**NOTE:** This is the first chapter of a book.

**Abstract:** This book explores the role of unauthorized water use in the American West (examining 11 Western States including: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), and argues that climate change and population growth will put more demand on water management agencies such as Idaho’s Department of Water Resources to demonstrate they are protecting the water rights of their citizens.  To assess how well-positioned each state is to adapt to climate and population changes, the author surveyed water management agencies on their unauthorized water use management strategies, finding that states vary significantly in their approaches.  After establishing the status quo, the book examines the likely policy options states and the federal government will have in addressing unauthorized water use. Weaving together a narrative drawing from a mixture of political science theory and water policy research, along with interviews of state officials and water users, and primary data, the author tells the story of how proper resource management is central to the social, political, and economic life in the American West.

**Chapter 1: Introduction**

The landscape of Elmore County, Idaho is a barren one. If you stand on the south side of Ditto Creek Road just west of the Chevron station, where Exit 90 off Interstate 84 takes you onto the east bound lane of the Old Idaho Hwy 30, and you look North, you see the Boise Range. Beyond this lies the Sawtooth National Forest and the acres of trees, streams, and Mountains contained therein, beckoning those inclined to explore the outdoors. To the southeast lies a seemingly endless flow of sagebrush , and to the southwest the treeless Owyhee Mountains greet the eyes. To a newcomer, this region may appear barren. However, no one knows what is possible on this land more than the farmers of the County, who for decades have been pulling water from the ground in order to establish and maintain a thriving agricultural community. The county, which contains a population of 25,000, many of whom are tied to the Mountain Home Air Force Base., produces $300 million in agricultural sales annually.[[1]](#endnote-1) Elmore County is one of those places that makes Idaho the highest per capita agricultural state in the nation. Just outside of the county seat of Mountain Home run the long dusty roads that line the fields producing beets, potatoes, and cattle feed. These fields are offset by recently arrived dairies from California’s central valley fleeing the decline water availability.[[2]](#endnote-2) This agricultural landscape is supported by a system of water rights which supply ground and surface water.

But that long standing system of water supply is currently under strain. The aquifer underlying this rich agricultural zone is quickly being depleted. Since the 1960s, the aquifer level, depending on where it is measured, has lost between 100 and 200 feet with each year seeing a three to five feet reduction, as some 79,000 acre feet (AF) are pulled from the ground annually.[[3]](#endnote-3) This drop in water level has resulted in many water users having to invest in well drilling or abandon wells altogether. Wells that were once productive at 100 feet have to be dug deeper. And late season pumping has become more complicated, as the surface water supplies that many growers have used to supplement their ground supplies have also been in short supply. The Mountain Home Irrigation District, which supplies thousands of acre feet of water to the county’s growers, historically have had water flowing from its two major reservoirs until September, with a dry year here and there. However, as illustrated by Table 1.1 in recent years this Irrigation District has had to move up the cutoff date as early as late June.

**Table 1.1: Mountain Home Idaho Irrigation District Delivery and Cutoff History**

|  |  |  |
| --- | --- | --- |
| Year | Total delivery (acre feet) | Cutoff date |
| 2011 | 11,794.56 | 30-Sep |
| 2012 | 12,957.84 | 30-Sep |
| 2013 | 4,655.78 | 26-Jun |
| 2014 | 4,642.88 | 23-Jun |
| 2015 | 4,930.22 | 5-Jul |
| 2016 | 8,728.00 | 7-Aug |

Fearing aquifer collapse the Idaho State Department of Water Resources (IDWR), the water management agency for the State of Idaho, in March of 2016 issued an order creating a new water district for the Mountain Home area (Water District 161), which included much of the County but not all of it. Idaho law authorizes the director of the IDWR to create water districts to manage the distribution of water to water right holders. Given that the Mountain Home area had been under a previous water management plan dating back to the early 1980’s, combined with the continued reduction in the aquifer level, the state argued that the new district was “necessary in order to properly administer ground water rights within the proposed water district boundary.”[[4]](#endnote-4)

Later in 2016, IDWR issued another order, this time requiring measuring devices for the 365 wells within the water district by 2019.[[5]](#endnote-5) The state outlined an approved list of meter devices, several of which that can cost several thousand dollars each, depending on model and size. Moreover, the funds for the new water district are being drawn from water users, and each member has been assessed an annual fee based on how much water they use; although surface water users pay roughly $75.00 for an acre foot from the Mountain Home Irrigation District, and nothing for ground water, it is clear that those prices are unlikely to be maintained. While there has been some push back and phone complaints to the IDWR offices about the creation of the new district, in general opposition to the new water management plan and the implementation of the new Water District has been minimal. However, IDWR officials believe this will change in 2019 when users will actually have to purchase a meter or face their water being cut off.[[6]](#endnote-6) After 2019, IWDR will monitor ground water use. Historically many water users have not utilized their entire water right. However, problems may arise if there is no stabilization of the aquifer. It is at that moment that the State of Idaho will have to make some tough choices, which may include cutting off new water right development, reviewing the beneficial use among the water users in the district, or allowing the aquifer to continue to decline.

This new regulatory structure will rest on the capacity of IDWR to obtain compliance with the water users in the county. While there is no inherent reason to suspect that many who will dismiss the new regulations and pump unauthorized water from their wells, IDWR will need to put in place an enforcement procedure on those metered wells and a system of punishments for those who violate it. While IDWR has been working to enforce compliance on water rights for decades, this is a new group of people to which more monitoring will be required, given the severity of the aquifer levels. How capable and prepared is IDWR to manage compliance on existing and new restrictions on water use? This is a critical component of any policy designed at managing the scare resource of fresh water. This book address the question of how prepared water management agencies are in the American west to address the compliance component of unauthorized water use, as the effects of climate change take root and the region becomes home to an increasingly larger population.

