Journal of Hydraulic Structures
J. Hydraul. Struct., 2022; 8(1):21-34
DOI: 10.22055/jhs.2022.40273.1206

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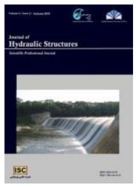

Non-priority and priority allocation policies in water resources management concerning water resources scarcity using the WEAP model in the catchment area of Fars province

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Abstract

Water shortage in dry regions include the region of this study urge the needs for management of water supply in different parts such as drinking and agriculture sectors, the effects and climate changes of the region should be evaluated in order to anticipate the necessary measures to deal with these effects. In the present study, based on the fifth IPCC reports, these changes were predicted using scenarios of RCP2.6, RCP4.5, RCP8.5. The results showed that by the end of this century, the annual temperature will increase by 4.7%, but in the case of precipitation, according to different scenarios, 4.5RCP scenario considered as optimistic scenario and 2.6RCP as pessimistic and finally 8.5RCP considered as the median. Two general policies of allocation without prioritizing consumption and prioritizing urban consumption found to be ineffective regarding the allocation of water resources until the end of the present century. Many problems were observed in the drinking water sector in the policy without prioritization in the allocation of water resources in the months of June to October and in the allocation with prioritization of consumption in the months of August, September and October. Therefore, the rationing policy should be used to supply drinking water to the cities of Shiraz and Marvdasht. This policy showed the best efficiency by reducing the area under cultivation and changing the crop. Thus it is possible to avoid problems in both drinking water and agriculture by substituting rice product to wheat and reducing rice product to 50% as well as reducing the area under agricultural cultivation by 58.4%. in this paper the volume of water entering the reservoir in different months of the year in the region was modeled and calculated in the years to come in addition SDSM software used to collect and forecast data and inputs of the study area and in the following WEAP software used to study the management and allocation of water resources and subsequently by using the WEAP water resources allocation model, the amount of water resources shortage for drinking and agriculture for each month during the study period (2019-2099) has been estimated.

Keywords: Water resources management, consumption prioritization, WEAP model, climate change.

Received: 28 March 2022; Accepted: 06 May 2022

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1. Introduction

Most global climate models have predicted that the phenomenon of climate change and global warming due to human activities will occur as a gradual and sequential process by the end of this century. Assuming that greenhouse gas emissions are prevented, many greenhouse effects will remain due to the long re-freezing time of melted ice and the long life of these gases in the Earth's atmosphere.

The issue of water resources management in developing countries is a complex phenomenon that arises from various economic, social, cultural and political factors. Factors such as increasing population growth, demand for other sectors of development and limitation of fresh water resources has caused serious problems for the optimal management of water resources in these countries. In addition, global climate change has increased the complexity and sensitivity of the issue Zarezadeh [1].

In recent decades, climate change in many parts of the world has had its effects and these impacts are expected to intensify in the coming decades. Unfortunately, Iran is no exception to these large-scale changes and its effects have been observed in many watersheds of the country which have sometimes led to instability of hydrological information Zahraei, Banafsheh et al. [2].

Lack of available water resources in the country and its disproportionate distribution, shows the need for optimal management of water resources. For this purpose, appropriate laws should be made for rivers and reservoirs of dams as one of the most important components. Applying such laws will create a balance between limited available resources and high consumption, optimize water consumption in the agricultural, urban and industrial sectors and ultimately achieve sustainable development in water resources management. The scarcity of surface water resources in arid and semi-arid regions is always increasing, so allocating water in large irrigation and drainage networks that have been established in such areas is even more difficult lu et al. [3].

On the other hand, increasing environmental concerns and raising public awareness in this area have led to the recognition of the ecosystem water needs. From a managerial and decision-making point of view, these conditions exacerbate competition for limited water resources between the agricultural sector and the environment sector, which can lead to serious conflicts. The water intake of Dorodzan Dam located in Maharloo-Bakhtegan watershed is one of the areas of Fars province that is experiencing disputes over water allocation. In this area, drought water shortage and the type of water management by the government has led to a serious increase in disputes over agricultural water Bijani et al. [4].

