California Water Crisis - Policies and Future Developments in Improving Water Shortages in California

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Abstract. The shortage of water resources has become one of the major problems worldwide in the 21st century. Water use has been growing at twice the rate of population growth over the last century, and although there is no such thing as a global water shortage, more and more areas are suffering from chronic water scarcity. California has been one of the regions suffering from water shortage since a century ago, while the situation has been eased by the implementation of a series of policies, which could be a typical case for later studies. This article analyzes and discusses the relevant policies in water usage, including agriculture, industrial, commercial and individual uses, that contribute to the major water shortage in California. Additionally, some suggestions are provided for the development of future technical needs and the development of future policy formulation. The objective of the article is to provide several suggestions for assisting the construction of water protection.

Keywords: Water crisis, Water scarcity, California, Conservation.

1. Introduction

As our world continues to spiral down the ladder of unstopping climate change, societies are facing numerous crises all around the world that have existed for many years in the past. From the warming of oceans to severe weather changes, issues relating to the scarcity of water rebound and resurface. Some facts presented by UNICEF state that: "half of the world's population could be living in areas with water shortage by as soon as 2025." The issue of the water crisis has spread across the globe, from rapid fire from Niger in West Africa to presuming the risk of the decline of the Tibetan Plateau in Asia, which supports almost 2 billion people [1]. California is no other to be heavily affected, with 6 droughts in the past 35 years [2]. Without an adequate amount of water, our world and our population will undergo severe changes, posing threats to people's health in sanitation and general intake of water, affecting the amount of food people can grow and the existence of all living beings.

Following the mentioned background, this article discusses and analyzes the problems in terms of agriculture, industrial, and individual uses and puts forward suggestions for each different aspect. Furthermore, it is intended to provide constructive suggestions, contribute to future water resources protection and rational use of water resources, and prevent regional water shortages in the future.

2. California Water Crisis Overview

Californians are living in the state's driest period of record [3]. Being no stranger to drought, with drying periods dating back to 1928 [4], the most recent drought period has extended from the drought state of emergency to today. Like anywhere around the world, California heavily relies on water to function and support almost 40 million Californians, with 3.97 million residential customers just in Los Angeles County. The state of California has developed into a top agricultural producer, a significant manufacturing hub, the most populous state in the union, and the eighth largest economy in the world as a result of the development of its natural resources, particularly water. California depends on two sources for its water: surface water and groundwater. There are ten principal drainage basins that makeup California's hydrologic regions [5]. California relies heavily on the Colorado River as a supply of water. The river's watershed includes six additional states (Wyoming, Nevada,

Utah, Colorado, New Mexico, and Arizona) and Mexico. North of Sacramento is where 75% of California's water supply is sourced [6].

Around the state, water conservation efforts have seemed to be diminishing. While there was evidence of conservation being done in the spring of 2022, many areas saw double-digit increases in water use - as much as 25 percent in some cases, according to a recent state water agency report. Gavin Newsom, the governor, requested a voluntary water decrease of 15% in July 2021. Californians have only cut their water use by 3.7 percent since then, far below their intended target. The drought situation is also becoming worse. Up from 0% in March, the most recent U.S. Drought Monitor update indicates that 12% of the state is experiencing "abnormal drought." In the past, these circumstances have led to a loss of agricultural goods, recreation opportunities, and extensive habitat destruction, as well as greater rates of unemployment, food poverty, increased greenhouse gas emissions, and higher fire season expenses [7].

The ongoing drought is caused by climate change factors, including high average temperatures, lack of rainfall, and drier air masses in the atmosphere, and all of these factors combined are dangerous to various aspects of the state. Average temperatures will continue to rise as far as can tell based on the existing pattern. California's water supply might be down by up to 10% by 2040 due to hotter and drier weather brought on by climate change [8].

3. Policies implemented for water crisis control

3.1. Agriculture Use

Some analysts indicated that the recent extreme drought in California, which has resulted in around 250 wells drying up, largely in the state's granaries, has not been this dry in the preceding 1,200 years due to the high temperatures and drought. They are a part of the 1,100 or so California wells that have already dried up this year, an increase of 60% from 2021. Given that California has 274,000 wells, even though that may not seem like much, it is a concerning sign and a personal tragedy for the one million Californians struggling to access safe water. It frequently also causes tension between highly significant agricultural producers (who rely on groundwater to cultivate their products) and their own employees, who must drink groundwater.

California itself yields over a third of the country's vegetables and three-quarters of the country's fruits and nuts. The agriculture abundance of California includes over 400 commodities, collecting a revenue of $50.8 billion in 2019 from the state's 69,600 farms. Due to the high production and wide varieties of goods, 34% of the water used in agriculture goes to growing fruits and nuts. 18% goes to growing alfalfa, along with 11% that is consumed by irrigated pasture [9]. In order to continue to thrive and maintain its title as the agricultural leader, California is in crucial need to battle the water crisis in a smart and sustainable way. There are a number of policies that could help Californian farmers adapt.