**Unauthorized Water Use: A Future Problem**

Elmore County and the State of Idaho are not alone when dealing with water scarcity. In fact water scarcity is a global concern, and people across the world are reacting to water scarcity in diverse ways. Water is essential for life, and thus water scarcity may result in outcomes unintended and unforeseen. Obtaining water illegally is one common response to water scarcity. Kenya[[7]](#endnote-7), India[[8]](#endnote-8), and Brazil[[9]](#endnote-9) are just a few of the countries experiencing increased rates of water theft as supplies decrease and firms and individuals scramble to respond. In the Indian capital of New Delhi, for example, organized crime syndicates control an enormous black market for water, as the government system has proven unreliable in meeting the demands of the city’s population. Criminal activity is draining the city’s aquifer, which makes up 85% of the city’s water supply.[[10]](#endnote-10) Few people are immune from the demand for water, and criminal organizations have a diverse set of clients from large landowners to hospitals and other operations that simply cannot function without water. Such break down in water regulations poses serious risks, and while the case of New Delhi is particularly problematic, such action is not limited to the developing world. Water theft is becoming increasingly common in the western U.S., as well.[[11]](#endnote-11)

For an illustrative example in the U.S. one only has to look at drought stricken Thousand Oaks, California, where on several occasions between 2013 and 2015 residents noticed that a tanker truck would regularly arrive in the early morning hours to siphon water out a fire hydrant linked to the Calleguas Municipal Water District of Ventura County, California.[[12]](#endnote-12) The water district hired an investigator and concluded that the actor Tom Selleck, most famous for his portrayal of the gumshoe detective Thomas Magnum in the 1980’s TV show Magnum P.I., was behind the water theft, using it for his nearby ranch. In Madera County, some 250 miles away, the District Attorney David Linn instituted a Water Crime Task Force in the summer of 2015, to address the growing problem of water theft there,[[13]](#endnote-13) while in Calaveras County a hotline was established where residents can call to report water theft. Unauthorized water use does not have to be about one person, it can also come from systemic failure to enforce water law. Agricultural producers tied to the Wapato Irrigation Project on the Yakima Nation Reservation in Washington State reported in 2015 that an increase in the number of water thefts had reduced their capacity to meet production expectations by 25-50 percent, suggesting that unauthorized water use is a problem with serious economic consequences.[[14]](#endnote-14) Residents there reported that the lack of enforcement and action created a culture of non-compliance, and undermined the local economy.

I myself own a water right, which as I discuss in the prologue has little oversight. Not many people have access to my backyard, or could easily determine if I was in excess of my allotment. While there are ways to determine if someone is overusing their right, such as the use of GIS, aerial photography, and computations on water right allotment and estimations of cultivated land, many of these strategies are expensive, time consuming, and require well trained staff whose compliance actions can lead to litigation, increasing the need to for well trained staff. Further, there are only a limited number of water compliance officers in the field, which means there is likely undetected unauthorized water use ongoing. State and federal fiscal policy may work to further undermine the capacity of states to address water scarcity and unauthorized water use. For example, the Montana water management agency, the Water Rights Bureau, had its 2017 budget cut by 10%, decimating their capacity to be proactive about unauthorized water use violations. Some states do not have the requisite resources allocated to tackle the problem, while at the same time the future projections of increased demand of a growing population and diminishing supplies brought on by climate change will make every drop of water count across the American west, either by climate change or overuse.

The centrality of water in communities and for the economic well-being across the American west is clear. The Magic Valley region of Idaho,[[15]](#endnote-15) for example, experiences desert like conditions with annual rainfall under 13 inches. Yet the region produces numerous crops such as beans, sugar beets, corn, and potatoes through irrigation from the Snake River and its tributaries. Farm cash receipts from the Magic Valley were valued at $3.1 billion in 2010, indicating that irrigation based agriculture is a substantial economic activity.[[16]](#endnote-16) Water use is the bread and butter of many local economies in this Valley, and beyond, and additional water equates to increased yields for many agricultural operations. This source of economic growth is under severe constraints, however, as the reduction of snow packs across the American west on account of climate change and the significant increased demand for water as population rates have dramatically increased water demand and reduced supply.[[17]](#endnote-17) Taken together, a serious problem of water scarcity, already well documented in the literature, becomes clear.[[18]](#endnote-18) It is this scarcity in the present, and the future, that will drive the motivation to violate existing water rights law, which can be as simple as wanting to water a lawn.[[19]](#endnote-19) I address these issues in more depth in chapter 2.

In the U.S., the responsibility to combat unauthorized water use falls to the states, who have water compliance agencies that adjudicate and enforce water rights. States have two basic options, the prior appropriation system and riparian water rights. In riparian right systems, landowners whose land is next to water or has water flowing through it, can make reasonable use of the water with allotments being given to those without water. Water cannot be moved from the basin without some review of the needs of those whose land adjoins the water. Whereas, in the prior appropriation system, water distribution is determined on who has the more senior water right. Many sources of water across the region are fully appropriated or over-appropriated, meaning that there are more claims than water, something that is likely to grow worse with time.[[20]](#endnote-20) However, enforcing water rights and ensuring that users do not overuse their legal amount is quite difficult. This is in part because there is little reliable data on water flows for most basins in the American west, including if and how much of the water supply is lost to theft or is misused. Several western states do not collect data on unauthorized water use, while others have limited enforcement systems in place, raising serious questions about how prepared western states are to manage an essential resource facing serious scarcity concerns. And unlike other types of items that are stolen, water is inherently fungible, allowing various actors to use it without being detected. In the Tom Selleck example, it was human eyes, not a measurement device that detected the theft. The presence of the tanker truck at odd hours of the morning triggered neighbors to report the suspicious behavior. And while the vastness of the water supply in many rural settings where agricultural outfits are located undermines the notion that there is an issue of water scarcity, the argument laid out in this book is that climate change models combined with trends in population growth and development in the American west are duel threats to supply and demand of what can only be described as limited water resources. The current regulatory capacity of western states is not prepared to handle this duel pressure of supply and demand, and the consequences of inaction could lead to serious economic and social issues.