Bakhsipoor et al. [5]. indicated that operational strategies can improve the demand coverage and reliability of the system. The intended scenarios are also capable of improving monthly demand for the demand between 0 % and 700 % for Abadan as a critical point in the system. Hafezparast et al. [6] for Takestan plain, examined the situation of the region in different scenarios using WEAP simulation model. They concluded that the construction of a dam and irrigation and drainage network will meet a higher percentage of supply demand in different irrigation methods. Despite the increase in the area under cultivation, the supply of demand increased by 5 to 10 percent. Kermanshahi et al. [7] investigated the application of WEAP model in evaluating the impact of irrigation water consumption management on water resources of Neishabour plain. The results showed that by applying these scenarios, the average annual irrigation need will be reduced by 9, 10 and 18%, respectively, and subsequently, the average annual deficit of the reservoir will be reduced by 13, 8 and 18%, respectively. Carpenter et al. [8] used WEAP model as a decision support system for watershed management. Results suggested that the addition of water storage structures as well as artificial groundwater recharge structures reduce the unmet water demand for domestic consumption and meet irrigation water requirements. Aghakarami and Moridi [9] investigated the effects of the implementation of the sewage project on the groundwater level of the Tehran-Karaj plain by the WEAP model. The results showed that the aquifer feed from the sewage well was reduced by an average of about 14% at the time of the project. Abdi and Tenalem [10] For the Ketar sub basin, the WEAP (water evaluation and planning) hydrologic model was developed and the model has demonstrated the capability to represent the hydrologic dynamics of the sub basin both at monthly and average monthly periods. In general, the overall model performance evaluation statistics show a very good agreement between measured and simulated streamflow at the outlet of the sub basin. Hashemi et al. [11] compared two models, LARS-WG and SDSM, to simulate heavy rainfall in the Klota Basin on the South Island of New Zealand. The results of their research showed that both models have similar and good capabilities in simulating heavy rainfall events and can be used for climate forecasting. Wichalainen et al. [12] investigated the effects of climate change on the hydrology and water resources of the Vioski Basin in eastern Finland. The results showed that climate change affected snowmelt and caused seasonal changes in runoff and lake water levels. Turns. Simon Gosling and Nigel [13] used different GCM models during a study for 1339 catchments and finally came to the conclusion that the water stress index (WSI) is used to calculate the increase and decrease of global water shortage due to climate changes. TV Rishmidavi et al. [14] examined the effect of climate change on water balance in the Indian basin. The results show that the reduction in runoff, annual flow and groundwater will continue to the end of the century. Rainfall forecasts for the future show an increase in the average annual precipitation. Qada Qatraneh et al. [15] in Azarq basin used RClimDex for six loading stations and two metrology stations to identify and predict the effects of climate change in Azarq basin by 2030 which showed that the maximum monthly average daily temperature, Tropical nights, maximum of monthly maximum, maximum of daily maximum, are significant indicators of climate change. Gundim et al. [16] made climate variables for the base period 1971-2000 by studying climate change over the Jaguaribi River Basin in Brazil using three RCP scenarios (2.6,4.5,8.5) and made forecasts for precipitation, temperature and evaporation in the future 2025 -2055. The results showed that evapotranspiration increased by 2.3 to 6.3% and both precipitation and increase were visible in the scenarios regarding precipitation of both samples decrease and increase were visible. Huang et al. [17] developed a framework involving targeted dynamical downscaling of historical and future extreme precipitation events produced by a large ensemble of a global climate model. Climate change vulnerability, water resources, and social implications in North Africa were investigated by Schilling et al. [18].

Almazroui et al. [19] examined the future temperature and precipitation projections over South Asia using the latest CMIP6 dataset. The paper further describes the projected changes in mean temperature and precipitation at national, annual, and seasonal scales, in South Asia.

Due to the above-mentioned issues regarding the high sensitivities of Fars province and Dorodzan dam for various reasons, including drinking water section and agriculture, and due to the location of this dam in a hot and dry geographical area, the effects and climate change of the region should be evaluated in order to deal with these effects. As for the lack of necessary studies in this regard, these changes have been predicted through citing the fifth IPCC reports, which are discussed on four groups of diffusion scenarios including RCP2.6, RCP4.5, RCP6, RCP8.5 and by using Scenarios RCP2.6, RCP4.5, RCP8.5 in the following, using WEAP software scenarios based on these changes were generated to measure the impact of climate change in this process

2. Area of study
2.1. Dorodzan dam

Dorodzan Reservoir Dam is located 100 km northwest of Shiraz, in the geographical range of 30 degrees and 11 minutes to 30 degrees and 14 minutes north and 52 degrees and 19 minutes to 52 degrees and 25 minutes east on the KOR River and with a regulation of about 760 million Cubic meters of water per year provides agricultural water to about 42 thousand hectares of Ramjerd lands and about 34 thousand hectares of lands in Karbal region and Marvdasht region. Dorodzan Dam provides drinking water of Shiraz, Marvdasht and a number of villages between the road and large industrial institutes nearby, as well as industrial water for the use of petrochemical industries.