The best way to reduce the water crisis in the agricultural area is to reduce the water use on farms, but how this could be ahieved? Establish stricter regulations that prepare farmers for a possible drought emergency and reduce the level of water consumption. Developing our knowledge on access to water, such as new locations or alternatives. One alternative is to increase the implementation of the allocations of groundwater. The largest water resource for agriculture in California during dry years is groundwater, which should be utilized. Local groundwater agencies can remind farmers to avoid pumping in areas where drying is likely going to happen. Discover better ways of storing water and develop new ways of watering. To extend the lasting time of water when watering crops, farmers can attempt to implement a way of handling land called deficit irrigation.

3.2. Industrial Use

In just the duration of 3 years, the fossil fuel industry used over 3 billion gallons of fresh water for drilling operations. The Industrial General Permit (IGP) implemented by the California Water Boards covers the uses of industrial facilities. There are 8 or 9 federally defined categories that the general

Industrial Permit manages. Manufacturing facilities include farm products, refrigerated and general warehousing and storage. Oil and Gas (Mining) facilities have ongoing production, exploration, development, treatment, and other operations, not limited to deserted operations. Landfills or land application sites where industrial waste is received. Recycling facilities are reusing and reclaiming items, including scrapyards, salvage yards, and automobile junkyards. Steam Electric power generating facilities, by means, the facilities that use combustion to create steam for electric power. Transport facilities, including maintenance shops for vehicles, equipment cleaning, or other operations specified. Sewage or wastewater treatment works that fix, store, and recycles domestic sewage. Hazardous waste facilities regulate the treatment, storage or disposal of all the dangerous material categorized by the Code of Federal Regulations [10].

Additionally, on the basis of the regulation of industrial stormwater discharge, a new regulation was implemented for areas that are emergently affected by wildfires. Sampling and analysis requirements must be fulfilled to recognize the public and environmental impacts due to wildfires: Collect, analyze, and report industrial stormwater runoff. Another is to conduct sample collection and observations during scheduled hours

On July 1 2020, a new industrial stormwater permit was implemented to receive waterbody standards. Facilities in these regions must assess the applicability of the Total Maximum Daily Load (TMDL) and modify their Stormwater Pollution Prevention Plan (SWPPP) to avoid potentially costly fines. Amendments to the IGP include:

1) TMDL Implementation Requirements
2) State-wide Additional Compliance Options to Incentivize for Stormwater Capture and Use
3) EPA's Sufficiently Sensitive Analytical Method Requirements

3.3. Individual Use

The State Water Board's prohibition applies to all Californians for the duration of one year, from January 2022 to January 2023.

- Outdoor watering that lets water run onto sidewalks and other areas (except incidental runoff)
- Washing vehicles without an automatic shutoff nozzle
- Washing hard surfaces like driveways or sidewalks that don't absorb water
- Street cleaning or construction site preparation
- Filling decorative fountains, lakes, or ponds
- Watering ornamental turf on public medians

The State Water Board later developed an emergency regulation for one year on January 18 of 2022 in response to a state-wide drought emergency where the conservation goal continuously failed to meet the state's intent, such as the declaration on October 12, 2021, by Governor Gavin Newsom.

- Prohibit water use on outdoor landscapes that results in more runoff than it should
- Prohibit washing motor vehicle with a watering hose without a ceasing nozzle attached
- Prohibit methods of street cleaning or construction site preparation using potable water when other methods are possible
- Prohibit the use of potable water for decorative fountains, lakes, or ponds
- Prohibit the watering of or new landscapes within 48 hours after one-fourth of one inch of rainfall
- Prohibit the watering of ornamental turf on public street medians

The Water Conservation Response Unit (WCRU) was developed in 2014 to address water waste among residential and commercial customers. They are pushing water restrictions created by the Los Angeles Department of Water & Power (LADWP), which include watering dates of odd and even addresses of LA residents and businesses.

4. Advanced technical suggestions for future policy design for prevention of water crisis

4.1. Development of the groundwater usage facility

In California, 12 desalination devices are found with an annual sufficiency of around 8900 acre-feet. A number of these plants are not operating at full capacity and may generate additional water supplies during droughts, such as "peak" electricity plants that operate for short periods to ensure power reliability during droughts. Furthermore, more than 20 brackish water desalination devices are found with an annual sufficiency of 139,627 acre-feet. Compared to seawater, brackish water treatment demands a much smaller amount of energy. Proposals to build desalination projects along the coast must be approved under the Coastal Act, among other regulatory requirements. As California gets hotter and drier, the state must be more resourceful to use the strategic opportunities our 840 miles of oceanic shoreline offers to build water resilience [11].

