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Population dynamics and water resource consumption in Spokane, WA

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Introduction

The idea of overpopulation is threatening, offensive, and potentially even fabricated depending on the knowledge base and perceptions of the interpreter. Regardless of this perceptional variability, however, overpopulation always presents as a worthwhile topic of discussion. Thomas Malthus raised the alarm of overpopulation in the early 19th century based off growing concerns about food shortages and overcrowding (Malthus, 2007). Not only was he wrong (he did not know agricultural practices and techniques would improve so drastically), but he was also found to be unethical in the kind of proposed solutions that many derived from his analysis, such as policies informed by notable hostility toward the perceived culprit, the lower classes, in order to preserve the affluent. This irrational conclusion, implicitly or explicitly articulated by those who cite him, or even champion such Malthusian ideas, has also been sharply scrutinized. However, could he have been on to something? The fact that innovations had to be implemented in agriculture to keep up with demand provides some degree of validation to Thomas Malthus's concerns. Clearly eliminating the lower class to preserve the rest should not be the answer, but we should at least be hyper-cognizant of existing and projected levels of resource consumption and population for the purpose of future planning.

Indeed, wars have often been fought over things like land, water, farmable land, and other renewable and non-renewable natural resources (Hayles, 2013). If we continue to follow the current path of global consumption, to what extent is it inevitable that future wars are to be fought over the same exact reasons? The ambiguity in mainstream discourse (and even much of academia) surrounding the answer to this perpetually looming dilemma is alarming. The academic literature on population growth and the conceptualization offered by Malthus is

voluminous, hitting a crescendo in the 1970s with, perhaps most sensationally, Paul Ehrlich's (1978) neo-Malthusian propositions.

Certainly, the potential for overpopulation to cause disruption on a global scale is devastating enough to warrant thorough investigation, yet scholarly interest that explicitly interrogates this topic has waned in recent years. For some, particularly in the mainstream sustainability literature, there is a degree of skepticism where the topic of population is either a non-issue (i.e., only non-human species can seemingly be "overpopulated," see Haggerty and Travis, 2006), or it is implicitly presumed that the Earth can support an expanding human population in perpetuity through technological innovation. There are many examples of population and resource related issues though, in the more densely populated areas of the Earth (China, India, and parts of Africa) that prevent the topic from being one sided. Population size has a direct impact on every related social issue, as it can amplify the effects of those issues (see Harvey, 1975). If humanity truly desires environmental friendly reform, then perhaps population size should be included more as one of the primary contributing factors to everything from resource-related conflict to global climate change, and that this is something that is decidedly within our ability to control. Freedom cannot be used as an excuse for irresponsible stewardship of the Earth.

The capitalist mode of production necessitates not only endless, but compound growth and expansion (including geographic expansion, seeHarvey 1975, 2014). Capitalism, when it is considered to be unproblematic or somehow sustainable, can be quite dangerous given the reality of Earth's finite stock of resources. As Taylor (1994: 161) put it, the "Earth is too small for forever expanding capitalism." This future terminal crisis point for the capitalist system is routinely silenced in the context of a neoliberal rationality that remains hegemonic today, and the profit imperative that drives the actions of corporate shareholders and CEOs (Harvey, 2014;

Klein, 2015). Yet, the capitalist approach to organizing a society around the logic of compound growth in production and consumption is inherently incompatible with the objectives of resource management and conservation – at some point, the rubber has to meet the road (Robbins, et al., 2012).

O'Conner (1996) discusses what he calls the second contradiction of capitalism: the tendency for capitalism to perpetually deplete the very resource base upon which its existence and survival is predicated upon. For example, in a study on rural gentrification in Missoula, Montana by Ghose (2004), affluent newcomers are escaping the hustle and bustle (and alienation) of urban-industrial surroundings, and flocking to the rural countryside for a slower, and presumably more healthy and fulfilling, pace of life. However, when executed in large numbers, this process ends up paradoxically contributing to the development of the very thing these migrants are escaping: new suburban development, which only serves to urbanize their new local surroundings, thereby ironically recreating the exact environment they were trying to escape. The idea of wanting to temporarily escape from large concentrations of people seems innocent enough, but defeats itself in this way. In the context of Missoula, the "natural amenities," i.e., mountain vistas, open space, are increasingly depleted with the presence of more and more development and people.

In short, capitalism invariably draws down its own resource base such that the only way for the system to expand is to perpetually widen its base of resources, suggesting a terminal crisis point at some future time when the capitalist system has, quite literally, outgrown the capacity of the Earth to supply the necessary stock of resources for the system to continue. In this way, the Earth represents the global collective "commons," as we are all collectively reliant on the available resources found on Earth. As such, disregard for resource preservation will eventually lead to the very "tragedy" identified by Hardin (1968), which is the overconsumption of our

collective resources, followed by crisis. However, it is not communal resource management systems that are the culprits (or privatized systems as the savior), as Hardin's discussion about this dilemma suggests, but the very inherently expansionary dynamics of capitalism itself (see O'Conner, 1996; Robbins, et al., 2012).

Alternative energy is a great idea or goal in theory, and its continued development in no way should be hindered (Kunstler, 2005). This also goes for the myriad other inter-related global tasks associated with "sustainability," such as reducing carbon dioxide emissions (Klein, 2015), designing more "sustainable" humanly-built environments (Kunstler, 1993), and conserving energy through less consumptive practices. The problem, however, is not any of these missions per se, but that which is not discussed with nearly the same degree of frequency or enthusiasm: population growth. And when it is discussed it is often dismissed as overly sensational Neo-Malthusianism or misguided. Why? Primarily because the seemingly immanent population crisis Malthus feared over two hundred years ago (and others more recently like Ehrlich) has yet to materialize. The reasons why this crisis point has not happened is that, ironically, it has been through capitalist-induced innovative practices that have allowed for more food, water, energy, etc., to be produced, thereby supporting an ever growing global population. Unfortunately, this has led to the rather hubris tendency to conclude that the human species will always be able to continue to postpone this crisis date further into the future. This type of sentiment ignores the very real planetary limits to perpetual compound growth, which necessarily entails growth in population as one of the principle (but not the only) means through which the capitalist system can expand and, thus, survive (Harvey, 1975, 2014).

By not addressing global population trends, to what extent are we trading one kind of crisis for another? Cutting carbon dioxide emissions has positive implications, but unfortunately, it will not necessarily matter how much energy is conserved or how new energy sources can be

better harnessed, if population growth patterns continue into the foreseeable future. Some would say that global population growth will ultimately resolve itself, citing demographic transition theory, as the rate of growth has begun to decline in countries that have been industrialized. Thus, the solution presents itself: stay the course, until the rest of the world is more fully industrialized (Mosher, 2011). Again, this may sound well in theory, and may even hold some degree of merit. But what this way of thinking does not account for is the question of whether (and where) the planet has the resource capacity to support the population size that will result from the rest of world completely developing. Can this implicated degree of production and consumption be sustained by resources derived only from one Earth? And further, as Harvey (1975) provocatively asked four decades ago, to what extent is a stagnant global population compatible with the inherently expansionary dynamics of capital accumulation? More research is needed with implications for these bigger picture questions, but are we afraid of what the potential answers might look like? And possibly even scarier is the question of the future of capitalism, the very economic process within which this dilemma is so thoroughly and intricately situated.

The topic of overpopulation is highly controversial. For instance, telling people not to produce offspring is a scary and offensive idea for many. Invariably, however, more responsible reproduction practices seem inevitable (and have already been imposed in China), although it is hard to discern if and how this might unfold. The need for clarity on this subject is paramount in making future natural resource management decisions and inquiries. Next to oxygen, water is the most important resource on the planet. It would be wise to ensure the proper use and conservation of this resource as it has an effect on many other resources and activities that govern human (and non-human) existence. Not monitoring its whole network of relationships would be irresponsible and we would only have ourselves to blame. Unfortunately, knowing an

actual number that would represent a water consumption threshold in terms of population is where it gets complicated. This is because there is not a specific number per se, but there is definitely a range, though a range that has yet to be defined. When population size increases, quality of life decreases if the result is greater resource scarcity, as less resources become available to each individual as they have to be spread across a larger quantity of people. Unfortunately, quality of life is not easily agreed upon in groups, especially in relation to a topic as controversial as overpopulation.

One of the reasons why this so controversial is the rather simple perceived solution that is almost immediately signified when the topic is invoked: some degree of global scale extermination of human life. However, this is not relevant to modern discussions of population related issues. Instead, our critical lens should be directed to the idea that, even if it is less popular, there are not, and will not, be any repercussions from rampant and growing consumption until crisis is staring us in the face (and to the detriment of future generations). This discussion has to be at the forefront of social and political debate. Despite a select few (and sensationalizing) Hollywood blockbusters (i.e., Inferno), this has not been the case. Even worse, these popular expositions on this problem cast the concerned parties as the villains due these characters' seemingly inevitable conclusions that inordinate sums of people must die, thereby having the effect of relieving our collective conscious that something has to be done at all or that this is a topic to even worry about. This study hopes to contribute to rectifying this situation.

The broad objective of this research is to raise awareness about an issue that has the potential to cause social, economic, and political hardships on a global scale, and could easily lead to national and international conflicts (Biro, 2012). The implications are widespread, such as the potential for loss of life due to famine, dehydration, war, pandemic, and myriad other

factors. These dangers warrant investigation into what role population growth currently plays in natural resource management planning (and what role it should play). The philosophy of "sustainability" has gained popularity in recent years, based on the idea that consumption can be achieved to a degree that is sufficient to meet the needs of the current population without compromising the needs of future generations. But many argue it has no chance of being attainable if existing population and resource consumption dynamics are not, at the very least, taken into consideration (Klein, 2014)). What will need to be done, however, is daunting, especially when considering Harvey's (2000: 194) sobering reminder that the "very concept of sustainability, [which] evolved in part to confront such difficulties," ultimately "points to spatiotemporal horizons different from those of capital accumulation."

