs in the field of reduction, protection, reuse, water recycling and environmental protection. Alborz Integrated Water and Land Management Plans, Tehran Sewerage Project, Northern Cities Waterworks and Ahvaz and Shiraz Waterworks are among the development projects that are partially supported by the World Bank]143[. Urmia Lake's drying crisis is the most obvious example. Urmia Lake in northwestern Iran is an endorheic saltwater lake, with an area of about 4000 to 6000 km, classified as the largest saltwater lake in the Middle East and the sixth largest lake on the planet]14 [.

In 2000s and 2010s, Urmia Lake faced severe environmental water crisis. As a result, about 70% of the lake's surface has already dried up]55[. Since then, various reasons (natural drought, water harvesting, dam construction projects and development of water resources) and solutions for drying up and saving the lake have been proposed. But due to the lack of data and integrated management, all of them have not been able to have a good understanding of the fate of the lake, so that the government accepted foreign aid to solve this problem. Another problem is related to biological and hydro chemical data. Sometimes pollution data is more or less available, but government agencies show little interest in releasing the data to avoid potentially arousing public concern. In some cases, ignoring local participation and public consultation in management activities is obvious. Sometimes, executive tasks are delegated to specific companies. This policy makes water related problems less attractive to others and hence many experts are excluded from providing solutions. Recently, water-related challenges have seriously raised warnings about the threat of political and military conflicts with water-threatening neighbors.

The challenges of water resources in the western and eastern borders are due to the unfair distribution and excessive allocation of water for human use, especially agriculture. The shrinking of Hamoon Lake can be considered a tragedy for Iranians. Lake Hamoon is in the Sistan Basin between eastern Iran and western Afghanistan, but it is fed by the Hirmand River, the longest waterway on the Afghan side. Between 1999 and 2001, due to the unequal distribution of water along with droughts and long-term climate changes, the flow of the river to the lake decreased and finally the lake disappeared. There is also such a problem in the west of Iran. Many experts stated that dust storms and the drying up of wetlands in this region are the cost of huge dam construction projects in neighboring countries]21,107,156[.

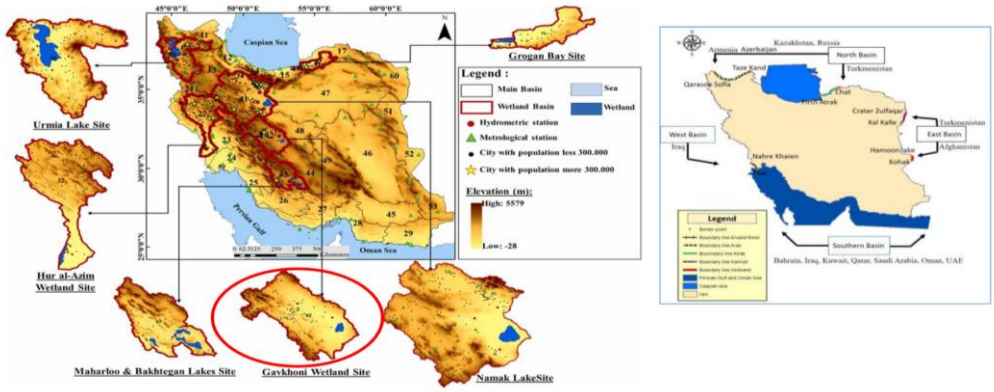


Figure 13: Map of hydro political areas of Iran

Conclusion

The location of the Middle East region in the dry belt of the world and the existence of limited and shared water resources in this region, as well as the trend of increasing population and demand, have turned the water of this region into one of the critical centers in relation to water resources and the resulting tensions and competitions. In general, 50% of the population of this region lives in common catchment basins and either desalinate the water or use a pump to collect water. The hydro political issues in each of the three studied basins are analyzed separately.