This project examines the role of unauthorized water use in the American west, defined as the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming,[[21]](#endnote-21) and the coming demand for water accountability. I address two broad issues that are closely linked: 1) unauthorized water use, and 2) water accountability. I argue that status quo responses to unauthorized water use (or water theft) are largely inadequate, and that because growing water scarcity in the American west will have far ranging impacts on issues ranging from food production to urban livability, there will be intense pressure at both the federal and state level to address the problem. The project addresses a series of research questions:

* What is unauthorized water use and how big of a problem is it in the context of water use throughout the western U.S.? (Chapter 2)
* What are the current responses of state governments to unauthorized water use? (Chapter 3)
* What are the possible future state government responses to water scarcity and unauthorized use? (Chapter 4)
* What are the possible future federal responses to water scarcity and unauthorized use? (Chapter 5)
* How will the various stakeholders be impacted by the possible policy changes implemented at the state and federal level? (Chapter 6)

**The Rise of Water Accountability**

This project introduces a new term into a long standing discussion of water in the American west. While there has long been some level of what I will refer to as ‘water accountability,’ the level of concern and focus on water issues has largely remained confined to a small group of stakeholders, mainly agricultural users, environmental groups, tribal governments, state and local governments, and few other water users. One argument advanced here is that water use and management issues will proliferate in the public consciousness, as water scarcity across the region will grow into a major policy issue at the household level. Certainly those who have lived through alternating watering days and have been exposed to endless conservation public information campaigns in Southern California and elsewhere can attest to the centrality of water as a political, economic, and social issue. However, this scarcity has largely been confined to a small portion of the region’s population. This is going to change, as climate change, among other things, increases the cost of water for agriculture, electricity, recreation, and drinking. Even if the margins are small, greater attention will be paid to how water is used, and particularly to how fair and efficient water use and distribution is across the region. When there is increased demand and decreased supply of a resource, and government regulations are introduced to manage that scarcity, there is renewed attention to any cheaters in the system. Whether it be human instinct to compare individual outcomes, or western civilizations focus on fairness and equality, if people are asked to undertake measures of conservation that undermine their previous habits and business models, they are going to want to see the state ensuring fairness across the population. If the highway patrol does not pull people over from time to time, the speed limit has less meaning.

 There is already some amount of ‘water accountability’ across the western region. Senior water right users can issue water calls, and witnesses to unauthorized water use in most states can report violators and expect some form of action from the state. However, the current system in most states is not prepared for the increased pressure enforcement is likely to experience as the supply and demand issues of water continues to increase. To understand why these questions matter, we first must address the drivers of water accountability, and why unauthorized water use will become a larger issue in the near future. Two major issues are driving the need for stronger and more robust institutional arrangements to manage the problems of water accountability. The first is climate change, which will ultimately limit water availability in the American west, and second is population growth and associated development which will increase the demand for water.

**Climate Change in the American West**

 It has been widely accepted by the scientific community that globally the climate is changing, and the effects of climate change in the American west can only be characterized as substantial.[[22]](#endnote-22) The focus in this book is on water flows and how they relate to the social, economic, and political dynamics in the region. Thus, in this section I will focus on climate change as it relates to water availability and accountability.

The USDA’s 2012 report on climate change and adaptation begins with these simple words, “Increases of atmospheric carbon dioxide (co2), rising temperatures, and altered precipitation patterns will affect agricultural productivity.”[[23]](#endnote-23) The findings from the USDA are clear: there are going to be a multiple stressors related to climate change that will affect the agricultural sector in the western U.S. There are three major climate change factors that affect the issue of water accountability: 1) High temperatures that make it more difficult to successfully irrigate, 2) snow pack reduction as temperatures increase there will be more rain and less snow, which feeds surface water sources widely used by irrigators and other water users, and 3) as temperatures increase, the occurrence of drought will as well. The well-publicized California drought made national headlines throughout 2014 and 2015, and resulted in major agricultural losses. Climate scientists predict the increased prevalence of these droughts, and mega droughts in the Southwest.[[24]](#endnote-24)

Snowpack is a problem for water use, as it is the predominate source of surface water, which is primarily used by the agricultural sector and for hydro-electric production. What will water flows be like in 50 years is a major question facing climate scientists, and is central to the topic of this book. As Figure 1.1 demonstrates, the U.S. Environmental Protection Agency (EPA) has documented a major decline in snow pack levels in the previous 50 years. This major shift in snowpack undermines the flow of rivers in the spring and summer, and reduces the available water for aquifer recharge. Actual projections of water flows in the future vary significantly, however, a major findings in the hydrology literature is that snow packs are expected to decline in the 21st century.[[25]](#endnote-25) The entire region of the American west is expected to experience this pattern of declining snowpack, undermining late season water flows and decreasing the ability of agricultural operations to irrigate.[[26]](#endnote-26)

 **Figure 1.1: Reprint of EPA Figure: Trends in April Snowpack in the Western United States, 1955–2016.[[27]](#endnote-27)**



 While snowpack may decline in reliability and size, precipitation will continue to flow into the region. However, it is predicted that this precipitation will increasingly come in the form of rain, which will likely be more difficult to manage given the current system of dams which have been built upon assumptions of snowpack. By this I mean that the capacity of water storage currently in place through the region is designed for the slow melt of the snowpack, not for rain. Under conditions of lower snowpack and greater rain reservoirs around the region will quickly fill up during the winter, and dam managers will be forced to allow more water to drain out of the basin, as opposed to having the same amount of precipitation in the form of snow come slowly through the growing season. This will limit the available surface water available for irrigation.