Within this broad objective, I propose to ask the following questions in the context of population growth and water management in Spokane County, WA: 1) what is the carrying capacity in terms of human population in Spokane County with respect to available water supply? 2) What are the primary concerns expressed by both water managers and consumers in terms of future water management in Spokane County? 3) Is the issue of population growth among the concerns expressed by water managers and consumers? 4) To what extent are the principles of development and conservation considered compatible (or contradictory) among water managers and consumers? And, 5) if the issue of population growth is not considered a pressing and important concern, why might this be the case?

Typically, population growth and water scarcity are not considered problems until some degree of drought-related crisis is declared or immanent. Considering that Spokane, WA is among the most privileged locations with respect to water availability, because of the aquifer, it represents a good site in terms of surveying the attitudes and predilections of both water managers and consumers in a place where water is still thought of as plentiful. And it certainly is

for right now, but in this way, the study is able to explore the potential conceptual barriers that likely exist in a seemingly water-abundant place, like Spokane, to the necessary task of developing longer-term water planning measures that more explicitly and seriously take population growth into account *before crisis becomes a reality*. Crisis might not be here today, but is it not too late to realize or plan for this before crisis hits tomorrow? In empirically addressing these questions, the study hopes to raise awareness about an issue that has global ramifications.

Literature Review

Hardin's (1968) *Tragedy of the Commons* thesis provides a good point of departure for examining the question of community or group resource consumption. The basic idea behind the *tragedy of the commons* is that if individual interest is placed above group interest when it comes to consuming shared resources, it ends up taking a heavier toll on the environment than if every individual in the group were to consume at a rate that could sustain the entire group. The heavier burden on the environment then facilitates a situation where natural resources are insufficient to provide for the needs of the entire group (Sydenstricker-Neto, 2012). The idea of placing individual interest above group interest often stems from fear that everyone else in the group also places self-interest above group interest, which creates unnecessary competition and overconsumption. In the contemporary environment in, for instance, highly competitive western societies, self-interest is often valued more than group interest in many contexts. Indeed, under the capitalist mode of production, continuous individual wealth accumulation, mobilized by this very competitive logic, is the primary focus and mechanism driving the system forward. This, however, does not necessarily have to be the case, as Anderson, et al. (2016) and others reveal, as there are many examples of human behavior around the world and in history (and even within western capitalist societies) that suggest this hyper individual competitiveness is as much, if not more, the result of a deep-seated socialization process than somehow being inherent to the human condition.

Large population sizes are the other half of this scenario. Overconsumption is achieved much easier with large population sizes. If freedom is championed as the argument against lower individual consumption rates that benefit an entire group, then current population sizes have turned freedom into a dangerous catalyst for self-destruction (Hardin, 1968). In short, the

promotion of “freedom” should not validate disregard for the common good of a community. Individual freedom is clearly a desirable condition, but in the final analysis, at what cost to the entire global population (including non-human life forms) given existing western consumption practices and standards of living? Freedom, in the end, could ultimately come to represent the biggest threat to its perpetuation.

One reason that some have cited for how the world is not overpopulated is the fact that you can situate “all of the current human inhabitants of the globe in Texas, each with his or her own townhouse to live in. And this would only fill a small corner of the earth” (Population Research Institute, 2009). But this does not account for so many related variables and raises several questions in the process. How are these people supposed to grow and eat food when everyone is living in townhomes? Plus, the amount of land on the earth available for agriculture is much smaller than this model implies. It is also completely ignorant of the logistical nightmare this would create in terms of transportation and exchange or acquisition of goods (and where this mass industrial production might take place). In short, the footprint of land needed to support the current global population within Texas would still be reliant on a massive amount of produced commodities and resources (water, energy, food, etc.) that would have to necessarily be erected and transported in from somewhere.

Secondly, does this model suggest that the earth is not overpopulated until 100% of the landmass on Earth is inhabited by humans? This leads to the next point which is the fact that myriad other things require and take up portions of the available land surface on Earth too, such as wildlife, vegetation, and fresh water. Can this model really ignore the countless animal species that are rapidly facing extinction (Dice, 1957)? They went extinct, at least partially, due to the occupation of, or impact to, their spaces and habitats by humans. Another thing to consider is space for recreation, urban sites and infrastructure, and conservation. In short, when

you take into account all of these realities, the world becomes significantly smaller, and the occupation of the earth suddenly becomes much more than a small corner, a misinterpretation of the spatial footprint of human development that woefully ignores the spaces of colonization and development (i.e., mega-dams, oil-gas drilling, coal mining, electricity-generation plants, sewage treatment plants, etc.) that support this supposed small corner (Brenner and Schmid, 2015).

On the topic of resource consumption equality, the distribution of said resources needs a closer look. It's no secret that the developed world consumes a strong majority of natural resources compared to the developing world. In this context, the term "developed world" is most certainly referring to North America, Western Europe, Australia, Japan, and parts of China. The living standards in the developed world are much higher than that of the developing world. Many people in the developing nations would no doubt love to live by developed world standards. This is totally justified, but also raises several concerns. Firstly, if the population on the planet were to stop growing right now, and advanced economies were allowed to bring the rest of the world up to developed world standards, implicating massive increased resource consumption, would the world yield enough resources to make this possible? That the answer to this question is uncertain is cause enough for concern. In addition, the current brand of western, neoliberal-guided capitalism would not allow this, as it is a system dependent upon exploiting the massive resource base of the developing world (Harvey, 2005). In this regard it's difficult to view the list of capitalist pros and cons, and feel justified in saying that the benefits from job creation and competitive markets (although monopolies do exist within capitalism) outweigh or equal the cost of placing ever more quantities of people in a permanent state of poverty, as the earth's population has not and, ostensibly, will not stop increasing for the foreseeable future.

The rate of population growth has seen the most dramatic increases within the last century. This can only mean exacerbation of current resource distribution trends, so long as industrial capitalism continues to steam-roll across the globe. Sustained resource consumption and distribution, even at the current unbalanced rate, is projected towards a highly contentious future. According to the WRI (World Resources Institute), as economies around the world continue to progress, over 3 billion people are projected to enter the middle class in the next two decades (WRI, 2017). The resultant increase in consumed natural resources will be tremendous. Competition for resources will be fierce, as the amount of available resources will likely continue to decline at growing rates (barring any future new innovations and discoveries).

Population growth in China, for example, has seen a fair amount of stagnation, and even decrease, due to harsh policies that govern the national birth rate, but the amount of resources consumed by this nation is aggressively on the rise (Fang, 2009). This is due to their desire to bring the remaining one billion people that live at developing world standards up to developed world standards that the other 300,000 Chinese citizens now enjoy. The relationship between population growth and resource consumption stems from the question of future development, in order to accommodate said population growth. Currently, the Spokane Valley-Rathdrum Prairie Aquifer (SVRPA) can sustain the demands associated with the existing population and some degree of population growth in the city of Spokane. The growing population numbers in Spokane cannot be solely attributed to procreation, as “migration to the region—rather than births—made up the bulk of population growth” (Boiko-Weyrauch, 2017). The necessary accommodations for growth are planned well in advance. Regardless of the specific drivers of this population growth (immigration or birth rate), the aquifer has its limits, and thus, like many other places, the greater Spokane-Coeur d’Alene metropolitan region cannot continue to experience growth indefinitely unless 1) additional water supplies are found, 2) more

substantive conservation practices are advanced, and/or 3) the supposed inevitability of future development is fundamentally arrested and rethought (see Harvey, 1974). In short, population growth can be interpreted as a major "elephant in the room" when debating and developing future water conservation policies and practices. At present, this crisis point has yet to occur in Spokane County, but this very real dilemma, as reflected in the recent 2014-2016 California drought, is almost certainly looming on the horizon. Are existing water managers, engineers, and officials currently and explicitly planning for this seemingly inevitable dilemma?

The notion of sustainability is often utilized (by both environmental science scholars and planning practitioners) as a means with which to tackle these broader issues surrounding resources and development (Dixon & Fallon, 2008). Unfortunately, there is little consensus on what the definition of that term is. As early as 1972, "the phrase 'sustainable development' was used explicitly to smooth over the apparent dichotomy between economic growth based on industrialization, and associated adverse environmental side effects" (Adams, p.358, 2009). That was from topics of debate at the United Nations Conference on the Human Environment in 1972. In that sense, it was tailored to support the agenda of ambassadors from the first world to argue against unmitigated development in third world countries. The political debate regarding the vague idea of "sustainability" has been unending ever since.

More recently, the term sustainability is routinely discussed in ways that render it synonymous with the term "renewable" - renewable in the sense of the ability to be replenished with little or no new impact on resource consumption (Dixon & Fallon, 2008). Energy in particular is amongst the most popular of current trends. In an effort to minimize greenhouse gas emissions, those who are environmentally cognizant increasingly support the idea of switching from fossils fuels to solar, wind, and water energy sources. Those sources are not only non-CO2 producing, but, following Mulder (2008), they can be replenished from a seemingly

limitless supply without fear of resource depletion. This potential switch to resources without limitations in supply, in theory, could probably create some degree of relief about the future of consumption. Unfortunately, the energy return from alternative sources (wind, solar, etc..) is nowhere near the return from gas, oil, or coal (Mulder, 2008). And when the economic side of energy is subjected to the capitalist imperative, the highest rates of return always win out. There is also difficulty in harnessing the energy from alternative energy sources in ways that distribute it through the gird and, thus, make it friendly to privatization. In short, these forms of energy are notably de-centralized, and make it hard to profit from its allocation.

Establishing empirical links between demographics and sustainable development can "often spark fundamental controversies and public discourse" (Hummel, p.482, 2013). In general, most can agree that this term, sustainability, is associated with sustained consumption for the foreseeable future (without negatively impacting future generations). However, does the term *consumption* in this context allow for growth and expansion? There has to be some degree of inherent conservativism without continued development embedded within the very idea of sustainability or else the whole thing is based on a tenuous contradiction, as notions of "sustainable development" become oxymoronic, akin to sustaining the status-quo. Nonetheless, the principle that a resource is limited has to be applied to future development planning in terms of limiting and/or governing the allowable demand the size of a population in particular places can make on said resource.