The statistics related to Dorodzan Dam used for this research related to 41 years (55 to 96) including input volume, evaporation, drinking needs, industry and agriculture and data related to the level, volume and height of the dam reservoir delivered and adjusted from Fars Regional Water Company. The inlet volume to the dam reservoir is 91.99 million cubic meters on average. 35.12 million cubic meters input volume as minimum belonging to September and 195.17 million cubic meters input volume as maximum belonging to April.

2.2. Molasadra dam

Molasadra Dam was built on 60 km upstream of Dorodzan Dam located in the north of Fars province, Eghlid city, 22 km from Shahrsadeh city and on the main tributary of Kor river in a place called Tange Boraq. The average volume of inlet to the dam reservoir is 103 million cubic meters. 5.23 million cubic meters of minimum input volume is pertaining to August and 159.53 million cubic meters of maximum input volume is pertaining to April.

3. Research Methods

In this research, the information received from meteorological and water organizations of Fars province from 1355 to 1396 has been used, the needs and inputs of the study area (Dorodzan Dam) have been collected and forecasting has been done until 2100 using SDSM software. Afterward according to the available information and forecasts, the management of water resources and the allocation of these resources have been studied using WEAP software.

In the present study, according to the rainfall and by estimating the amount of precipitation caused by rainfall, the volume of water entering the reservoir in different months of the year in the region was modeled and calculated in the years to come. According to the water inlet volumes to the dam reservoir, by using the WEAP water resources allocation model, the amount of water resources shortage for each of the uses (drinking and agriculture) for each month during the study period (2019-2099) has been estimated.

Scenarios of RCPs in 2014 were designed by a scientific committee under the auspices of the Intergovernmental Panel on Climate Change with the aim of providing a set of information from which the main causes of climate change can be traced and the results can be applied to climate models. The RCP scenario consists of 4 different scenarios, which are: 8.5, 6, 4.5, 2.6 and are based on different specifications of technology, social and economic status, future policies that can lead to dissemination of greenhouse gases and climate change. In each version of this scenario, the effect of greenhouse gas emissions according to the role of them on radiation induction is classified into four categories: 8.5, 6, 4.5, 2.6 (2W / m) by the end of the 21st century. It also covers the results of these scenarios from 1850 to the end of the 21st century, and formulated by 2300.

These scenarios are designed based on the results of some socio-economic and technological parameters as well as the concentration of some gases for the coming decades.

1. In the RCP8.5scenario the CO2 concentration by 2100 is estimated to be 1370 PPM and the effect of greenhouse gases on radiation emissions is estimated to be 8.5 watts per square meter.
2. In the RCP6 scenario the CO2 concentration by 2100 is estimated to be 850 PPM and the effect of greenhouse gases on radiation emissions is estimated to be 6 watts per square meter.
3. In the RCP4.5scenario the CO2 concentration by 2100 is estimated to be 650 PPM and the effect of greenhouse gases on radiation emissions is estimated to be 4.5 watts per square meter.
4. the RCP2.6scenario the CO2 concentration by 2100 is estimated to be 490 PPM and the effect of greenhouse gases on radiation emissions is estimated to be 2.6 watts per square meter.

In 2014, IPCC working groups presented the Fifth Climate Change Assessment Report. The Intergovernmental Panel on Climate Change has used new RCP scenarios in its Fifth Evaluation Report as representatives of the trajectories representing different concentrations of greenhouse gases. The new scenarios have four key trajectories named RCP2.6, RCP4.5, RCP6, RCP8.5.

4. Results

4.1. The results of the SDSM model

In Figure 2, the efficiency of the SDSM model based on the result obtained from model validation during the 2010-2019 statistical period is depicted for RCP2.6 ،RCP4.5 and RCP8.5 scenarios. As is clear, the efficiency of the downscaling model is higher for middle-range temperature compared to precipitation. This can be explained by the fact that temperatures are continuous and do not include zero values. Also, results show that the average precipitation predicted by the RCP2.6 scenario is approximately 180% higher than the observed value and this model involves unacceptable prediction error. On the contrary, the result generated by the RCP4.5 scenario is of sufficient accuracy and there is a small difference between observed and predicted values. Based on the results, the maximum error between observed data and values obtained from the RCP4.5 are only 15% and 4%, respectively.