 There will also be reduced capacity of hydroelectric dams to produce electricity throughout the year. Some 50-70 percent of precipitation in the western US comes from snowfall.[[28]](#endnote-28) While hydropower is a small portion of the overall sources of electricity in the country at only 6.1%, it makes up a third of overall renewable sources. Moreover, it is and has been a substantial source of electricity for much of the American west since the start of the 20th century. [[29]](#endnote-29) One of the most famous dams in the Washington State is the Grand Coulee Dam, a mountain on concreate that can supply power to some 2.3 million households. Sitting on the Columbia River, it is joined by 20 other major dams across the state that produce two-thirds of the state’s electricity production.[[30]](#endnote-30)

**Table 1.2 Western U.S. Hydro Generation Profile, 2013[[31]](#endnote-31)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **Conventional Hydro MWh** | **Total MWh** | **Total Renewables MWh** | **Hydro as a % of total** | **Hydro as a % of renewable** | **Powered & Non-powered Dams** | **National Rank in Electricity Production** |
| Arizona | 5,950,654 | 110,126,600 | 8,597,650 | 5.40% | 69.21% | 346 | 11 |
| California | 24,541,380 | 199,997,700 | 61,105,380 | 12.27% | 40.16% | 1,468 | 4 |
| Colorado | 1,258,341 | 53,396,300 | 8,901,340 | 2.36% | 14.14% | 1,795 | 30 |
| Idaho | 9,100,528 | 15,741,960 | 12,274,530 | 57.81% | 74.14% | 428 | 43 |
| Montana | 9,953,300 | 27,573,220 | 11,614,300 | 36.10% | 85.70% | 2,916 | 41 |
| Nevada | 2,681,573 | 36,494,480 | 6,493,570 | 7.35% | 41.30% | 512 | 35 |
| New Mexico | 185,477 | 36,042,320 | 2,802,480 | 0.51% | 6.62% | 519 | 39 |
| Oregon | 33,457,372 | 60,164,740 | 41,984,370 | 55.61% | 79.69% | 935 | 26 |
| Utah | 633,830 | 42,822,570 | 1,576,830 | 1.48% | 40.2% | 795 | 33 |
| Washington | 77,906,959 | 113,321,300 | 86,657,960 | 68.75% | 89.90% | 746 | 13 |
| Wyoming | 716,600 | 52,395,110 | 5,131,600 | 1.37% | 13.96% | 1,416 | 31 |

Sources: [National Hydropower Association](http://www.hydro.org/why-hydro/available/hydro-in-the-states/west/)

For some states, such as Washington, hydroelectric power has been a major source of electricity, and it costs much less relative to other sources, excluding environmental damage. In large part because of this supply of hydro power Washington state maintains the cheapest electricity rate in the nation, at 9 cents a kilowatt hour. Other western states are not far behind. For instance, Idaho is the 47th cheapest when it comes to electricity rates, and Oregon is 44th.[[32]](#endnote-32) The outcome of this has been certain economic benefits, such as the location of server farms close to the tech hubs of Portland and Seattle.[[33]](#endnote-33) Among other users who benefit from lower rates are the 13 states and several provinces of Canada that Washington exports electricity to. Moreover, research indicates that electricity rates and economic growth are related, with many energy intensive industries dependent on lower energy prices to stay competitive in the globalized market.[[34]](#endnote-34) In short, hydroelectricity is a substantial factor in the overall management of the economy in the American west, particularly in the Northwest and Intermountain west, and thus the flow of water is an important component for hydroelectric power, and the regional economy more broadly.

**Table 1.3: Cost of Electricity Across the Western U.S.**

|  |  |  |
| --- | --- | --- |
| Rank From most expensive to cheapest | State | Average Retail Price of Electricity to Residential Sector (cents/kWh) |
| 6 | California | ₵18.85 |
| 19 | New Mexico | ₵13.57 |
| 22 | Arizona | ₵12.74 |
| 28 | Colorado | ₵12.45 |
| 30 | Wyoming | ₵12.15 |
| 37 | Utah | ₵11.91 |
| 39 | Nevada | ₵11.64 |
| 40 | Montana | ₵11.59 |
| 43 | Oregon | ₵10.94 |
| 47 | Idaho  | ₵10.58 |
| 50 | Washington | ₵9.87 |

Source: U.S. Energy Information Administration

 In summary, the projections of climate change in the Western U.S. are significant. Increasing temperatures and changes in snowpack will both influence water accountability in the region. By mid-century, the snowmelt is project to shift 3 to four weeks earlier than the last century’s average, the region will see increased fire risk, insect and disease outbreaks, loss of high value specialty crops, and an increase in severe heat waves.[[35]](#endnote-35) The supply of available water in the region will decrease, while longer, hotter, and geographically larger droughts and disruptions, will increase. At the same time the population will continue to rise.

**Population Growth**

Population growth is a particular concern for water distribution in the American west. The westward expansion of the 19th century started with Lewis and Clark making their way to present day Astoria, Oregon to view the Pacific Ocean. This expansion appears to be as yet unfinished. In just a few decades, the landscape, the culture, and the population have been radically altered. Between 1950 and 2013 the population of the 11 states examined here grew from 19.5 million people to 72.1 million.[[36]](#endnote-36) This population growth, demonstrated in Table 1.4, shows the rapid growth the region experienced in the second half of the 20th century.