There is a climate change component as well. The Earth has been getting warmer in terms of annual global average temperatures as a result of the growing amount of greenhouse gases (CO_2, methane, nitrous oxide) that have been injected in the atmosphere, which act as heat insulators. The pumping of greenhouse gases into the atmosphere is most closely correlated with human activity, but more specifically, the energy production processes (i.e., burning coal,

powering automobiles) that are intimately bound with the capitalist mode of production (Harvey, 2014; Klein, 2015). Climate change projections also suggest future degradation of available water supplies (particularly in places that are already dry). For example, projections that take climate change, population growth, and water usage and availability into consideration, show that there are predominantly more locations on a global scale that will experience significant increases in water scarcity (Vorosmarty, 2000; Hunter, 2014). Three different scenarios were run to account for varying levels of climate change, and all scenarios indicated at least some degree of confirmation that future water availability will be degraded as a result (Vorosmarty, 2000).

Even though some locations are projected to experience increases in available water, those same areas then become vulnerable to things like "flooding, deteriorating water quality, and malfunction of water related infrastructure" (Schewe, 2014: 3247). The role of climate change, however, in impacting existing water supplies has received extensive academic and public interest and even media exposure. However, to Schewe (2014: 3248) "population growth [also] plays a major role in this increase in water scarcity because it reduces per-capita availability even with un-changed resources." In short, climate change and population growth both represent absolute and relative declines, respectively, in available water supplies. As such, how far into the future could water rations become a reality?

And when represented in the mass media, as in the case of the California drought, it is often portrayed as if "nature" is being cruel, a matter that is inherently temporary, of there not being enough rain. Consequently, and unfortunately, mainstream conceptions of drought are often shaped in ways that understand this phenomenon as induced by "nature" rather than human activity, thereby disconnecting and obfuscating instances of water scarcity from population growth or development.

More attention should be paid to the water scenario in California in order for other places to avoid entering into the same uncertainties that California water management officials face annually. The current climate in the American west, which is hot and dry, combined with population size and a high volume of agricultural water usage in California, has led to an increasingly risky confidence in the ability to utilize alternative potable water sources, should primary sources become temporarily compromised (or worse). Burgeoning climate change factors have recently added further complication, and will only continue. In 2015, Governor Jerry Brown moved to impose permanent water conservation measures (Lovett, 2016) after experiencing consecutive years of strained water conditions in the entire state: "Californians have reduced their water use by 23.9 percent compared with 2013 levels" (Lovett, 2016). The interesting part is when considering average homeowner usage versus agricultural and industrial usage, in California agriculture alone is appropriated over 40% of available water, while urban use is 10% (NCWA, 2015). That being said, the widely accepted assumption, exacerbated by the media, that urban water users bear a disproportionate responsibility for water conservation is technically not true. In 2014, 30% of the farmers with irrigational needs received no water rations at all (NCWA, 2015). Of the farmers who were fortunate enough to receive water in 2014, none of them received an amount of water that was sufficient in relation to the amount of their land available for agricultural use (NCWA, 2015). This decrease in water appropriation led to a decrease in 5.1 billion dollars' worth of agriculture production and jobs (Cal OES, 2017).

The fear of running out of water in the agricultural sector only further exhausted the ground water supply as farmers continued to pump water out of the ground for their remaining crops (Cal OES, 2017). This intense use of water in Central California over the past few decades has depleted the ground so severely that the ground has begun to subside. The evidence can be observed in the damage to infrastructure, which gets worse as the surface continues to sink (Cal

OES, 2017). Media reports almost universally portray the ground sinking phenomenon as a natural crisis, a matter of not enough precipitation. The elephant in the room continues to be population size and the demand on the California agricultural sector, *which demands an immense amount of year-round water availability*, to support the rest of the United States and beyond with year-round food products. Out of all the contributing factors to whether or not the State of California will have access to a sufficient amount of water to meet demand, population size is the circumstance humans have the ability to control the most, yet mention the least. If substantive and truly sustainable solutions to water issues in California are to be established, the topic of population size has to receive adequate consideration.

The drought has also had myriad negative environmental impacts. Forest fires, for example, wreaked havoc on the forests of northern and Central California between 2012-2015. There were 473 total fires in the summer of 2014, which is much higher than normal (Cal OES, 2017). Local fire crews, unexperienced with handling the increased volume of wild fires, were unable to keep up with the demand for their assistance. In addition to fire, as a result of drier climate conditions, some species of conifer trees saw a decline in health which made them more susceptible to deterioration from tree consuming insects. An estimated 102 million trees died as a result (Cal OES, 2017). This situation warrants inclusion in the topic of water distribution at a higher priority than it has received in the past.

Water rights contention in the state of California is not new. There have been numerous arguments involving dams, reservoirs, irrigation, urban projects, and the environment for the past century. Southern California government officials would love to import more water to a region flirting with the limits of carrying capacity in terms of water consumption (VICE, 2012). The question has always been about where to import the water from. No other location in the state can afford to allow the government to come in and continue to divert water from their

local areas in ever-increasing quantities. There aren't any areas in California with excess water to provide without having detrimental social and ecological consequences (VICE, 2012), as "sprawl has hit the wall" in Southern California and beyond (Dear, et al., 2002). Unfortunately, those with significantly more in terms of financial means and political clout have more influence and priority on the government's allocation of water rights: "If you want to know who's responsible, just follow the money" (VICE, 2012).

Importing water from somewhere else would make California vulnerable, more than it is already, due to the allowance of continued growth and development beyond their actual water subsistence capabilities. It would allow them to ignore a problem temporarily while the actual problem remained unaddressed. One proposed external location is in Washington State, in a river into which the Spokane River drains. As Monroe (2015) asserts, such a move "would capture Columbia River water in a low-head structure at Bonneville Dam, pipe it down the bottom of the river and out the mouth, then turn south along the coast to California, still along the ocean floor" (Monroe, 2015). The mere fact that California leaders have even considered ideas like this as possible solutions to the problem should raise more red flags, a move that could immediately threaten the Pacific Northwest's position in the region as comparatively water secure. It also debunks anyone's optimistic view that California actually does have a sufficient amount of annual water if allocated correctly. Fortunately, there were plenty of "permits, political fights, and environmental issues" to discourage the California Water Control Board from further consideration for the meantime, not to mention public outrage. The monetary aspect cannot be forgotten in this equation either, as some of the members of the California Water Control Board stand to profit from a contract to import water (VICE, 2012). These members are part owners of companies trying to broker water deals with the California

Water Control Board. If there was ever a conflict of interest, this certainly qualifies, and the effect of population size in the situation remains ambiguous.

Presently, there is no concrete data regarding specific limitations on or carrying capacities in relation to human population size due to its controversial nature. To move forward in the investigation of the relationship between population growth and its impact on natural resource consumption, the literature on this subject must be navigated. China and India have the two largest populations in the world, and Illustrations of social and environmental challenges related to population dynamics are easily identified in both contexts. In India, for example, rapid population growth overshadows any or all gains in the economic sector, which means that "economic progress cannot address the issue of poverty or increase the quality of employment" (Perveen, p. 631, 2004). On top of this are the food and water issues in India. The key to it all is water: "80 percent of the water consumed in India is in the agriculture sector" (Perveen, 2004). Not only is potable water necessary for drinking purposes, but it is also key to the agricultural industry in particular. This high demand for water in India stems from growth that may or may not be sustainable, but only time will tell: "Perhaps the strongest of all population impacts is on the demand for freshwater in the coming decades" (Perveen, p. 632, 2004). Regardless, more people need to be asking if this is something that should be acknowledged and addressed more by resource managers and government officials.

Overconsumption cannot be overlooked, and it is a crucial issue that needs to be examined in relation to population growth. An increase in population size places an increase on demand and consumption. As soon as a resource becomes insufficient to satisfy demand, overpopulation, almost by definition, has occurred: "Overpopulation occurs all the time in the wildlife realm. It happens anytime a species cannot be sustained by its own habitat after experiencing substantial population growth" (Dice, 1957).

Humans have managed to stave off catastrophe up to this point in history through ingenuity and creating new efficient ways to utilize natural resources. Dice (1957) also recognized that "the great advances in science and technology made during the past few centuries, in particular, have tremendously increased the carrying capacity of the earth for human populations," one of the chief reasons for why Malthus' immanent population crisis has not yet happened. In short, prior population increases came after or because of these sorts of technological advances. Even back in 1957, population sizes were outpacing advances in technology in many regions of the world (Dice, 1957), and this problem only continues today. The American southwest is a good example of this, given the current water resource conditions. The opposition to raising awareness about population dynamics relies heavily on the potential for continued human innovation to perpetually resolve this predicament. This mindset is arguably foolish because it places a heavy responsibility on future generations to develop innovations to problems that have yet to occur – there is nothing automatic or inevitable about the innovative human spirit to perpetually be able to postpone this persistent dilemma. Negligence in this area creates serious problems because if these innovations are not made in time, Malthus may still be right in terms of the inevitability of crisis. And even if they are made in time, to what extent will space colonization eventually become a very real necessity? According to Elon Musk and Richard Branson, this is already an issue worth contemplating and even financing.

The last century has been the most severe in terms of human consumption of natural resources. Population size is intimately connected to this subject because it governs the severity of impact: "You cannot sustain population growth in the rates of consumption of resources" (Bartlett, 2009). Increasing consumption efficiency, while noble in theory, should not be relied on to accommodate future development in perpetuity, as this only further postpones the inevitability of crisis. Population awareness and responsibility are the other half of increased

efficiency, and have to be promoted together in order to strengthen their association. This represents one of the chief reasons necessitating the need for this research project in Spokane, WA. Solutions to potential issues associated with population and resource consumption can develop in unpleasant ways if neglected until circumstances degrade until there is no other (especially desirable) alternative pathways forward.

