Water Scarcity and Wildfire Risk

STATE POLICY TEAM RESEARCH PUBLICATION

Wildfires are intrinsically linked with water supply in the American West. This report provides an overview of the policy landscape regarding water and land rights and their relation to fighting wildfires. It also aims to describe the regional disparities in water supply throughout the state of California.

Prepared by: Angelina Ma, Bryan Fok, Chasen Rose, and Arman Rostomyan

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I. Abstract

Over the past few years, the state of California has experienced a surge in wildfire occurrences and the expansion of Fire Hazard Severity Zone (FHSZ) markings, raising the question of what preventive measures can be taken to reduce risk, prevent damage, and protect land.

Although wildfires are intrinsically linked to water demand and supply, this correlation is overlooked in existing research and consistently excluded as a use category in data and policy analyses. This report examines California's current policy landscape on water rights and reviews available data on water demand and supply, arguing that a stronger emphasis on water trading could indirectly address wildfire prevalence by ensuring the equitable distribution of rights and allocations across the state. An expanded water market could address existing policy gaps that incentivize unsustainable practices and promote more sustainable water use across the state. In the water market, we propose that the explicit allocation of water supply dedicated to wildfire risk is necessary for equitable and timely distribution.

II. Introduction

We classify the state of California into three regions: Southern, Central, and Northern.

The southwestern United States has long been susceptible to wildfires. Before large scale Western development, Indigenous peoples in California had long practiced controlled burns to reduce the risk of uncontrolled wildfires (Lightfoot and Lopez 2013). However, climate change has increased the frequency and intensity of wildfires. Although fires in California have traditionally occurred between April and October, wildfires now pose a year-round risk. Santa Ana winds in Southern California also increase the risk of wildfires in October and November (Haddock, Cone, and D'Agostino n.d.). The area burnt by wildfires between 1996 and 2021 is five times larger than that burnt between 1971 and 1995, indicating increasing wildfire severity in the region (Turco et al., 2023).

Human pressures on natural water systems are amplifying the impacts of droughts, increasing the dryness that leads to wildfires (Robinne et al., 2021). For example, Central California's primary groundwater basin is critically overdrafted, despite having the highest water demand among the three regions. A more illustrative example is Southern California, which has the smallest groundwater basin volume as well as the smallest reservoir volume, matched by consistently low rainfall (Ayres et al., 2021; Legislative Analyst's Office, n.d.). It is not a coincidence that this region has the greatest number of FHSZs (Office of the State Fire Marshal, n.d.).

Central and Southern California rely on Northern California's water exports (Legislative Analyst's Office, n.d.). Northern California has historically received the greatest amount of precipitation and has the largest reservoir volume (CoolWeather.net, n.d.; Ayres et al., 2021). It also has the sparsest distribution of FHSZs (Office of the State Fire Marshal, n.d.).

The relationship between water availability and wildfire risk can also be observed in reverse. Wildfires can affect water availability and quality. While there is no framework that links fire impacts to water supply, it is well known that wildfires interact with water systems at multiple levels, including effects on water quality (Hallema, Robinne, and Bladon 2018). For example, a study conducted in Colorado shows that wildfires could impair water quality in 15.7 to 19.4 percent of years for diversions from large watersheds (Gannon et al., 2022). While some research explores the effects of wildfires on water supply, consensus is that further research is needed to fully quantify these impacts.

Nonetheless, there is a clear correlation between water supply and wildfire risk, with precipitation patterns and human pressures, such as groundwater basin overdrafting, as contributing factors. Policies that promote efficient water management help address precipitation variability, as evidenced by Northern California's role as the net exporter of water to the rest of the state.

III. Existing Water Rights Allocations and Land Protection Legislation

The Water Commission Act, passed in California in 1914, established the State Water Resources Control Board, which manages and oversees water rights allocations and handles conflicts, applications for, and transfers of those allocations between parties (El Dorado Irrigation District). There are three major systems of water rights allocation in California, two of which are based on different forms of property rights. The first and least common form of water

rights allocation is those made pre-1914, or before the establishment of the Water Control Board, which are continually maintained by the state government to the present (Grantham and Viers, 2014). Riparian rights are those that allow landowners to use water from sources that flow through or next to their property. Established by English common law, these rights are inherently tied to the ownership of the land adjacent to the water source desired, as long as the use of the water does not interfere with another's rights. Additionally, those rights cannot be transferred separately from the land, which limits potential solutions for marketable water rights permits (El Dorado Irrigation District). The third and most widely recognized and implemented form in California is appropriative rights. Formed by the Doctrine of Prior Appropriation, these rights are defined on a first-come, first-served basis and require a beneficial use of the water itself. These rights may be lost if they do not meet the requirements of beneficial use, as defined under the Water Control Board's purview (Bellinger, 2023). There is no regulation surrounding groundwater regulation under the purview of the Water Control Board. Monitoring issues can create overdrafts of groundwater basins and threaten surface water supplies and freshwater ecosystems (Grantham and Viers, 2014).

Due to litigation surrounding water rights allocation, groundwater, riparian, and pre-1914 appropriations are excluded from the Water Board's authority (Grantham and Viers, 2014). Therefore, the primary method of appropriation concerns appropriative rights above all others, which account for the majority of claims and the largest volumes of water allocated. Although claims are mitigated by an application process to determine beneficial use, current rights allocation volumes make more than five times the amount of the state's average annual supply, by incentivizing parties to over-report water use to protect their permit estimate, and double-counting by downstream appropriators of return flows from irrigation runoff or canal leakage, which leads to larger reported amounts of water per party relative to the actual supply (Grantham & Viers, 2014). The current state of the system and underfunding create significant inefficiencies in the Water Board's monitoring and reporting, which in turn lead to further inefficiencies in allocations during droughts or periods of scarcity. This can create infrastructure bottlenecks, making it difficult to accurately sanction emergency water allocations during wildfires, as the supply on which state and local governments depend

is dwindling faster than it is reported.