**Table 1.4 Population in American West, 1950-2025[[37]](#endnote-37)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| State  | 1950 | 1980 | 1990 | 2000 | 2010 | 2025 Projected  |
| Arizona  | 749,000 | 2,718,000 | 3,665,000 | 5,130,000 | 6,392,000 | 6,412,000 |
| California  | 10,580,000 | 23,670,000 | 29,760,000 | 33,870,000 | 38,290,000 | 49,285,000 |
| Colorado  | 1,325,000 | 2,890,000 | 3,300,000 | 4,327,000 | 5,049,000 | 5,188,000 |
| Idaho  | 570,000 | 944,000 | 1,102,000 | 1,299,000 | 1,571,000 | 1,739,000 |
| Montana  | 569,000 | 786,000 | 800,000 | 903,000 | 990,000 | 1,121,000 |
| Nevada  | 162,000 | 800,000 | 1,221,000 | 2,109,000 | 2,705,000 | 2,312,000 |
| New Mexico  | 735,000 | 1,333,000 | 1,522,000 | 1,821,000 | 2,066,000 | 2,612,000 |
| Oregon  | 1,532,000 | 2,633,000 | 2,860,000 | 3,430,000 | 3,839,000 | 4,349,000 |
| Utah  | 696,000 | 1,461,000 | 1,731,000 | 2,245,000 | 2,776,000 | 2,883,000 |
| Washington | 2,387,000 | 4,132,000 | 4,903,000 | 5,911,000 | 6,744,000 | 7,808,000 |
| Wyoming  | 270,000 | 469,000 | 453,000 | 493,000 | 564,000 | 694,000 |
| Total  | 19,575,000 | 41,836,000 | 51,317,000 | 61,538,000 | 70,986,000 | 84,403,000 |

In the last 25 years, the population in the region increased 32%, a good 50% above the national average.[[38]](#endnote-38) The American west continues to grow, holding several of the fastest growing metropolitan regions in the country as of 2017, including Provo-Orem (3), Seattle-Tacoma (7), Portland (9), Salt Lake City (10), Boise (11), Ogden-Clearfield, UT (13), Phoenix (16), Las Vegas (16), San Jose (22), Denver (23), and Sacramento (25).[[39]](#endnote-39) Boise, Idaho, for example, has seen its population grow from 30,000 in 1980 to over 205,000 in 2010.[[40]](#endnote-40) Seven of the fastest growing states in the country are also in the region, including Nevada, Idaho, Washington, Colorado, and Arizona. As an illustration of the growth in the region is the number of residents who were born in the state. Examining U.S. Census and the University of Minnesota Population Center data, it can be observed that Southern and Midwestern states have high retention rates. For instance, Mississippi has a 72 percent retention rate, and Pennsylvania has a 74 percent retention rate. This means that in Mississippi 72 percent of the population that lives in Mississippi was born in the state. This stands in stark contrast to the retention rates in states in the American west, which often fall at 50 percent or lower. For instance, with the retention rate in 2012 in Montana was 52 percent, was 52 percent in New Mexico, and was 62 percent in Utah.. These figures indicate that western populations as they current stand contain high numbers of new residents that have moved to the region during their lifetime.

**Table 1.5 Population Retention Rates in the Western U.S., 2012**

|  |  |
| --- | --- |
| State  | % of Population Born in the state  |
| Arizona  | 38% |
| California  | 55% |
| Colorado  | 42% |
| Idaho  | 47% |
| Montana  | 54% |
| Nevada  | 25% |
| New Mexico  | 53% |
| Oregon  | 46% |
| Utah  | 62% |
| Washington | 47% |
| Wyoming  | 40% |
| Average  | 46% |

Source: New York Times[[41]](#endnote-41)

The projections for population growth in the region suggest a similar and dramatic pace of growth seen in recent decades. One of the many factors driving the population increases in the region are the sharp increase in property values in the coastal regions, which have prompted relocations, as those from Southern California and Seattle flee cost of living issues. Here in Idaho, people have come from all over the West Coast, escaping crowds, traffic, and high home prices. 99% of migration into Idaho from other states are concentrated in the Boise Metropolitan Area, also known as the Treasure Valley.[[42]](#endnote-42) Of the population that has settled (and continues to settle) in the Treasure Valley, a high percentage have college degrees, and many are employed in the growing tech sector. The growing population in the region has also spurred further economic growth. Drawing from Table 1.4**,** the total population gain across the 11 states of the American west between 2010 and 2025 is approximately 14 million people. The expectation is that there will be continued growth in the region for decades to come, compounding the issue of demand for scare water resources, as people need water to live, for their lawns, for economic development, and every other use. While there has been some discussion of Phoenix and other dry areas losing population, it is likely the bulk of those leaving the Phoenix area will move west or north, as opposed to east. So much of what befalls the region is the sheer space and capacity, the mythology around the ever growing west capable of anything still persists today.

**Why Water Matters**

Most people understand that water is an important resource that should be well managed. Intuitively, it is understood that water matters for so many facets of life, of the economy, social relations, and of course politics. Water can also be confusing. The overall per capita rate of water use has declined in recent years, with its peak in 1980.[[43]](#endnote-43) Even from 2005-2010 there was a 17% decline in per capita water use.[[44]](#endnote-44) The growing efficiency in domestic use can be traced in part to the National Energy Policy Act of 1992, that established efficient standards for household water uses such as toilets, urinals, faucets, and showerheads. Similar legislation set standards for water efficiency for appliances such as washer machines and dishwashers.