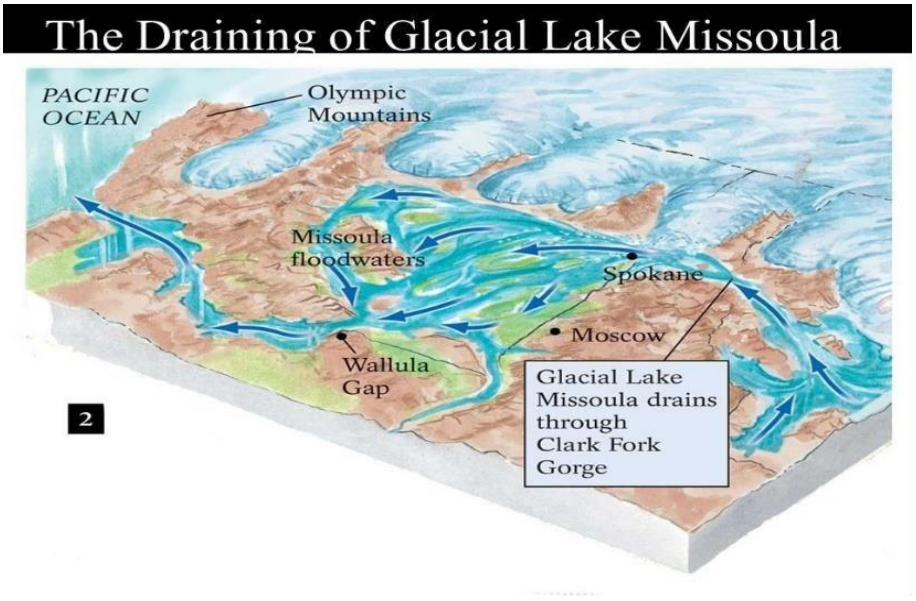
The Spokane Valley-Rathdrum Prairie Aquifer

Spokane is well known for having one of the best sources of potable water in the United States. The primary source of potable water in Spokane is the Spokane Valley-Rathdrum Prairie Aquifer (SVRPA). The ability for the aquifer to provide water is contingent on whether (or not) the recharge rate is enough to replenish whatever volume of water is consumed. Currently, the recharge rate exceeds the consumption rate of the aquifer by a considerable amount. However, as soon as consumption exceeds the recharge rate, the aquifer will lose the ability to replenish itself (Daily, 1992). At that point, the aquifer will begin to be depleted.

The history of how the Spokane Valley-Rathdrum Prairie Aquifer was formed provides a better understanding of its characteristics and dynamics. The geologic make-up of the aquifer was deposited after a series of floods, known as the Missoula or Bretz Floods, gouged and scarred the landscape while overwhelming the region with water. Eventually the water was dumped out to the Pacific Ocean via the current path of the Columbia River. The floods were immensely violent and changed the terrain tremendously. Today, in the Spokane/Coeur d'Alene area, water still flows underground through the aquifer along the same path.

Roughly 13-18 thousand years ago, in several different sheets called "lobes," the polar ice caps extended as far south as Spokane (Kahle & Bartolino, 2007). As they began to melt and retreat northward, large amounts of water were released. The ice cap that existed over what is

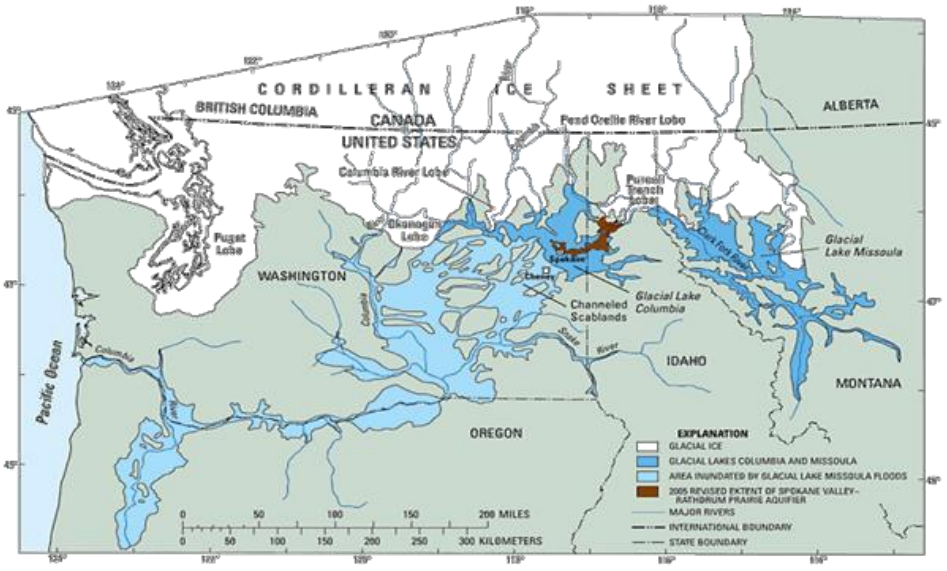
now Lake Pend Oreille, known as the Purcell Trench Lobe, damned up the Clark Fork River which created an enormous reservoir of water behind it (Kahle & Bartolino, 2007). This vast area of water is known today as Glacial Lake Missoula due to the fact that it existed where the present city of Missoula is located. At its largest, the lake consisted of over 500 cubic miles of water. Evidence of various lake depths can be observed in the surrounding hills from strandlines made by wave-cuts (Kahle & Bartolino, 2007). As the Purcell Trench Lobe began to melt during an earlier period of climate change, it eventually gave way to the immense amount of pressure from Glacial Lake Missoula. Flood water then came bursting westward. The floods came in a series of events as the ice cap continuously reformed and broke under the pressure of water behind it. The figure below illustrates the origin and flow of the Missoula floods as they eventually made their way out to the Pacific Ocean.



SOURCE: The Spokane Valley-Rathdrum Prairie Aquifer Atlas

The water that flowed over the land was so powerful that it ripped and eroded away all vegetation, rocks, and soil horizons from the landscape which exposed the barren rock parent material in several areas (Kahle & Bartolino, 2007). Soil formation requires many years of

physical and chemical weathering of rock parent material to manifest. The floods wiped all of the soil away. This explains why there are extremely thin soil conditions in the "scablands" of present day Eastern Washington. The figure below shows the current location of the SVRPA in relation to the former period of glaciation.



SOURCE: The Spokane Valley-Rathdrum Prairie Aquifer Atlas

Today, water continues to flow along the same path via the Clark Fork, Spokane, and Columbia rivers, as well as the SVRPA (Bayview, 2005). The lakes surrounding the aquifer are all aquifer contributors. Those lakes include: Coeur d'Alene Lake, Liberty Lake, Lake Pend Oreille, Newman Lake, Hayden Lake, Spirit Lake, and Hauser Lake. These lakes were formed from deposited sediments from the Missoula floods as they began to calm (Kahle & Bartolino, 2007). The floods carried away most of the silt and sand and deposited large boulders, cobbles, gravel and some course sand. As a result, the water in the aquifer moves extremely fast compared to most aquifers. Unfortunately, that makes it highly vulnerable to contamination and pollution because contaminates can cover more ground in a shorter amount of time. Contamination

control becomes that much more difficult because of this. At the same time, this geologic composition of the SVRPA is ideal due to its high permeability.

The SVRPA provides local residents with access to one of the cleanest water resources in the world. The current volume of the aquifer is estimated at around 10 trillion gallons (Bayview, 2005). Therefore, not only is the water in the aquifer clean, but it more than satisfies the needs of the region's current population, which is over 500,000. This facilitates a situation where water prices are relatively cheap, and residents are content with readily available access to potable water.

The dominant theme in Spokane regarding the topic of water use, from the county planning perspective, is preservation. However, stronger mitigation policies are still in need of attention. Mitigation efforts must be developed and implemented by local authorities to reduce the effect of industrial contamination and pollution, overconsumption, and other various human activities in drawing down the volume of water in the aquifer. It was not until the 1970's that efforts (mostly government-led) were made to study and protect the Spokane aquifer (Dobratz, 1986), a reflection of the myriad state-led resource management campaigns that emerged nationwide at this time (Anderson, et al., 2016). This development initiated a much-needed change in management orientation in terms of addressing how valuable and vulnerable to contamination and other hazards the Spokane aquifer really is. One study revealed that humans have negatively impacted the aquifer due to the presence of higher chloride and nitrate concentrations located adjacent to human activity (Dobratz, 1986). Any substantive contamination to any part of the aquifer could be detrimental to the current and future water supply due to the fact that the SVRPA moves so quickly; 50ft per day in some areas (Dobratz, 1986). The apparent vulnerability of the Spokane aquifer has led to increased public support for

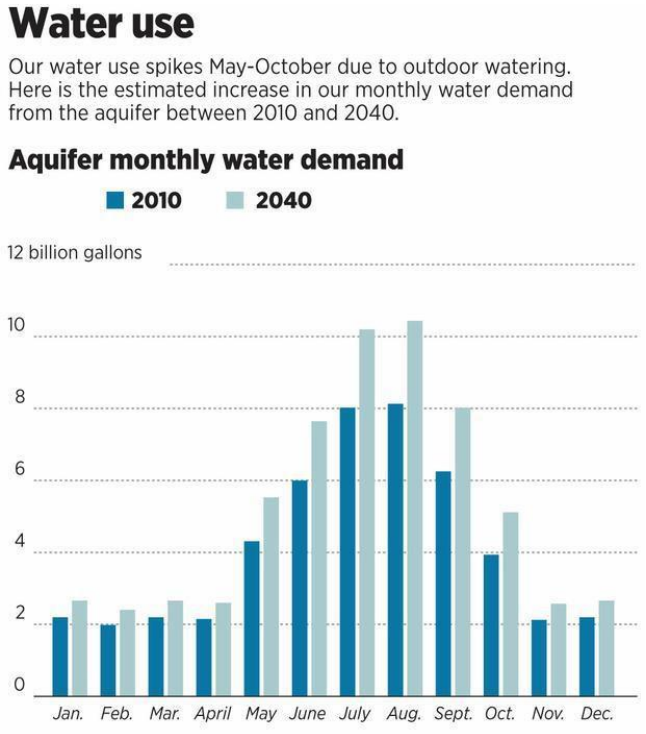
policies that enforce protection and conservation, as contamination directly impacts the quantity of water available for human consumption.