In Table 1, the mean value for temperature and precipitation of different seasons are compared for all three studied scenarios during the 2010-2019 statistical period. As can be seen, there is a big fluctuation in the mean precipitation for different months, while this is not the case with mean temperature. The maximum seasonal temperature errors are 7%,3%, and 12% for RCP2.8, RCP4.5 and RCP8.5, respectively.

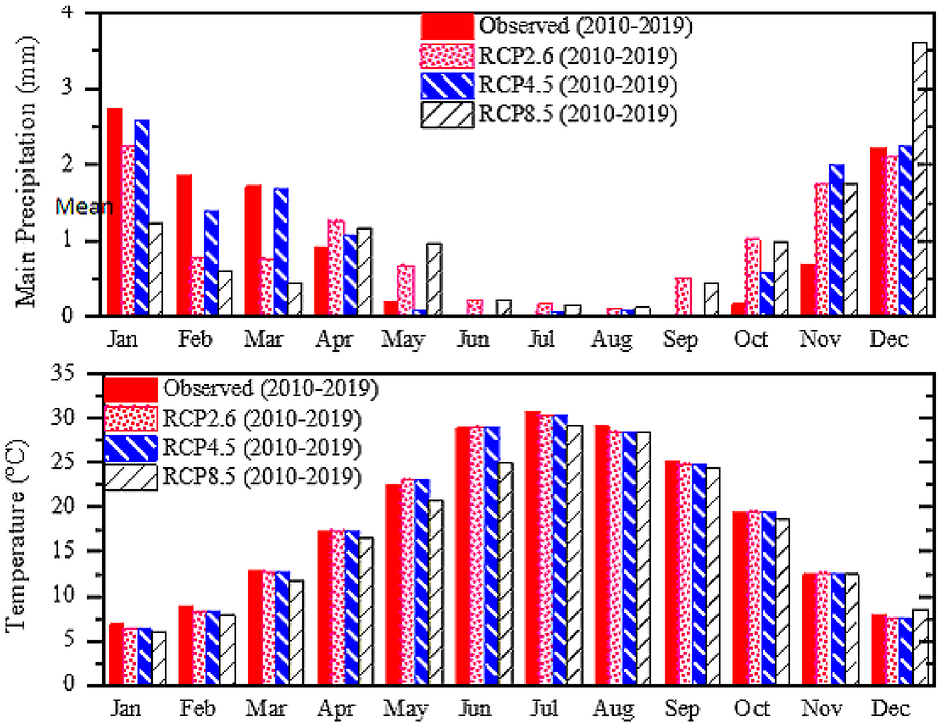

Figure 1. The efficiency of the SDSM based on the result obtained from model validation during 2010-2019 statistical period a) Average precipitation b) Maximum precipitation c) Maximum temperature d) Mean of Average Temperature

By having the output information from the SDSM model as well as the information collected from Dorodzan region, it is possible to change the precipitation and temperature changes in table number (1) as well as the average. Observed annual rainfall and temperature.

Table 1. comparison between mean temperature and precipitation studied scenarios during 2010-2019 statistical period

Month	Observation	RCP2.6	RCP4.5	RCP8.5
		Main Precipitation		
Winter	2.278	1.604	2.143	1.692
Spring	0.945	0.898	0.950	0.856
Summer	0.019	0.159	0.054	0.179
Autumn	0.289	1.087	0.871	1.163
		Average Temperature		
Winter	7.248	7.744	7.341	7.953
Spring	16.656	17.769	17.142	18.566
Summer	28.159	29.657	28.327	29.740
Autumn	18.481	18.981	18.621	19.007

However, in terms of temperature, these changes did not occur with such intensity and the rate of temperature changes will change by 14% only in January, but during the year, these changes will be less than 5% for different scenarios.

4.2. Results from the WEAP model
4.2.1. The amount of water collected from rainfall

To calculate the amount of runoff due to rainfall in the region, in the first step, the model should draw a schematic plan of the region in the VIP software environment and the information of general characteristics of the region such as the area and consumption amount, as well as rainfall during the months of the year will be entered in the software. Figure (2) is schematic diagram of the study area.