Along with 17 above-ground water storage reservoirs, California has an existing underground water storage capacity that can be seen as a possible strategy to implement. Groundwater recharge allows the state to provide solutions in the quickest, most cost-effective way to take advantage of when there is more rainfall. Additionally, groundwater recharge aids in preventing surface collapse brought on by excessive pumping, which can harm bridges, canals, and roadways. Compliance with rules is necessary to increase groundwater recharge so that underground rivers can flow without endangering the environment or water users upstream and downstream. New York State wants to assist local water agencies in accelerating the rate and scope of groundwater recharge through the variety of initiatives listed below. Helping local authorities comprehend the ideal recharge locations, assess how their recharge ideas will affect the environment and other water users, and swiftly approve their projects is essential to these actions. Then, regional and state-wide groundwater recharge initiatives can be created by local governments. The state will put in a total of 350 million dollars by the end of the following year. More than 340 new recharge projects, which, if completed, could increase water storage by up to 2.2 million acre-feet by 2030 in a wet year, are proposed by municipal agencies in planning documents. It is uncertain how much water these projects will be possible to divert to subterranean storage until these facts are established; other ideas might use the same unsuitable water sources. However, the extra 500,000 acre-feet is an accurate projection of the additional average yearly replenishment that these projects may get after being examined, approved, and built.

California must also prepare for a wet winter ahead. Thankfully, there are procedures in place to direct water from high-flow occasions to underground storage. To get the diverter ready for a potential wet winter and receive a permit before the rainy season starts, more outreach, education, and technical support are essential. State governments should think about a coordinated state-level approach to efficiently, and orderly allocate rights to high winter flows if local operations are too fragmented or ineffective to maximize recharging chances.

4.2. Water Storage facility development

A coalition of water agencies in Colusa County, 70 miles north of Sacramento, is planning to build California's first large reservoir in nearly half a century. With the support of Bipartisan and Gov. Newsom's support, the funding is almost ready, but the main issue they are facing is the ability to get attain water to fill the reservoir as the drought and water scarcity worsen [12].

The $4 billion plan would divert water from the nearby Sacramento River to pastures and send water as far as the Bay Area and Los Angeles to urban and farmland irrigation areas. However, according to the letter sent by California regulators on the 26th, reservoir plan officials were told that their water rights application was incomplete because it failed to prove that the Sacramento River had a sufficient flow to draw water. The Sites Project Authority has 60 days to emphasize the point of the application.

The comments from the State Water Resources Control Board are not only a setback for reservoir construction but also underscore the challenges California faces in maintaining water for 39 million people and nearly $50 billion in agriculture. Most of California's rivers and streams have been depleted, and natural life, including fish and wildlife, has dwindled in some areas due to too little water. As the climate changes, things get worse. However, plan officials said they remained confident in applying for water rights, the biggest obstacle and the most important step in pushing the reservoir to work. The new reservoir will provide 1.5 million acres of water storage space, about 3 million households a year of water use, which will be the eighth largest reservoir in California and the largest since the federal government built the "Lake New Mylarney" reservoir in the late 1970s (The first reservoir to exceed 1 million acres in capacity since New Melones Lake.)

4.3. Future Policy Suggestions

Taking into consideration all the regional divergence of water uses in California, suggestions for future policies and designs arise to alleviate the stress the water crisis has on the state right now. California's severe drought has compelled state officials to spend more than $8 billion to upgrade water infrastructure and management. The current drought in California has enough funding to support it, including money for emergency programs installing water storage tanks at homes where wells have failed. What California needs is to make the most of its current resources, improve them, and find new, more sustainable solutions to problems.

Acknowledging the existing water governance frameworks is crucial for the prevention of water crises. Following the infamous goal created worldwide by the United Nations, the 6th Sustainable Development Goals, 6 is the target aims to ensure everyone has access to safe drinking water and sanitation. It has six additional goals that fall under this target linked to the water crisis. Better water quality via reducing pollution and the number of people without access to water, adopting IWRM at all levels, and protecting and restoring water are all important goals. While developing new frameworks is crucial, people must always be reminded of the global objectives the whole world already share. Also, people need to make significant and urgent changes to the way they see, manage, and value water and its ecosystems in the context of our rapidly urbanizing, globally interconnected, and demographically diverse world. The society may create new tactics to reinforce the efforts being made when keeping these long-standing aims in mind.

5. Conclusion

The water crisis in California needs to be more urgently alarmed throughout the state. Climate change is the main factor in the water crisis, and we continue to struggle deeply to gain control of it. The constant high temperatures looming over will continue to pose threats in all the different areas of water use. Policies in agriculture should focus on cleverly manipulating the advantageous ground water resources they have in the state to store water for future uses. The policies implemented for industrial use should carry on the existing demands they have of the 9 categories and ensure the requirements are reached by all industries covered. Water restrictions for Californians should be held of high standards and frequently monitored according to The State Water Board's prohibition.

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