The current water system in Spokane includes over 1000 miles of water mains and is fairly simple. In the first phase, water is pumped out of the aquifer by 7 main wells evenly spread out around town. From there it is transferred to one of 32 different water storage facilities; typically a water tower. After that, it finally makes its way to the location (residence or place of business) where it's either used or consumed (SAJB, 2017). The second phase involves discarded or waste water. Wastewater in Spokane all ends up back in the Spokane River via three possible routes: a) the sanitary line, which is the main sewer system that runs to the Spokane Wastewater Treatment Facility in Riverside, b) the combined sanitary and storm water line, which also runs to the treatment facility, or c) the storm water line, which directs untreated water back into the river (Spokane Utilities Department, 2017). The fact that the storm water line is untreated is a bit unsettling when considering all of the contaminants easily found on the ground throughout the city. However, this is common practice across the country due to the fact that these systems were installed well before society became environmentally conscious (Benton-Short and DeSousa, 2013). Correcting this problem would be highly complex, in addition to being expensive and time consuming. The Spokane City Utilities Department website does indicate that continued water treatment efforts are being made, especially from an environmental perspective.

Recently in Airway Heights, an adjacent city to Spokane, the water supply became compromised. Chemicals utilized in fire suppression practices at Fairchild Air Force Base were discovered as the source of the contamination. As a result, the City of Spokane supplied water to Airway Heights while their water system was flushed (Francovich, 2017). It took three weeks for the City of Airway Heights to cleanse their water mains. The chemicals responsible for the

contamination have only recently emerged as something that could be potentially harmful to humans by scientists (Francovich, 2017). Currently Spokane has a large enough supply of fresh water to place themselves in a position to help, should an occasion such as this arise. If Spokane's population were large enough to limit the ability to help Airway Heights, what would the solution be then? This most certainly will not be the last time an accident like this transpires. Planning for situations that cannot be anticipated have to be given more consideration. It would be irresponsible not to. As the City of Spokane moves forward with water management planning, it would be wise to remember this situation with Airway Heights.

The biggest consumer of the aquifer in Spokane is residential lawns during the summer months (Maben, 2014). Some residents are willing to leave their sprinkler systems on for multiple hours a day in order to ensure their lawns are well taken care of. This is not the most efficient way to water, but the price of water is low enough that it isn't an issue. This is due to the ample supply of water provided by the aquifer. This high intensity use of water in the summer does not even come close to putting the aquifer at risk of depletion, and that allows consumers to be carefree in their water usage endeavors (Maben, 2014). It also means that water wasted in runoff to the streets or elsewhere is no big deal. That can seem weird to residents that have migrated to Spokane from various locations around the U.S. where water resources are not as abundant and more regulated. All other Spokane water consumption categories like toilets, faucets, laundry, agriculture, and industry are all dwarfed by water utilized for lawn maintenance. Relatively, water use in the winter time drops to annual lows. As a result, the conservation effort in Spokane revolves around watering lawns in the summer time, at peak consumption. The figure below illustrates the dramatic rise in Spokane water consumption during the summer months, as well as provides projections for future water consumption if current trends remain.



SOURCE: Spokane County Water Resources

When analyzing water usage in the entire state, consumption proportionality changes dramatically. Over half of the water in the state is used for agriculture (USGS). This makes sense. Farms are abundant in Central Washington from the outskirts of Spokane all the way to the cascade mountain range. Industrial water use has seen a decrease in use over the years due to increased efficiency – though an efficiency championed by a desire to increase profits, rather than regard for the environment per se. It's important to note the difference between surface water and ground water in terms of consumption. Ground water requires more work to exploit and can take time to replenish. Surface water is more readily available. Most of the irrigation in Washington takes place next to streams in low lying areas because of that (USGS). Both are susceptible to human activities that degrade the environment or utilize natural resources irresponsibly. This becomes interesting when considering how conservation is promoted to urban users versus rural or agricultural users. It seems like conservation should have a better

impact in the areas where water is consumed the most. If increased efficiency can be achieved in the agricultural sector, can the water that is saved as a result then be utilized somewhere else? If so, the next question revolves around how to transport the water to wherever it would need to go. It seems sort of silly to tell urban users to conserve water when they are responsible for about 28% of the water consumed in Washington State, while agriculture is responsible for 53% (USGS). However, given the fact that there just are not many farms that rely on the aquifer for their crop yield, it makes sense. The idea of Spokane officials targeting residential lawn watering for conservation is merely about the peculiarities of this particular location.

The possibility of utilizing reclaimed water seems unappealing. Reclaimed water is just treated wastewater. However, if it is used for irrigation in place of clean freshwater, it could extend water supplies considerably. "Roughly 40% of the water in the U.S. is used for agricultural purposes" (Asano, p.30, 1998). Agriculture is the largest water consuming category not only in in the U.S., but the world. Using reclaimed water would, at least partly, cut down on water stress. "In addition to providing a low cost water resource," to Asano (1998, pg. 30), "the other side benefits include increased crop yields, decreased reliance on chemical fertilizers, and increased protection against frost damage. The EPA has indicated that there have been no documented health problems that stem from the use of recycled water in the agricultural sector."

If reclaimed water is an undesirable solution to scarcity, then what are the other options to the issues associated with population size outside of placing limitations on population numbers and birth rates, or fundamentally rethinking the perpetuation of the capitalist system? No feasible argument can be made in opposition to the idea that eventually, water resources will be stretched so thin that they will not be adequate for the needs of a constantly growing human population (this is already the case in many drought-prone regions in the world, and will only

worsen and include more habited regions in the future barring any substantive corrections from the existing pathway). How far off into the future can these questions be pushed, before society is forced to provide actual answers (rather than delays) to questions of this nature?

Carrying capacity, or maximum population size of a given species, is measured by the ability of an area of land to provide for said species without any degradation to the land's ability to provide for future generations of the same population size (Daily et. al, 1992). Some areas have the ability to provide for larger carrying capacities than others. Once the carrying capacity is breached, the natural resources in that area of land begin to deteriorate and eventually become insufficient to supply for the needs of the population. As contentious as the topic of population dynamics are, this is not a topic of debate among ecologists. The problem with measuring this number for humans, at least on a local scale, is because of human innovations that create new efficient or alternative ways of consuming natural resources (Dice, 1957). This means that the human carrying capacity or maximum population number has continuously shifted throughout history to allow for larger carrying capacities (despite the ever clear detriment this has historically had on the habitats of non-human species).

The preferred method to finding solutions to the population question must materialize in continuous carrying capacity analyses that take human innovation into consideration when identifying contention between resource availability, and the demand for said resource. This idea has a strong association with Malthusian based ideology which states, "This implies a strong and constantly operating check on population from the difficulty of subsistence" (Malthus, p. 5, 1798). Unfortunately, this strategy has not been implemented into future planning as effectively as it should be. This research project aims to rectify this situation by initiating a type of research that explores potential appropriate and responsible courses of

action for population growth and the associated complications based on solutions derived from carrying capacity analysis.

Development and growth are inevitable, especially under capitalism, but they should be conducted with greater awareness of associated impacts. On small Islands, where population density has already reached a level that creates maximum strain on subsistence, more responsible procreation practices have willingly been adopted by society: “This apparently stems from a widespread acceptance amongst these Island populations of the desirability of introducing voluntary constraints on family size” (Findlay, p.165, 2009). This was all accomplished without the implementation of any policy enforcing public adherence. It was simply adopted as socially acceptable in order to preserve quality of life. This is a great idea that doesn’t have to remain confined to island living. Of course, the implication is that things need to get particularly dire before people would willingly endorse such practices. But why does this have to be the case?

There is an automatic negative connotation with the name “Thomas Malthus” due to the fact that he was hostile towards the lower class, was perceived as a pessimist, and his prediction of crisis never came to fruition. But was his prediction wrong or simply too early? And surely the fact that he is still referenced in the modern era means that there was some degree of relevance to his assessment of the circumstances. An even better question though would be: why is every question or concern about population size automatically associated with Thomas Malthus anyway? Is it not possible to have genuine modern inquiry into this topic? Thomas Malthus may have been the first one to make some logical arguments regarding population size, and his solutions (and even understanding of the underlying forces at work) to the “problem” are perceived as wrong and immoral by the majority, and rightly so. However, the more population-related crises (i.e., the California Drought) worsen and grow in occurrence, the more likely

people might be tempted to consider extreme and clearly undesirable "solutions," such as the elimination of some humans to preserve the rest. Indeed, the purpose of more substantively interrogating this issue now is to avoid the moment when less drastic and horrific courses of action are permanently lost. Therefore, for the purpose of this research project, let Malthus' name simply be confined to the fact that he initially raised the issue.

This research does not shy away from confronting the legitimacy of the current capitalist mode of production, resource consumption, ambiguity surrounding the relationship between population and resources, and the survivability of current consumption practices and cultures into the future. There currently is not enough resolve in the literature that takes population size into account, which is why this project is warranted now more than ever before.

David Harvey's take on the population question is interesting. After identifying the fact that terms like "scarcity," "resources," and "subsistence" are socially constructed and therefore malleable in definition, Harvey claims that there are 4 possible ways to address the perceived issue of tension between population size and resource consumption. They are as followed: 1) change the ends we have in mind and alter the social organization of scarcity, 2) change out technical and cultural appraisals of nature, 3) change our views concerning the things to which we are accustomed, or 4) seek to alter our numbers (Harvey, 2010). The words "change" or "alter" were used in every one of those possible solutions. Change is the very thing society wants to avoid, yet will necessarily have to come to terms with likely in the near future. In acknowledging that there must be some degree of change in Harvey's options for a solution, he validates the fact that the current state of the population consumption relationship is in need of review. This research takes the next step in that type of inquiry by analyzing the relationship of a particular resource (water) with population data in order to gain a better understanding of how the relationship works.