But these improvements simply mask the fact that overall domestic water demand in the region has increased over time.[[45]](#endnote-45) In their individualized pods, Americans are able to rationalize the use of science and technology to undermine any crisis, as their own lives are filled with everyday examples of water conservation and progressive acts. Likewise, in the agricultural sector, water efficiency has increased and the average amount of water being used from dropped from 4 acre feet to 2.1 acre feet.[[46]](#endnote-46) However, by 2010 the Americans was irrigating more land than ever before.[[47]](#endnote-47)

The domestic side of water use, which is defined as indoor and outdoor uses, including watering lawns, drinking, food preparation, maintaining pools/ponds, flushing toilets and so on, has its own western problem.[[48]](#endnote-48) The western states maintain a higher rate of per capita water use then those in the east and Midwest. 8 of the 10 highest domestic per capita use states for water are in the region of study for this project, and only Montana, Washington, and New Mexico retain similar rates to those of the Midwest, which is still more than most of the eastern seaboard.[[49]](#endnote-49) Nevada, Idaho, and Utah lead the nation in rates of domestic water use per capita, and are also some of the driest states in the country. Boise, Idaho, for example, gets some 11 inches of precipitation a year on average, yet tour the city and you will find well-watered lawns, golf courses, and city parks; access to irrigated water makes all of the greenery possible. The population growth in areas such as Boise is facilitated by the fact that housing prices, compared to the coastal metro areas of the Bay Area, the Puget Sound, and Portland-Vancouver, are all much lower, increasing the attractiveness of relocating business and people to the region. As noted above the west, particularly parts of the intermountain west, will continue to growth, which will further aggravate issues of increased water use in the region.

Domestic use of water is certainly important, but agriculture is the main driver of water use in many of the states examined in this study. From early on, particularly in the inter-mountain west, it became clear that irrigation would be necessary for agricultural production to thrive. The area is more or less dependent on snowfall for surface water, as in general snowfall, as mentioned above, makes up the majority of precipitation in the region. In the early 1900s the federal government invested millions into a far reaching dam system on most rivers in the western U.S., providing storage capacity and thus facilitating irrigation throughout the long hot summers. An example of the benefits of this irrigation can be found in the dry deserts of eastern Idaho, which have become rich and productive farm land. However, while irrigators still consume some 90% of the available water in the region, the growth of cities and urban centers has begun to reduce their share. What makes the intermountain west a region that is particularly susceptible to population growth induced scarcity, is that this growth has come in areas with some of the lowest rates of precipitation. Many of the cities mentioned above who are counted among the fastest growing in the country, are in the inter-mountain region. They need water for drinking, bathing, etc, but also this is an area with large homes and plots. Little of this new growth is high rise apartment buildings, rather it is suburban subdivisions all with lawns that need irrigation systems since rainfall is not a reliable way to water your grass.

While agriculture remains central, it should be noted that the impact of scarcity, even if it involves a small amount of water can cause problems. Consider the increased demand for electricity from new arrivals to the region, creating more on hydroelectric dam systems. This has added additional pressure on water managers to ensure enough water is left in the rivers to create enough flow for optimal generation. Agriculture and hydroelectricity are not the only players in the region. Industrial development has also increased over the last 50 years as jobs have moved into the region. These industries also require adequate water supplies and have further complicated the nature of the problem facing water managers in the region. For example, in 2015, the City of Mountain Home located in Elmore County, Idaho was approached by a food processing company with a proposal to build a 1.3 million square foot facility with 450 workers, however, the required water for the facility exceeded the available rights.[[50]](#endnote-50) The trend in economic shifts is from manufacturing to a service based economy, deepening the crisis over water availability.[[51]](#endnote-51)

In sum, water shortage can be linked to climate change, population growth, and structural changes in the economy. And water shortages can have serious consequences. An example of the economic damage that water shortage can play and the radical changes that can occur from them is evident in the way in which the recent drought in California brought about changes to the state. Hundreds of thousands of acres of farmland went unplanted, including 250,000 in 2016, and 540,000 acres in 2015.[[52]](#endnote-52) Forests in the Sierra Nevada mountains lost thousands of trees to the Pine Beetle, fish stocks declined across the state’s rivers, and the state ordered a 25% reduction in urban water use.[[53]](#endnote-53) Some research examining the economic impact put the total economic cost to the agricultural sector at $603 million just for 2016,[[54]](#endnote-54) while others put it higher, at $1.0-1.5 billion.[[55]](#endnote-55) There were even higher estimates for the economic costs for 2015; some research put the total economic cost for the agricultural sector in 2015 at $2.7 billon. During the drought the value of farmland dropped, food prices increased, particularly specialty crops such as almonds, artichokes, olives, and raisins. The drought also caused a shift in other aspects of the agricultural economy. For instance, some dairies moved from California to Idaho and other states, resulting job loss and reduction in tax base. There have also been shifts for residential water users. Homeowners across the state, encouraged by a subsidy program, tore up their lawns to plant native succulents and other zero-scape landscaping designs, moving away from traditional grass lawns. While the impact has been bad for California, the saving grace has been access to groundwater, as large aquifers have fed agricultural fields for decades. However, groundwater is quickly being depleted and new groundwater regulations in the state undermine the long term use of that source, both from a regulatory point of view but also one of supply. Future droughts may not be mitigated by the use of groundwater if there is none available.

Second and third order economic outcomes suggest that the economic consequences of water shortages are even greater. For instance, consider the economic consequences of employees who have lost their jobs, and subsequently moved their families. The domino effect of related economic consequences from agricultural producers limiting their operations can include agricultural operation suppliers, such as tractors, veterinarians, truck drivers, and others. While it is too soon to estimate the social cost of the drought, we can draw on lessons from previous droughts in California and the country more broadly. While the situation in the west might not end up being as bad as say the Dust Bowl or present day New Delhi, the impact is similar as people have to make tough choices about whether to stay where they have made a home, leave, or find new lines of employment. The economic consequences of drought in places like California also extend far beyond the borders of that state, as well. For instance, consider that rising food prices are not contained just to the states with droughts, but impact the entire country, and often have global consequences. This is all to say that the costs of inaction and failed policies on water shortages will be substantial.