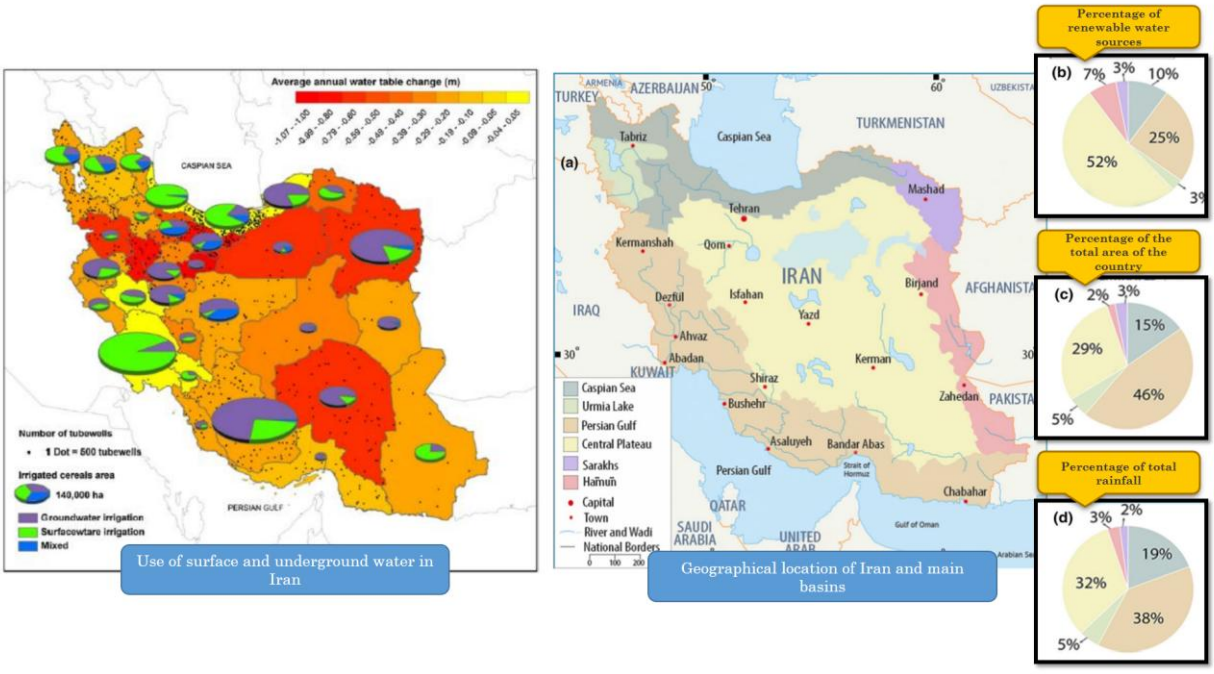


Figure 14: Percentage of surface and underground water in Iran

One of the most fundamental issues in each of the studied basins is the population growth process and the consequent increase in water needs and its consequences. The population growth rate in the Nile basin in 2005 was equal to 49.2%, which is considered a high growth. The population of this basin increased from 91 million people in 1950 to 380 million in 2005, which indicates that the population has increased more than 4 times in half a century. It is expected that this number will increase to 587 million people in 2025. The population growth rate in two of the three major Nile water consuming countries, namely Ethiopia and Sudan, is higher than the average population growth in this region, and the population of Ethiopia increased from 77 million in 2005 to 110 in 2025 and Sudan will increase from 40 to 54 million people, and this issue and the production of electricity and food for this growing population will affect the amount of water withdrawal of these countries as countries located in the upper part of the Nile and will cause problems for Egypt. . The influence and actions of Egypt's competitors in the countries of the upper part of the Nile River are also other issues raised in this basin. The unrest in South Sudan also hinders the country from taking effective measures to prevent 50% of the White Nile water from being wasted in the swamps of Sawad and accelerating the flow of Nile water to the north of the country. This issue, in turn, has an effect on Sudan's use of Nile water due to the need to produce more fodder. Ethiopia is one of the pioneer countries in the African Union, and if it can receive loans from the African Development Bank, it will be used in infrastructure sectors such as the construction of dams and power plants, which will have a direct impact on the amount of water in the White Nile. In general, with the passage of time, water issues in this basin will become more complicated. The population of the Jordan River Basin, excluding Syria, has increased from 4 million people in 1950 to 20 million people in 2005, and the average population growth in this basin is also high.