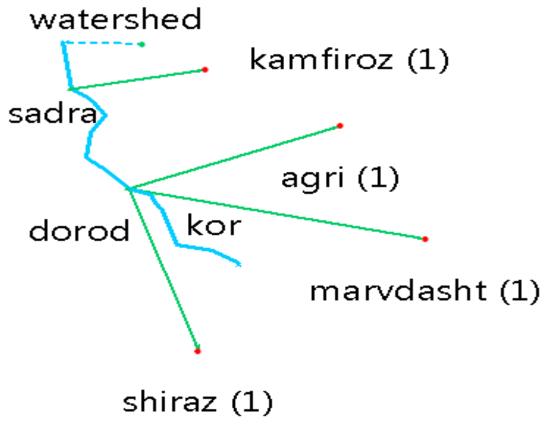

Figure 2: Schematic drawing of the Kor River basin

Using WEAP software and runoff model Rainfall values during the study period (2019-2099) are presented in the form of diagrams in Figure (3) for scenarios (RCP 2.6, 4.5, 8.5).

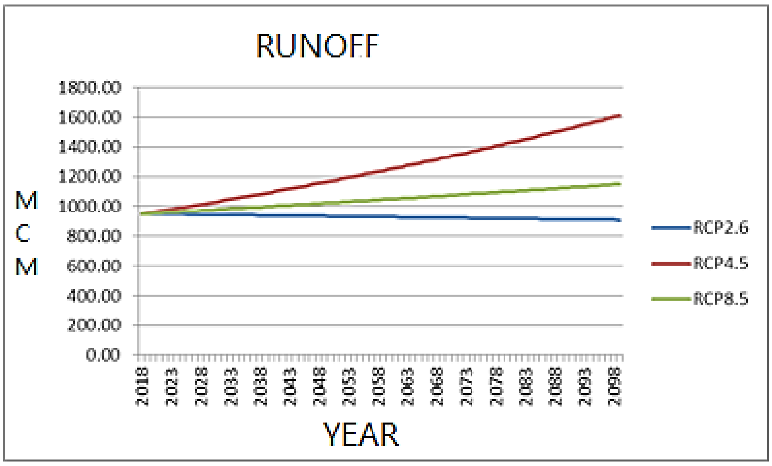

Figure 3: Runoff rate due to precipitation from three scenarios

4.2.2. Consumption of water resources

Following the management of water resources, consumption is divided into three parts: drinking and first-class agriculture and second-class agriculture. In all three policies, changes will be made to meet all three types of consumption. It should be noted that the amount of consumption during the study period in the agricultural sector is considered constant regarding planning and development projects, but due to the increase in population in Fars province, there will be changes in the drinking water sector, which will increase consumption. According to the population and housing information in 2016, population growth in Iran will be equal to 1.4 percent and the amount of drinking water required by the cities of Shiraz and Marvdasht, considering the supply of only 30 percent of Shiraz consumption from Dorodzan Dam (70 percent of underground resources) and One hundred percent of Marvdasht city consumption will be calculated based on the consumption pattern of each person in the province and will be applied in consumption management.

4.3. Water resource allocation policies
4.3.1. Non-priority allocation

In this scenario, all information received from the amount of consumption in the study basin will be evaluated without prioritizing the need for water supply. In simple words, there will be no prioritization for any of the region's consumptions, such as drinking, agriculture, or industry, to supply 100 percent of a water requirement considering surplus resources. Based on this, the amount of water resources for consumption can be seen separately in Tables (2), (3) and (4). These tables show the estimated water levels in different scenarios in different months of the year over the coming years. According to the results of Scenario 2.6, Scenario 4.5 and Scenario 8.5, we can assert the ineffectiveness of this policy and the increasing complexity of this policy in water resources and the resulting public dissatisfaction with the shortage of drinking water. It can be seen that in this policy, except for the RCP4.5scenario where the shortage of drinking water and agriculture will be less than 2%, the rest of the scenarios in most months, in addition to the lack of resources in the first and second type agricultural sectors, cannot meet the drinking water needs of Shiraz as well as Marvdasht and in this case the problems will be doubled.