When Harvey states, “If we accept a theory of overpopulation and resource scarcity but insist upon keeping the capitalist mode of production intact, then the inevitable results are policies directed toward class or ethnic repression at home and policies of imperialism or neo-imperialism abroad” (Harvey, 2010). The continued growth and expansion required for the survival of capitalism has only benefited the extremely affluent members of society, even in developed countries. It exploits everyone else underneath. Can the affluent members of society survive with less? The rest of society has managed to do so. Plus, what would the current state of scarcity look like if consumption was decreased as a result of the absence of greed by those who benefit at the top of the capitalist pyramid? The question of overpopulation and resource scarcity has to be accepted as legitimate to warrant further inquiry and examination with the highest of priorities. Capitalism cannot be allowed to continue in its current state. It has essentially been unchecked in devouring resources that may not be necessary from the view of subsistence. Even if the current volume of resource consumption is necessary, these resources most certainly have not been evenly distributed, as Marx (1867 [1976]) and Engels (1844 [1993]) so clearly pointed out long ago, and which has only been exacerbated since (see Harvey, 1975, 2010, 2014; Wallerstein, 1974).

Population geography engages with trends in demographic change in particular places and the forces impacting on these trends, but tends to shy away from the broader political and economic questions of population growth and resource consumption and scarcity (e.g., see Castree, et al., 2013). For example, in the journal *Population and Environment*, there were 6 articles written within the last 10 years that specifically deal with the impact of population growth on resource consumption. Indeed, as recent progress reports on population geography in the journal *Progress in Human Geography* have indicated, population geography, broadly speaking, is primarily concerned with other areas of inquiry, such as the contemporary forces of

international migration, population and demographic change in particular places and regions, and human trafficking (Smith, 2017, 2018). Following these recent entries, the population-resource consumption question is currently not on the menu as a prevalent scholarly topic in precisely the area of human geography that one might presume. Such questions, however, are squarely within the purview of political ecology (Robbins, 2012), but have a tendency to be peripheralized in relation to questions concerning the role of "nature" within capitalist production processes, power imbalances, inequality and justice (also see Heynen, et al., 2006; Loftus, 2012). In this context, this study initiates bringing these two bodies of literature into closer dialogues with the objective to more directly and explicitly re-engage with the population-resource question in ways that can shape policy today, in pre-emptive ways rather than waiting until it is too late.

If the population dynamic is acknowledged in research, it is often undervalued. The incorporation of an appropriately weighted population component has to become the new norm. Even the water resource rich area like Spokane, Washington shows annual signs of consumption related stress via low river levels resultant from a high amount of lawn maintenance. If the population in Spokane was smaller, or the cultural practice of lawn watering rethought (see Robbins and Sharp, 2006), as has been the case in more water scarce places like Las Vegas, NV, lawn watering would not have as big of an impact. Nonetheless, there are enough individual lawn waterers in Spokane to have a significant impact.

A good example of insufficient attention to population would be Jonathan W. Bulkley's journal article titled *Global Overview: Water Resources and Distribution Issues (*2000*)*. In this article, Bulkley discusses the issue of water availability based on seasonal variation, water quality, and the impact of local natural landscapes. However, population size was not adequately discussed in Bulkley's analysis. The population dynamic is needed in order to assess

the degree of change in water distribution issues at smaller and larger population sizes. In contrast, articles do exist that address the broader scope of population impact, but they are few and far between. Sarah Postel says, “against this global picture of freshwater availability and future needs is an unsettling reality; in many parts of the world, signs are evident that water use has already reached or exceeded the limits of the renewable water supply” (Postel, p. 133, 2000). The short supply of articles that investigate this type of relationship raises the following question: where is the cross-disciplinary dialogue between political ecologists and demographers (population geographers)? This study hopes to fill in the gaps by asking questions about the limitations of the local water supply in Spokane, WA, and the degree to which different kinds of actors in the local community are aware of those limitations.

Methodology

In order to acquire clear answers the research questions mentioned prior, a mixed methods approach was utilized. This was accomplished by utilizing carrying capacity analysis and GIS on the quantitative side, as well as conducting interviews with water managers and users on the qualitative side. The carrying capacity analysis consists of volume, consumption, and recharge rate data from the 2015 Aquifer Atlas (provided by the Spokane Aquifer Joint Board). Ideally, data would have been used from multiple years instead of just from 2015, but the difficulty of data retrieval places severe limitations on data accessibility. Therefore, data from the most recent year available (2015) was utilized. Population data was acquired from the Washington State Office of Financial Management, and Spokane Valley-Rathdrum Prairie Aquifer data was collected from the United States Geological Survey, Spokane Aquifer Joint Board, and the City of Spokane's water department. The key elements in the quantitative evaluation of water were the current aquifer volume, consumption, and recharge rates.

Ten semi-structured interviews were also conducted, from individuals with varying perspectives (Williams, 2001; Longhurst, 2003; Seidman, 2006). This variation added an interesting dynamic to the data collected for analysis. The perspectives included: religious (Christianity), agriculture, industry, average consumer (non-religious), city planner, county planner, ecology, environment and sustainability, city council member, and city water department. Views of overpopulation, water consumption, and their relationship were taken into account in an attempt to identify how and why certain individuals perceive this issue in the ways that they do. The data was derived in response to the following questions:

- *What are your thoughts on the relationship between population dynamics and natural resource consumption?*

- *How would you define the moment of overpopulation? If we ever had a population problem, what do you suggest we do about it?*
- *To what extent do you think we should be concerned with city management and planning that accounts for future growth and development in terms of resource consumption?*
- *In your opinion, is the idea of development compatible with the idea of conservation, or are they two conflicting ideologies?*
- *How often have you thought about your personal water consumption? Where does that water come from?*
- *How close do you feel we are to a population problem in relation to water consumption?*
- *Water scarcity has become increasingly severe in recent years, especially in the Western United States. Some attribute this, at least in part, to climate change. What are your thoughts on this matter?*

The quantitative data was then analyzed in conjunction with the interview results in order to gain a deeper understanding of the relationship between commonly accepted perceptions regarding water usage and the actual impact of water usage. For instance, different water managers with different water requirements exhibited differing and sometimes contradictory understandings of this relationship (i.e., whether conservation and development are compatible). This component is essential to this research project because it also deals with the governing aspect of water use in that it uncovers where disconnects are present that have not previously been thoroughly identified.

Carrying capacity analysis is rooted in identifying limits to population size. The amount of factors involved in determining an accurate carrying capacity measurement are too numerous for this project. As such, this research isolates water in this analysis due to the gravity of its

importance in sustaining human life. Water resource consumption is used as an indicator for measuring the maximum amount of people that could live comfortably in Spokane, WA. The analysis attempts to recommend a maximum number that, if exceeded, would have negative impacts economically, socially, and even mortally. Climate change was also taken into account by decreasing the amount of available water for use in the future.

There are two types of carrying capacity: 1) biophysical carrying capacity, and 2) social carrying capacity. Biophysical carrying capacity refers to the basic necessities required in order to sustain life. Social carrying capacity refers to the increases in consumption that ultimately result in elevated quality of life. Therefore, social carrying capacity will always be lower than biophysical carrying capacity. This research project will focus on social carrying capacity in an effort to optimize numeric conjecture regarding maximum population sizes in the Spokane-Coeur d'Alene region, which is firmly rooted in developed world consumption practices.

The interview results shed light on the degree to which the impact of water consumption (particularly from population growth) is apparent to some and nonexistent to others, and the underlying reasons for this range of understandings? On the larger scale, to what degree do ideological systems like neoliberalism have to do with the exchange of water in the region? The current state of water affairs in this terrain would suggest that regulation would not be taken kindly if resorted to in the future. The abundance of available water in the region could also facilitate an atmosphere where subtle greed is difficult to detect. The current form of American capitalism thrives in that type of environment. Critical observation of the way water is perceived in Spokane, a water abundant region, provides insight into the kinds of social, political, and economic dynamics that contribute to the varying levels of blindness that people exhibit toward the population-resource conundrum, until crisis is staring us *individually* in the face.

More specifically, the analysis of the interview results follow the method of "critical discourse analysis" (CDA). Following Fairclough (1995, 2000), CDA identifies the various rhetoric, practices, and values, that guide the climate of societal understanding. In this context, for example, interview responses were interpreted as deeply rooted within existing political, economic, and social frameworks. As such, the ideas and worldviews they communicate are reflected in ways that are typically indicative of conditions, ideals, and fears shared in the community (also see Denzin and Lincoln, 1994; Lindlof and Taylor, 2010).

Understanding the big picture in this way sheds light on what actions are necessary as next steps in order to accommodate freedom from policy debate and change for as long as possible. Up to this point in Spokane's history, the "status quo" has not been an issue because there has never been a true crisis in the realm of water distribution. For that reason, the perception is that current water consumption trends in Spokane are perfectly fine. If it truly is fine then there is no problem, at least not immanent, but that conclusion cannot be arrived at beyond a reasonable doubt and perhaps may not be appropriate when considering what we can collectively do now to pre-emptively avert crisis conditions (and the limited and undesirable courses action that might necessarily follow) down the road.

Carrying Capacity Analysis

In the most recent Census (2010), there were 208,916 citizens recorded in Spokane, and 89,755 citizens recorded in Spokane Valley. Each city added roughly 10,000 citizens in 2010, since the previous census in 2000. It's interesting to note that Spokane Valley was never included in the census until 2003 when they finally became their own municipality. The mere fact that Spokane Valley crossed over from county to city governance is a clear indication of population growth. Since the Census is conducted every 10 years, the population information for every year in between is only an estimation. The estimation in Washington State is conducted by the Office of Financial Management (OFM). The current (2017) estimated population size for the city of Spokane is 217,300.