The population is expected to increase from 20 million to at least 27 million in 2025. The highest rate of population growth with 3.4 percent is related to Palestinians and the lowest rate is related to Lebanon and Israel. The average per capita water in this basin will decrease from 535 cubic meters in 2005 to 428 cubic meters in 2025. The lowest water per capita will be for Palestine with 47 cubic meters, which cannot meet their needs in any way. Currently, the high use of water from the Jordan River's tributaries has caused up to 90% of the water of this river to be used before reaching the Dead Sea, and this problem, in addition to increasing the salinity of this lake, will eventually cause it to dry up. This trend has led to proposals to transfer water from the Red Sea and the Mediterranean to this sea. In general, it can be said that in the future, the problems of the Jordan River Basin will be more acute, because the lack of water and the increase in demands, especially from the Palestinians, and the existence of discrimination in the use of water resources, as well as the high cost of water desalination, will affect the peace issues of the Middle East. According to the given information, although the rate of population growth in the Tigris and Euphrates basins is lower than that of the Nile and Jordan rivers, Iraq and Syria have a high growth rate with an annual growth rate of 2.7 percent. The population of this basin increased from 47 million people in 1950 to 189 million people in 2005 and it is expected to increase to 245 million people by 2025. The amount of water per capita in this basin in 2005 was equal to 2761 cubic meters, which is expected to decrease to 2761 cubic meters in 2025. 94% of the sources of the Euphrates and 51% of the sources of the Tigris are located in Turkey, and it is predicted that water consumption in Turkey will increase in the coming years due to reasons such as population growth and urbanization, which will change life and consumption patterns and ultimately increase water consumption. The implementation of a series of irrigation projects by the government (GAP) which, upon completion, will increase the demand for water resources in the country. Also, the rapid increase of industrial areas and the rapid process of industrialization, which has increased the need for electricity, and the country also lacks fossil fuel to produce electricity and has to rely on hydroelectricity, will increase very quickly. Even now, big cities like Ankara are suffering from water shortage. The increasing expansion of tourism in Turkey causes the water consumption along the coast of Turkey to increase due to the tourism in those areas, and a large amount of water that should be used for agriculture is allocated to this issue. The absence of a comprehensive agreement between Turkey and the downstream countries regarding water and the contradictory views of each of these countries, as well as the increase in the needs of all countries in this basin, can lead to tensions. Water quality is also one of the basic issues raised in this basin, the high use of chemical fertilizers and poisons due to the expansion of agriculture, along with the decrease in the amount of water and its increase in salinity, has caused the downstream countries to face problems in supplying their drinking water. Currently, Syria is having problems in supplying water and electricity to its cities, including Damascus. In general, in Turkey, there is a great desire to

manage water resources and sell it to countries in need, and proposals such as the peace pipeline and transporting water by ship and plastic bags are examples of these efforts. The existence of some issues, such as the fear of more dependence on Turkey, as well as the cost and time of implementing these plans, are obstacles to their realization.