Table 2. Water supply in percentage on a monthly average in the coming years in RCP2.6 scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	99.91	99.91	99.91	99.91
FEB	99.21	99.21	99.21	99.21
MAR	98.94	98.94	98.94	98.94
APR	98.07	98.08	98.09	98.09
MAY	45.62	29.93	45.67	45.67
JUN	1.23	1.22	1.23	1.23
JUL	1.22	1.22	1.22	1.22
AUG	1.22	1.22	1.22	1.22
SEP	1.22	0.54	1.22	1.22
OCT	1.22	0	1.22	1.22
NOV	100	99.85	100	100
DEC	99.79	99.79	99.8	99.8

Table 3. Water supply in percentage on a monthly average in the coming years in the RCP4.5 scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	100	100	100	100
FEB	99.8	99.8	99.81	99.81
MAR	99.24	99.24	99.24	99.24
APR	99.84	99.84	99.84	99.84
MAY	98.78	98.78	98.78	98.78
JUN	98.78	98.78	98.78	98.78
JUL	98.78	98.78	98.78	98.78
AUG	98.78	98.78	98.78	98.78
SEP	98.78	92.76	98.78	98.78
OCT	95.37	79.98	95.37	95.37
NOV	100	99.85	100	100
DEC	99.79	99.79	99.8	99.8

Table 4. Water supply in percentage on a monthly average in the coming years in the RCP8.5scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	100	100	100	100
FEB	100	100	100	100
MAR	97.37	97.38	97.39	97.39
APR	100	100	100	100
MAY	61.65	42.39	61.69	61.69
JUN	3.37	1.22	3.38	3.38
JUL	1.22	1.22	1.22	1.22
AUG	1.22	1.22	1.22	1.22
SEP	1.22	0.54	1.22	1.22
OCT	1.22	0	1.22	1.22
NOV	99.82	99.67	99.83	99.83

4.3.2. Priority allocation

In this policy of allocating water resources, we will try to supply drinking water to the cities connected to this cycle, and in the next step, considering the land reforms and regional conditions of cultivation, the needs of strategic crops and finally the needs of high-consumption irrigated crops will be met.

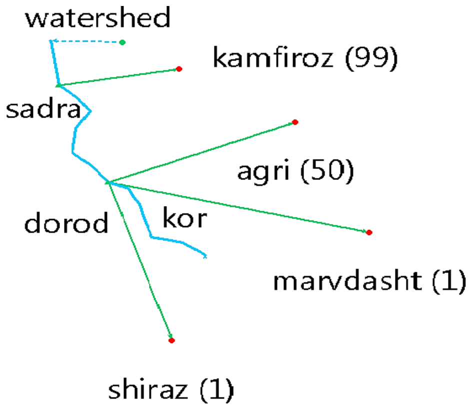

Figure 4: Schematic layout of the basin based on the prioritization policy

In policy by prioritizing, through calculating the information received from the amount of water resources shortage during the coming years 2019-2099, just like the previous policy (without prioritization), tables called the average Estimation of resources for consumption in percentage prepared to clarify these shortages on average during the months of these period and for different scenarios of RCP (2.6,4.5,8.5) which can be seen in Tables (5), (6) and (7).

Based on the following tables, it is possible to improve the consumption conditions in the drinking water sector and estimate the resources for these two cities in different months of the year compared to the policy without prioritization of resource allocation. Clearly, as with non-prioritized allocation, the RCP4.5scenario would be more appropriate than other scenarios due to higher rainfall estimates. As can be seen in Table 5-12, in the RCP4.5scenario, in all months of the year, it will be able to estimate the consumption of drinking and first grade agriculture, but in the second-grade agriculture (Kamfiroz), it will still have problems in different months.

Regarding other scenarios, this policy will often be able to allocate and supply 100% of drinking water, except in August, September and October in which due to excessive consumption in the agricultural sector and lack of resources for storage and rainfall, we will have much problems even in the drinking water section

Table 5: Water supply in percentage on a monthly average in the coming years in RCP2.6 scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	100	26.03	100	100
FEB	100	23.63	100	100
MAR	100	19.42	100	100
APR	100	21.19	100	100
MAY	100	15.56	100	100
JUN	100	10.41	100	100
JUL	95.66	5.26	100	100
AUG	63.6	1.75	81.05	81.05
SEP	22.42	0.35	44.8	44.8
OCT	1.22	0.28	1.38	1.38
NOV	100	6.77	100	100
DEC	100	24.6	100	100

Table6: Water supply in percentage on a monthly average in the coming years in RCP4.5scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	100	97.71	100	100
FEB	100	95.2	100	100
MAR	100	90.05	100	100
APR	100	88.75	100	100
MAY	100	79.6	100	100
JUN	100	71.84	100	100
JUL	100	64.39	100	100
AUG	100	57.46	100	100
SEP	100	51.08	100	100
OCT	98.78	44.75	99.28	99.28
NOV	100	49.18	100	100
DEC	100	98.65	100	100