The recharge rate of the Spokane Aquifer is key to understanding the degree of water security enjoyed in Spokane. Once consumption exceeds the recharge rate, overpopulation has been achieved due to the fact that the recharge rate will never again be able to replenish the aquifer to prior levels. At that point, the aquifer will begin to diminish until it is eventually depleted. If it is possible to increase the recharge rate, it then becomes possible for consumption capacity to expand. However, given the current trend in climate change towards warmer temperatures, it follows that such recharge rates are likely to decline in areas becoming drier, such as the western USA. In Spokane, it is then reasonably safe to predict that due to climate change, the recharge rate of Spokane's aquifer is likely to decrease over time, and therefore decrease the overall available water for consumption. As such, it follows that the maximum allowable water consumption quantity, which is principally associated with population size, must remain below a likely declining average recharge rate to account for things like contamination, natural disasters, or anything else that would decrease the amount of

available water for consumption. Because of this need for a buffer, in short, population growth, whether it be from changes in the birth/death rate ratio or immigration, will have to become increasingly managed and incorporated into water planning policy in a manner that accounts for these possibilities.

This project assumes the absence of further technological advances in water usage efficiency. The carrying capacity will be derived from the current consumption rate, measured against the current recharge rate. In theory, this should tell us how much larger of a population the Spokane region could support in terms of potable water from the aquifer before crisis occurs. This will then answer questions about uncertainties regarding future water use by agriculture, municipal, and industrial users. This topic then leads into a series of other highly contentious questions regarding population management, control, policy & enforcement, and development.

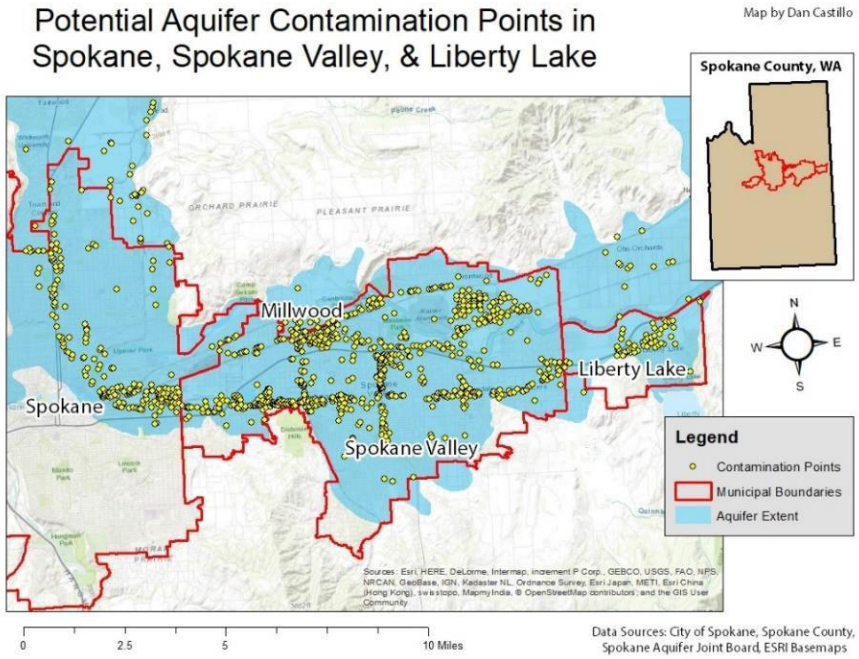
The following statistics were acquired from The Spokane Aquifer Joint Board: The SVRPA currently provides potable water for over 500,000 residents in the local area. The current volume of the SVRP Aquifer is 3,185,000,000,000 gallons, or roughly four times the amount of water in Lake Coeur d'Alene. The annual recharge rate is roughly 237,250,000,000 gallons. The annual consumption level is roughly 74,580,000,000 gallons. Therefore, current annual water consumption, from the aquifer, is roughly 1/3 of the recharge rate.

237,250,000,000 (recharge) ÷ 74,580,000,000 (consumption) = 3.18

The question that water managers in the Spokane/Coeur d'Alene area need to ask themselves is how close they are willing to allow consumption rates to get to recharge rates. If the local population were to double in size, without any improvement in consumption efficiency and assuming no additional degradations to water quality anywhere in the aquifer in the time it takes the population to swell, the consumption rate would also double. That would leave a gap

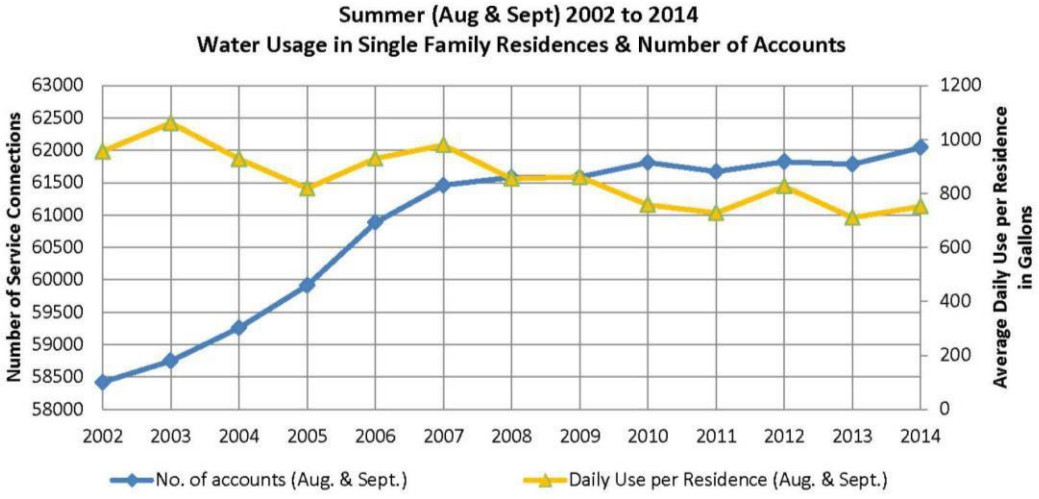
of roughly 1/3 between the consumption and recharge rates, with a population size of roughly one million. Is that enough of a buffer? If so, one million people would be the ideal maximum population size for the Spokane/Coeur d'Alene area in theory. Can further consumption efficiency guarantee that consumption rates will remain non-threatening? Current water consumption is not a concern, but it at what point should it begin to be regularly evaluated in order to prepare for potential future problems – in other words, to prevent the kind of crisis in California happening in Spokane. In this context, preserving an adequate buffer is crucial even though crisis may not (yet) be staring us in the face.

The map below shows all the locations of sites identified as potential contaminant sources affecting groundwater or storm water runoff in the future due to the nature of the activities being conducted at the identified location. It is not difficult to discern that there are quite a few potential contamination points. There are over 1200 locations on this map. The map also does not include any data from Idaho. When contamination occurs, wells have to be shut down, cleaned up, and water has to be temporarily reallocated, all of which can take weeks at a time.



Progress towards higher water consumption efficiency has been achieved in Spokane in recent years. The graph below, courtesy of the City of Spokane Water Department, shows an increase in accounts (population) without an increase in water consumption from 2002 through 2014. The graph focuses on the months of August and September because this is typically the time of year when water consumption is at its maximum.

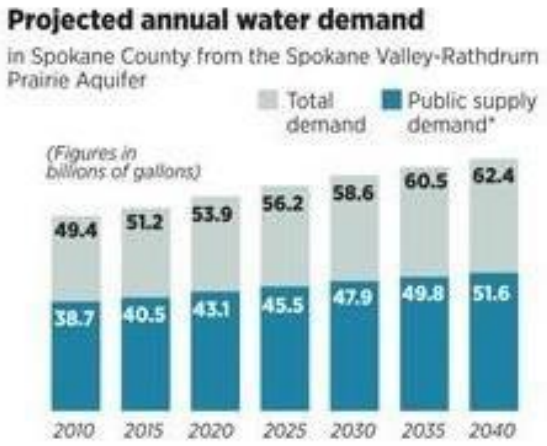
Utilities Business Model



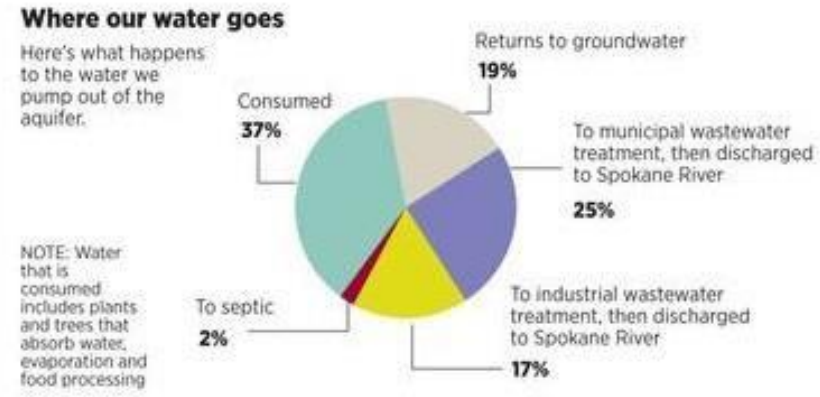
SOURCE: Spokane Water Department

The graph creates a sense of security in the impact of population growth. An increase in consumption efficiency, or even an outright decision on behalf of Spokane residents to do with less water, can be attributed to this reduction in consumption despite the increase in water accounts. However, the graph may be misleading. What is left out is the very reason behind

increasing water consumption efficiency in the first place, which is to ease the human footprint that will eventually result from continued population growth, development, and urbanization. Based on data from the Spokane County Water Resources Department, water demand projections will only increase in the coming years.