Some states have recognized the problem of water shortages and are trying to figure out how to manage the consequences of it. Oregon, for example, has estimated that by 2050 the state will require an additional 424 billion gallons of water (or 1.3million acre feet) to meet the demands of agricultural irrigators.[[56]](#endnote-56) This is a sizable sum for a state know for rainfall, which indicates many of the other western states, particularly those in the inter-mountain west are in particular danger of facing water shortages that could upend their current use patterns, and the lives and economies build around them.

**Considering the Importance of Environmental Security**

As noted above climate change and population growth are presenting major challenges to the future of western economic, environmental and social conditions. As this book is being written fires in California are dominating the headlines, drought on the Colorado is raising questions of sustainable water practices, and acidification of the oceans is resulting in die off of starfish throughout the Puget Sound in Washington State.[[57]](#endnote-57) Government agencies unprepared or unwilling to address problems that arise because of climate change and population growth, including water shortages, will find themselves with a set of complicated and expensive problems. This book aims to address the uncertainty that surrounds climate change in the American west from a state institutional perspective. How well prepared states are to adjust and adapt to the effects of climate change is critical for predicting how the future of the American west will unfold. Water is a strategic resource, whose management can determine the well-being of a community. With the increase of water demand and decrease of water supply, communities in the west face great pressure on water systems. This book helps understand that pressure, and frames the issue in the context of climate change adaptation policy.

Climate change adaptation has quickly emerged as a cutting edge field connecting the natural sciences with the social sciences. The election of Donald Trump to the presidency of the U.S., the subsequent U.S. withdrawal from the Paris Climate Accord, the gutting of the Obama era EPA regulations on coal power plants, and the lack of bi-partisan consensus on some of the most basic questions concerning climate change have only fueled the need for academics, policy leaders, and government agencies to examine how and where climate change adaption policy can be adopted. The research on hydrology has rapidly been advancing, and utilization of advanced modeling techniques have brought important scientific tools to the public policy debate on climate change. The field of climate change adaptation is able to demonstrate that the problems of water scarcity are going to increase not decrease based on the clearest science available. Dozens of research projects have mapped the western region’s climate outcomes. The findings are stark and clear, and state agencies should consider the right course of action given this growing body of evidence.

 States’ policy apparatuses will need to adopt and advance policy innovations in order to address the increasing pressures on water supply articulated earlier in this chapter. In this book I introduce the term of ‘water accountability,’ which refers to the process by which stakeholders politically mobilize in more visible and significant ways in order to create a regulatory system which can respond to growing pressures from climate change. While there are many established actors in the realm of water policy, and excellent models of cooperative governance have emerged in many water basins throughout the west, I argue that the degree to which change in water demand and supply is occurring will alter the political landscape. A core assertion here is that regulatory agencies, such as Idaho’s IDWR, are going to have more work in coming years in managing the competing demands for water flow, and the issues of compliance.

There is a vast body of research on water management. This research articulates that there are many different types of schemes used to manage scarcity of natural resources, including place based management, adaptive collaborative governance, adaptive management, adaptive collaborative management, among others.[[58]](#endnote-58) But these approaches have mostly skirted the issue of compliance and enforcement, as they handle water distribution, while unauthorized water use occurs after the distribution of rights and any subsequent arrangement to utilizes banks, temporary transfers, and other arrangements.[[59]](#endnote-59) This raises the question, with which ever management approach is adopted, how are the rules enforced and regulated. The water management literature, such as collaborative governance models, along with most of political science, recognizes how government agencies can easily become isolated and operate with a separate agenda.[[60]](#endnote-60) In water compliance, the focus on their goal based compliance agenda and strong statutory guidelines, end up excluding innovative solutions to managing scare resources. How strong and reliant are the institutions designed and tasked with managing a scare resource is exactly the focus of another branch of literature relevant to this topic.

Environmental security as an academic field emerged in the 1990s, and has grown in strength in the past two decades, as scholars, policy makers, and activists tie the roots of many conflicts worldwide to resource scarcity. Researcher such as Homer-Dixon (1999) have identified scarcity as a driving force in many civil wars around the world, such as the Philippines, Darfur, and Rwanda. Homer-Dixon (1999) and many other scholars in the field fall into a category referred to as neo-Malthusians, whose work builds on the 18th century writer Thomas Robert Malthus’ , whose 1798’s *Essay on the Principle of Population* outlined a concern that population growth would out pace agricultural production and lead to a major crisis. Long associated with an effort to control population growth, Malthusian theorists have been concerned with the balance of caloric production and the size of the global population. Neo-Malthusians literature, of which Homer-Dixon (1999) is a staple, have produced in recent decades a set of arguments outlining how current environmental issues such as climate change, deforestation, soil erosion, and air pollution will undermine the capacity of modern society, particularly in poorer countries. To be clear, Homer-Dixon and much of the neo-Malthusian literature does not single out scarcity as the only cause of conflict, rather, they argue that “[e]nvironmental scarcity is never a sole or sufficient cause of large migrations, poverty, or violence; it always joins with other economic, political, and social factors to produce its effects.”[[61]](#endnote-61) These other factors can, and often do, contribute to the breakdown of the social contract and the ability of states to provide public goods that are the glue that holds societies together. What becomes very important, and is at the center of this project, is the institutional capacity of the state to manage scarcity. Homer-Dixon (1999) focuses on the role of social factors that respond to the impact of scarcity and highlights where ingenuity can mitigate and manage the damage and instability that resource scarcity can create. This ingenuity can come in many forms, such as creative institutional responses to scarcity that can undermine the conflict creating dynamics. For the topic of water in the west, much of the literature on water policy has worked to address and field test new approaches to water management, and many innovative policies have been put in place to do just that. In Idaho, for example, the Eastern Snake River Plain Aquifer Comprehensive Aquifer Management Plan creates a long term program for managing water in the aquifer with a phased, adaptive management process that allows for adjustments and changes and issues emerge involved a complicated process of negotiation and collaboration between a diverse group of water users, the state government, and other stakeholders. The need for a plan was sparked by the significant drawdown of the aquifer, which was on an unsustainable path and if left unabated would have created a major economic crisis in the Eastern part of Idaho long dominated by agricultural production as a key component of the economy. The intervention by the state, and the balancing of the various stakeholders, represents the Homer-Dixon (1999) concept of ingenuity, specifically, institutional adaptive capacity to manage scarcity.