California has passed legislation in recent years addressing wildfire risk and water affordability to mitigate disproportionate impacts on disadvantaged or marginalized communities. The California Senate passed a bill during the 2019-2020 session that reduces the costs of small water system projects in disadvantaged communities by providing exceptions to the California Environmental Quality Act (CEQA) (McCann & Sencan, 2020). CEQA requires state and local agencies to analyze the environmental impacts of proposed government or commercial projects. Exemptions, however, are granted for projects that improve water reliability, supply, and quality in disadvantaged communities, provided that environmental impacts are mitigated and labor requirements are met (McCann & Sencan, 2020).

This policy aligns with legislation on land protection and wildfire prevention. CA AB 3074 outlines legislation that requires fuel reductions between 5-30 feet around structures and creations of ember-resistant zones within five feet of structures. Current legislation only requires a "defensible space of 100 feet from each side and from the front and rear of [a] structure...in, upon, or adjoining a mountainous area, forest-covered land, brush-covered land, grass-covered land, or land that is covered with flammable material that is within a very high fire hazard severity zone, as designated by a local agency" (CA AB 3074). High-risk zones often include areas with an older population or limited mobility, which are particularly prevalent in disadvantaged areas. The amendments created now require fuel reductions between 5-30 feet around [a] structure [and] creation of ember-resistant zones within 5 feet of [a] structure [designated in a high risk zone]" (CA AB 3074). In addition, it states that "California must develop scalable statewide options to encourage cost-effective structure hardening to create fire-resistant homes, businesses, and public buildings within wildfire hazard areas, with a focus on vulnerable communities" (CA AB 3074). Each policy seeks to assist marginalized communities in achieving equitable allocations of water, fire safety, and pollution protection.

The Sustainable Groundwater Management Act (SGMA) was enacted in 2014 to regulate groundwater use. SGMA requires local groundwater sustainability agencies (GSAs) to bring basins into balance by the 2040s. Methods of doing so include setting pumping allocations based on rainfall that can be traded and stored, and addressing the adverse effects of groundwater overdraft, such as

subsidence, dry wells, degraded water quality, and harm to wetlands and streams. Wildfire risk is not taken into account when determining these allocations. While SGMA establishes a framework to regulate California's historically unsustainable groundwater use, its allocations are often poorly defined or weakly enforced, thereby limiting its effectiveness.

Complementary policy mechanisms are necessary to improve transparency, tighten monitoring of accurate allocations, and strengthen incentives for sustainable use (Ayres et al., 2021).

IV. Recommendations

Existing water rights legislation and allocation policy have been first-come, first-served, rather than priority-based, have been tied to water overallocation, and have been restricted by land ownership. These limitations contribute to continued unsustainable water use, legal ambiguity, and regional inequity.

Water markets offer a solution to these limitations. Treating water allocations as market transactions addresses concerns about regional equity by allowing areas in greater need, such as wildfire-prone areas, to receive additional water when demand exceeds the originally allocated amount. The flexible nature of trading also reduces reliance on permanent, land-based rights to determine water supply, which are often too rigid to respond to environmental changes that affect water demand in real time.

California already uses Dry Year Option Trades, which allow water users with consistent demand but short supplies to purchase water during drought conditions from senior, reliable water rights holders at a prearranged price (Ayres et al., 2021). We propose expanding this system by integrating wildfire risk conditions alongside drought conditions.

Water markets, which have historically been the dominant system for water distribution, should serve as a secondary mechanism for water allocation, as expanding water markets can exacerbate inequity through outbidding by wealthier districts or harm ecosystems if environmental flows are not protected. Proper safeguards should be implemented, including total allocation caps, minimum instream flow requirements to mitigate potential environmental damage, and emergency wildfire allotments for at-risk communities. Water allocation legislation should be revised to mandate honest reporting of water use, and explicitly set aside allocations for rights holders in regions of greater environmental risk (wildfire risk).

V. Conclusion

Precipitation, wildfire, and water-supply data from the comparative regions of Southern, Central, and Northern California indicate that in areas with lower water availability, wildfire risk is also higher. The state's current water management legislation is rigid, lacks enforcement and transparency, and fails to account for real-time trends such as the surge in wildfire frequency and risk. In particular, it lacks structures to control for inaccurate reporting of water use and regulatory enforcement, and to adapt to real-time changes in water demand and supply.

To address these limitations, water allocation should shift to a more priority-based approach rather than first-come, first-served, with particular emphasis on reserving water supplies to mitigate environmental risks such as wildfires. As a complementary measure, California should expand its water market to enable adaptive responses to changing environmental conditions and emergencies. Trading also enables a more equitable distribution of water supply, thereby countering the effects of over-reporting in the traditional water allocation system.

Overall, the expansion of water markets will enable California to meet the state's flexible water demands, which have been affected by the recent surge in wildfires and related causal factors, including climate and human-driven challenges.

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Publication Team

Angelina Ma

AUTHOR

State Team Policy Analyst

Bryan Fok

AUTHOR

State Team Policy Analyst

Chasen Rose

AUTHOR

State Team Policy Analyst

Arman Rostomyan

SENIOR EDITOR

Vice President of Policy