Table7: Water supply in percentage on a monthly average in the coming years in RCP8.5scenario

	AGRICULTURE	KAMFIROZ	MARVDASHT	SHIRAZ
JAN	100	21.45	100	100
FEB	100	20.26	100	100
MAR	100	18.4	100	100
APR	100	23.43	100	100
MAY	100	17.68	100	100
JUN	100	12.43	100	100
JUL	99.82	7.16	100	100
AUG	75.65	2.96	91.68	91.68
SEP	40.31	0.73	59.11	59.11
OCT	4.99	0.31	19.8	19.8
NOV	100	4.73	100	100
DEC	100	12.7	100	100

4.3.3. Allocation with ration policy

Due to the lack of estimation of drinking consumption in previous policies, which is the most important part in the allocation of water resources in resource management, an alternative policy apart from those two policies should be considered which is called ration policy in this study. According to the calculations and various modeling in all three scenarios for the agricultural sector with this consumption model , rice cultivation due to its very high water consumption will be almost impossible, but in terms of changing the type of cultivation to more low-consumption crops, It will be possible, therefore, by using available information and reducing the combined area of cultivation in both agricultural sectors (first and second grade) ,water shortages in the drinking sector and agricultural sector can be prevented.

For instance, for a 50% reduction in the area under rice cultivation and its conversion to wheat cultivation, and at the same time a 58.4% reduction in the area under agricultural cultivation in the first grade, estimation of available water resources for all uses during the years under study will be possible.

5. Conclusion

In this study, we tried to predict the effects of climate change on precipitation and temperature during the current century and results derived by using the scenarios of the fifth IPCC report based on greenhouse gas emissions, radiation inductions and other factors affecting climate change. The results show a fundamental change in the amount and timing of precipitation, so that the average annual and seasonal precipitation in the three scenarios showed that on average we can see a growth of 24% in the coming years, with the difference that most of this Rainfall, unlike in the past, which occurred in autumn and winter, will occur in spring in coming years, but the temperature of the region due to radiation and increase in carbon dioxide in the atmosphere will face with an annual increase of 4% On average for all three scenarios.

In addition, in the discussion of water resources management and how to allocate future water resources, which is the outcome of climate change, the results showed that water allocation policies cannot be followed without priority policies and without standard conditions, because according to the findings, we will face with the shortage of water in urban areas in all month of the year. Also, with the policy of prioritization and consumption with priority of supplying drinking consumption, drinking water of Shiraz in July, August, and September and October will not be provided. Therefore, both policies will fail and the only solution will be to use the third policy as an alternative called ration policy, so that by reducing 50% and changing the crop in Kamphiroz from rice to wheat and through reducing the primary agricultural cultivation by 58.4%, problems can be prevented in both agriculture and drinking sectors. Consumption in both drinking and agricultural sectors should be optimized using consumption patterns, and then water resources wasting should be avoided by utilizing products and industrial tools in the agricultural sector as much as possible, and finally regarding water shortages in the July, August, September and October in which the highest shortage of drinking water occurs, so water resources should be stored in the reservoirs of Dorodzan Dam before these months in order to be released in this period.

Suggestions

1. Due to unsustainable urban and industrial development and greenhouse gas emissions, efforts should be made to achieve sustainable development and reduce greenhouse gas emissions.
2. In the coming years and considering the increasing flow of water and rainfall in the region, the facilities of the region and the ecology, as well as the physical and hydrological conditions of the region should be used to carry out watershed management, maintain and reduce waste of water resources.
3. Regarding the way water resources used in the agricultural sector, which covers a major share of consumption, basic arrangements should be made about how to use

and manage water resources, for example, how to irrigate and transfer water to cultivated lands using modern methods such as drip, sprinkler and subsurface irrigations.

4. In order to increase civic awareness, more efforts should be made by all authorities, including media, and regional water companies, In the form of incentive and punishment schemes so that the consumption model become closer to global consumption patterns.