• Work methods and proposals at the domestic and regional level

- Construction of dams on border rivers: Construction of dams and dams is one of the ways to save water and fight against drought.
- Continuous monitoring: checking and considering regularly and continuously the amount of precipitation and the water level of underground aquifers and its annual comparison with the amount of consumption can be somewhat preventive.
- Wastewater treatment: water recycling for reuse directly or by changing its use, such as using safe and treated wastewater in agriculture, industry and health, is another way to deal with water scarcity and optimal use of water. The development of wastewater treatment in the city and industries for recycling and reuse is an inevitable necessity today.
- Demand management approaches, which are one of the main topics of water resource management, especially in countries with limited water resources, should be given more focus and attention in the water resources management programs of the countries.
- It is suggested that in the form of a comprehensive and continuous program, the governments of Iran and Iraq allocate one percent of their gross national product to solving water problems and its crisis.
- From a theoretical point of view, the most logical way to efficiently manage transboundary water is for countries to use water for agriculture, hydropower and other services based on their relative advantage.
- It is suggested to form institutions consisting of representatives of Iran and Iraq to resolve disputes and coordinate common resources, including common water resources and other strategic concerns.
- Groundwater is extremely sensitive, which is unfortunately used indiscriminately. Therefore, it is necessary to manage underground water resources in countries, especially in Iran, and to monitor its consumption more.
- Exchange of water and its export between the countries of the region according to technical, economic, social, security, political and environmental justifications, respecting the rights of the beneficiaries of each basin.
- The need to establish increasing cross-border cooperation between countries and develop a global action plan for access to safe water for all sections of society.
- Increasing international aid to developing and underdeveloped countries.

Since the last few decades, climate change and the effects of global warming, along with natural phenomena such as droughts and floods, have become one of the main concerns of Iranians. Although it is difficult to assess the extent of climate change and the effects of global warming on Iran's water resources and ecology independently, several monitoring reports predict that there will be a warmer and drier climate in most parts of the country. However, changes in spatial and temporal distribution of rainfall, evaporation and transpiration and hydrological abstractions, severity and frequency of droughts and floods, water quality, water consumption, over-harvesting of underground water, soil salinity, soil erosion, desertification, land use, quality Product and product production systems. We can mention the direct and indirect effects of climate change and global warming. It should be noted that the existing challenges related to Iran's water have intensified over the centuries and cannot be solved immediately. If appropriate management measures are not taken to deal with these challenges, the future of Iran may be exposed to the risk of water insecurity. In conclusion, to minimize the challenges facing water resources management in Iran, the following suggestions are suggested:

•Water resources management in Iran is a complex process that requires complex solutions. It should be managed in a way that includes the health, environmental, geographical, climatic, financial, technical, political, social and

cultural conditions (religious, norms, etc.) of each region. Policies should address environmental sustainability and social responsibility from a national and regional perspective

• There are still many lessons that Iranians should learn from local water resource management strategies to solve water-related problems in the future. Although the concepts of ownership, fair distribution and equity (sustainable use of water to ensure a fair share of water for future generations), public services, accountability, quality, economic cost, efficiency, integrity and access to justice are very prominent in modern systems. Integration with traditional practices can make them more attractive and valuable for improving water management. In this regard, for the protection of traditional technologies and sustainable ways of using water resources, prevention, repair and renovation efforts and appropriate credits are needed. Also, the socio-cultural aspects of traditional water systems should be taken into consideration before they are forgotten

• Most water related problems stem from ignorance of what they can do to secure and sustain their water resources. In this regard, more studies and activities are needed in the field of implementing educational and general educational programs

• In the past few decades, food subsidies have led to the promotion of a culture of consumerism, food demand and dependence on monoculture agricultural activities. In this regard, Iran's focus on the cultivation of low-value crops with high water demand, such as wheat, not only does not improve food security, but can be considered as a threat to water security. Therefore, the cultivation of water-intensive crops should be controlled in low-water areas by importing them from high-water areas, and also encourage farmers to plant low-water-intensive crops or switch to better irrigation methods such as drip irrigation.

In short, according to the most important factors and factors that cause Iran's water problems, adjusting the price of water, increasing the efficiency of water consumption, managing demand, recycling water, controlling runoff, preventing the decrease of underground water, renewing the water resources network, creating restrictions in the structure hydraulics of constructions, preventing water pollution and rehabilitating polluted waters, reducing the growth of urbanization, determining the appropriate cultivation pattern for each region, creating a mechanism to adapt and reduce climate changes, floods and droughts, increasing investment in technology transfer, expanding applied research and Improving education has been suggested as a solution for water management.

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