 Such ingenuity and capacity is no small thing. As documented by Homer-Dixon (1999), the breakdown of institutional capacity and lack of ingenuity is visible in many cases around the world. As the 2014 National Climate Assessment summarizes, the success of the U.S. is dependent on creative solutions that require a range of actors and assets to come together. They site a partnership between the conservation group Ducks Unlimited and the Nisqually Indian Tribe whose efforts to restore an estuary in the Nisqually River Delta in Washington state, removed a 100-year-old levee that reconnected the isolated wetlands with natural tidal flow. The project restored 21 miles of historical tidal channels and floodplains, while also building a new exterior dike to protect freshwater wetland habitat for a number of migratory birders from future sea level rise.[[62]](#endnote-62)

 The institutional capacity of states to be flexible, adaptive, and effective in managing the problems of climate change, as argued above, is and will continue to be a major political issue. This book is an attempt to establish a baseline understanding what capacity exists among water management agencies across the American west, where improvement is needed, and how best can the stakeholders involved adapt to the changes on the horizon for the region.

**Organization of this Book**

Chapter 2 investigates the dynamics of water use, focusing on the supply and demand factors for water in the American west. I first examine the history of water use in the American west, and detail the economic impact water has on the region. Agricultural and industrial uses were historically dominant, but urban growth throughout the latter part of the 20th and start of the 21st century, and the continued trajectory of that growth, will continue to put pressure on watersheds throughout the region. I include in my examination the historical dimensions of water rights.

In Chapter 3 I establish what the status quo response is by Western U.S. states to unauthorized water use, paying particular attention to the investigation methods employed by states, the data they collect on violations, the budget allocation for enforcement, and the personnel assigned to enforce water rights. In Chapter 4 I examine what additional steps states might be required to take as the growing crisis of water scarcity undermines the ability of states to properly deliver water supplies to essential components of their economy. I examine the possible policy responses from the state level on this issue, including from the perspective of water users, environmental groups, and the political elite. Chapter 5 examines the possible federal government responses to water scarcity. This chapter examines two sets of options, the first is an examination of the what can be done in the status quo, while the second addresses what options would be available if the federal government suspended the prior appropriation system. The conclusion for many of the states in the region is that few of them are prepared to handle the growing water scarcity, and the required water adaptation. This chapter offers insight on how the federal government can proceed if the states fail to act. Chapter 6 provides some conclusions and draws together a coherent picture of the present and future policy environment surrounding water policy in the American west. I outline strategies that non state actors can pursue to advance their agendas. I focus first on agricultural based water user’s interests and possible options, and then on environmental groups looking to continue protections for fish and wildlife habitat. I close with a discussion of weaknesses of my approach, and offer suggestions for future research.

**A Note on Theory and Methods**

Along the way this book employs a variety of theories, data sources, and methods to outline the possible outcomes of water scarcity in the American west. There is a dearth of theoretical and empirical work in the field of political science, public policy and administration, and criminology that help us understand how various actors behave and shape the dynamics of water use in the American west. Administrative theories on government enforcement, and public policy processes inform and shape the field’s understanding of how policy decisions are made. Where appropriate, I explain how theoretical models from the fields of public policy, political science, and subfields such as environmental security inform the structure of the argument or underpin major assumptions. To demonstrate and evaluate the arguments presented here, I utilize a variety of data sources and research methods, such as interviews, secondary data sources, data from state water enforcement agencies, media reports, and others. The use of various data sources is described throughout the book. The core data is drawn from interviews of water management agencies from the 11 states examined, along with reviews of their annual reports that shed further light on their activities, capacity, and strategies in managing unauthorized water use. In addition, I conducted interviews with water users in Elmore County, Idaho. The rest of the book is drawn from media reports, scholarly research, and raw data. I have an effort to steer clear of heavy academic language and theory, as to keep the book accessible to a range of readers.

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11. Water theft has been reported in non-western states such as Iowa and West Virginia, however, mainly in residential zones. See also Knotts 2004 [↑](#endnote-ref-11)
12. (Covauurbias, et al. 2015) [↑](#endnote-ref-12)
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15. The Magic Valley consists of Cassia, Lincoln, Minidoka, Gooding, Jerome, and Twin Falls counties. [↑](#endnote-ref-15)
16. Hines and Packham 2014 [↑](#endnote-ref-16)
17. Mote 2016 [↑](#endnote-ref-17)
18. These are among many other contributions from a variety of disciplines. (Reisner 2013; National Research Council 1992) [↑](#endnote-ref-18)
19. Bensten 2006 [↑](#endnote-ref-19)
20. Whittlesey 1995 [↑](#endnote-ref-20)
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