Water shortage in dry regions include the region of this study urge the needs for management of water supply in different parts such as drinking and agriculture sector

References

1. ZareZadeh M. 2011. Water Allocation in the Qezelozan- Sefidrood Basin under Climate Change, using Bankruptcy Approach for Conflict Resolution. Thesis of Master of Science (M.Sc.) in Water Resources Engineering. Tarbiatmodares university of tehran. (in Persian with English abstract).
2. Zahraei, B. (2010). Modeling the effects of climate change on water resources in Sistan and Baluchestan province, Fourth Regional Conference on Climate Change, 219, Tehran, Iran.
3. Lu, H., Huang, G. and He, L. (2011). An inexact rough-interval fuzzy linear programming method for generating conjunctive water-allocation strategies to agricultural irrigation systems. Applied Mathematical Modelling, 35(9): 4330-4340.
4. Bijani, M., Hayati, D., Abdulvand, b. (1391). Conflict in water utilization in the irrigation hut of Dorodzan Dam: The view of regional water experts, Environmental Sciences, 10 (3): 14-26. (In Persian).
5. Bakhsipoor, I. E., Ashrafi, S. M., Adib, A. (2019). Water Quality Effects on the Optimal Water Resources Operation in Great Karun River Basin. Pertanika J. Sci. & Technol. 27 (4): 1881 – 1900.
6. Hafezparast, M., Mavdat, M., Kholghi, M. and Fatemi, A., (2009). Evaluate and planning water resources of the Takestan plain with WEAP and LINGO models. In 4th *National Congress of Civil Engineering*, *University of Tehran*. (In Persian).
7. Kermanshahi, S. Davari , K. Hasheminia, S.M. Farid Hosseini, A. and Ansari, H .(2013) .Using the WEAP Model to Assess The Impact of Irrigation Water Use Management on Water Resources of Neyshabour Plane. Journal of Water and Soil. Vol. 1, No.22, p. 25-36. (In Persian)
8. Carpenter, A., Choudhary, M. (2019). Water Demand and Supply Analysis using WEAP Model for Veda River Basin Madhya Pradesh (Nimar Region), India. TRENDS IN SCIENCES 2022; 19(6): 3050.
9. Aghakarami, M. Moridi, A. (2014). Effect of implementation sewer scheme in groundwater (Case Study: Tehran-Karaj Plain). 5th Water Resource Management.

10. Abdi, D. A., Tenalem, A. (2021). Evaluation of the WEAP model in simulating subbasin hydrology in the Central Rift Valley basin, Ethiopia. ecological processes, https://doi.org/10.1186/s13717-021-00305-5.
11. Hashemi, H., (2015). Climate Change and the Future of Water Management in Iran. Middle East Critique, 24:3, 307-323, DOI: 10.1080/19436149.2015.1046706.
12. Veijalainen N., Dubrovin T., Marttunen M., and Vehvileinen B. (2010). Climate Change Impacts on Water Resources and Lake Regulation in the Vuoksi Watershed in Finland. Water Resour Manage. 24:3437 3459.
13. Gosling, G., Arnel, N. W., (2016). A global assessment of the impact of climate change on water scarcity, doi: 10.1007/s10584-013-0853-x.
14. Reshmidevi, T.V., NageshKumar, D., Mehrotra, R., Sharma, A. (2018). Estimation of the climate change impact on a catchment water balance using an ensemble of GCMsJ.Hydrol., 556 (2018),pp. 1192-1204, 10.1016/j.jhydrol.2017.02.016.
15. Alqatarneh, G. N., Al Smadi, B., Al-Zboon, K., Shatanawi. K. M. (2018). Impact of climate change on water resources in Jordan: a case study of Azraq basin. Applied Water Science. https://doi.org/10.1007/s13201-018-0687-9
16. Goandim, R. Silvira, C. (2018). Climate change impacts on water demand and availability using CMIP5 models in the Jaguaribe basin, semi-arid Brazil. Environmental Earth Sciences, https://doi.org/10.1007/s12665-018-7723-9
17. Huang, X., Swain, D. L., & Hall, A. D. (2020). Future precipitation increase from very high resolution ensemble downscaling of extreme atmospheric river storms in California. *Science advances*, Vol. 6, No. 29, pp. 34-45.
18. Schilling, J., Hertig, E., Tramblay, Y., Scheffran, J. (2020). Climate change vulnerability, water resources and social implications in North Africa. *Regional Environmental Change*, Vol. 20, No. 1, pp. 1-12.
19. Almazroui, M., Saeed, S., Saeed, F., Islam, M. N., Ismail, M. (2020). Projections of precipitation and temperature over the South Asian countries in CMIP6. *Earth Systems and Environment*, Vol. 4, No. 2, pp. 297-320.