SOURCE: Spokane County Water Resources



SOURCE: Spokane County Water Resources

The majority of water pumped from the aquifer is for consumption. Regardless of how efficient Spokane water consumers are able to become, an influx of people ultimately equates to an increase in the demand for potable water. In short, does efficiency mean we are just

kicking the ball further up the hill, only to have to continue doing this in perpetuity? In relation to the phenomenon whereby increasing the lanes of traffic on highways only invites more traffic, Duany (2000) treats this dilemma as akin to attempting to cure obesity by merely loosening the belt. This can be observed on a larger scale as well with energy efficiency, a key objective and one of the more important priorities in the developed world in general. As energy becomes increasingly efficient, the cost of energy will be driven down. As the cost goes down, these new energy efficient practices will become more widespread and more energy will be consumed as a result, assuming current capitalist development trends continue uninterrupted.

Interviews

When it comes to water resources, the city planning department has little to do with the managing and projection aspect. Water resources are managed at the county planning level. Spokane's city planning department focuses more on the city's infrastructure and public services. This planning representative was uncomfortable answering water related questions due to a lack of background knowledge in that area. However, this person did have several other contact recommendations for people who were better experienced in this field.

This planner was confident about the idea of controlled development in the city of Spokane due to the fact that the Growth Management Act sufficiently accounts for population. The Growth Management Act states that "each city and county within the state of Washington is required to have a Comprehensive Plan, which looks at population, land use, transportation systems, utilities, and other various public services." The plan is centralized around preparing for future infrastructure development and restoration. Within this development and restoration planning is where the idea of efficiency improvement is initiated prior to implementation.

This planner was also fairly optimistic about the idea of development being compatible with conservation: "I think they can be really compatible." That was an expected answer from a person who engages with the idea of conservative development on a daily basis. The exact number may not be clear as far as maximum population size for the city of Spokane, but there is certainly still room for growth, following this respondent's testimony. At the planning department, the only concern today regarding water revolves around storm water management, for which there is an entire subsection of planning allocation. On the subject of climate change, there was no disagreement with what recent climate change data suggests, which is that the planet is indeed warming up.

An interview with a county planner revealed much more on the topic of population and water resources in Spokane. Conservation and resource management were understood as elements that required extreme care and attention. Contrary to the city planner, over-consumption was considered a real possibility if managed poorly: “It’s critical. And I think that the municipalities and the local government could do a much better job of identifying resource allocations, particularly along the developed margins” (Spokane County Planner). The term “smart growth” was used when explaining how development should proceed with a conservative mindset, in order to mitigate ecological impact. Growth was seen as something that is inevitable, and that the abundance of water in the local area is going to allow the area to flourish for the time being. That being said, an exact number could not be placed on possible maximum population size for Spokane, but this planner did acknowledge the lack of recognition given to that type of inquiry in the past. According to this planner, population growth has only recently become a relevant topic of review among city officials for incorporation into long term planning: “Up until very recently, very little has been done in terms of planning for population growth. Currently, Spokane uses about half the water it has rights to on paper.”

The population debate is still ongoing. One of the main reasons for disagreement and confusion is the variation in what is being used to measure it. For example, the flow of Spokane River water in cubic feet per second (CFS) varies in different parts of the river and at different times of the year. When considering the needs of some species of fish, the CFS is already too low in some parts of the Spokane River during the late summer months. Interestingly enough, this county planner also noted that “there is not a one to one relationship between increased population and increased water use.” This is due to the variation in water consumption quantities from individual homes.

The business side of water gets interesting when discussing some of the smaller water purveyors from Spokane Valley. Many of these purveyors work with austere budgets, which make them slightly hesitant to partner with the city of Spokane on promoting water conservation. The amounts that purveyors charge for water are limited by the cost of what it takes to provide their services. The motivation to make money works in contrast to the idea of promoting conservation as these purveyors are hampered by the need for acceptable profit margins. Conservation is then forced to take a back seat (unless draconian pricing mechanisms are introduced).

Spokane water reclamation facilities have received criticism from environmental groups for discharging treated water back into the Spokane River, rather than utilizing it in places like wetlands, golf courses, or industry. However, the county planner made it clear that this idea has already been explored: "The abundance of water in the region simply does not allow that to be cost effective. The guys over at the concrete company aren't going to pay me 5.00 per gallon for recycled water, when they can get it for 1.00 per gallon from their own tap." The treated water is not drinkable, but it does meet the state standards for swimming. In the grand scheme of things, following this planner, it does not contribute much to the total amount of water in the Spokane River to begin with:

> "8 million gallons of water a day is released back into the river (from the Spokane Water Reclamation Facility on Trent Ave). That converts to 12 CFS. If we stopped putting water into the river, the gauge downtown wouldn't see it. We're in the noise on the gauge."

A representative from the office of Environment and Sustainability was also interviewed. As somebody from California, this person had an intriguing take on water resources in Spokane. The average citizen in southern California is much more knowledgeable about water

conservation than the average citizen in Spokane, which is reflective of the water conditions associated with each region. Overpopulation for this person was defined as follows: “when a resource is impaired such that future generations don’t have the same opportunities as the current people who live there. That’s the time to begin being very thoughtful about planning for resource use.” This individual also noted that “the city of Spokane does incorporate efficiency and proper allocation of resources into planning. Development is compatible with conservation dependent upon the level of detail in planning.”

According to this representative, Spokane does include population projections into water planning, but that there is need for a culture shift. Spokane is terribly blessed with an abundant supply of water and an extremely clean aquifer, which has led to a situation where nobody worries about this because it’s not an immediately pressing issue, which is arguably the very thing that might lead to problems down the road. Lawn watering in the summer is rampant, and is the largest water consuming activity in Spokane. The representative expressed concern with the time it takes to bring about culture change to a more conservative mindset, when it has not been necessary in the past. There was also an expression that climate change is something that needs to be incorporated into future resource estimations. The respondent stated:

> “Over allocation and climate change are the two biggest issues for water in the west. The biggest reservoir in the Sierra is the Sierra snowpack. As the snowpack rises in elevation, and it melts earlier, then it’s not stored there for summer use. As the climate shifts, it’s going to change the timing of water, which is most important in terms of agriculture and when peak irrigation occurs.”

Following a Spokane Water Department representative, “there has to be a balance to the amount of growth that the environment can sustain, however all human activity does impact the environment at some point.” There are many variables to measuring water consumption, which makes it difficult to evaluate. For the Spokane Water Department, this representative noted that overpopulation would occur if their water rights ever became insufficient for the needs of the city. The Spokane Water Department is the primary authority on the water in the city comprehensive plan. Before their water plan is accepted into the comprehensive plan, all of the other water districts have a chance to look them over and voice concerns prior to final approval by the state. The comprehensive plan then moves up to the state for final approval. The State Department of Health regulates the drinking water quality of all water purveyors in the county while the Department of Ecology is in charge of maintaining natural water quality.

For this respondent, development and conservation were believed to be both compatible and contradictory. “To a certain point they are compatible, but overwhelmingly they become conflicting. The very fact that you exist on the earth cannot equate to zero impact.” This respondent was not necessarily supportive of development, but did indicate how development may contribute to conservation in some cases by stating, “on the flip side of that, if you can’t allow any form of development, that impacts the funds that can be gathered in order to help fund environmental cleanup and environmental projects.” The current water supply has to be firmly protected, and a buffer between water usage and available supply must be maintained:

> “We sit in a very good area for domestic water. We have an abundance of available water. That doesn’t mean we should squander that resource. There could be an environmental mishap. There could be a major spill that contaminates our aquifer and now we’re out trying to find other sources of water. You always have to protect what we do have”

Water management in Spokane does not just revolve around managing the aquifer itself. Instead, it is charged with managing how much water is allowed to be consumed on paper. Spokane cannot dictate physical changes to the aquifer:

> "There are upstream and downstream users in different states and even countries (Canada), which prevent anyone from acquiring too much control. The real challenge is trying to strike a balance between conservation, allocation equality, and economic gain."

In terms of growth and development, this water manager felt like Spokane would run out of developable land before running out of water. Therefore, water consumption, according to this individual, should not be an issue in the future: "I don't foresee that we have enough land to develop that would exceed the amount of water rights that we have." The science behind climate change was interpreted as something that is still uncertain and should not yet be a factor in future water availability assessment.

A representative from the Department of Ecology felt that a cultural shift in society had already begun to influence the way water is consumed in Spokane. This respondent felt that more people are interested in urban living than previous generations, which will result in "increase[d] population density, but not necessarily … with a substantial increase on water consumption due to the absence of lawn care." However, whether it's large or small, an increase is still an increase. This respondent also noted that the ecology department feels like there may be room for population growth in Spokane, but also asserted the following:

> "We're already at the environmental question of, where is the balance? Can we continue on with consumption efficiency, and how much further will that get us? And that is what cities are currently planning for right now."

If the city does grow, suburban sprawl will most likely have negative consequences associated with a substantial increase in water consumption. In addition, sharing water fairly and equally, and determining the best way to go about it, will add pressure in planning processes. This respondent was also fairly optimistic about the relationship between conservation and development, noting that the advancement in construction and engineering technologies have decreased the impact of resource consumption substantially in the 21st century. The respondent stated:

> "I weigh higher on the idea that conservation does not conflict with development, because especially when you talk about new development, no matter what the scale is, technology is getting better. So you really get a smaller quantity of water being used, compared to something in 1950 that would've consumed a significantly larger portion."

Something noteworthy mentioned during this particular interview was the seasonal fluctuation of river water during the year. It is in August and September that the Spokane River experiences low flows. This already lower flow is exacerbated by lawn care during the summer months as mentioned before. This means that the aquifer is being utilized to water lawns rather than replenish the river level, which would be preferable for local aquatic life. Average low flow in the Spokane River is not currently used as a measurement for the ideal maximum placed on water consumption, but that may need reconsideration if water conservation is given higher priority in the future.

The respondent from the Department of Ecology did acknowledge the reality of water as a business, and that it is, in this context, contradictory to the idea of conservation. There is also a difference between the water rights on paper, and the water being consumed. Right now, Spokane has the legal right to twice as much water as it consumes, because, as this respondent

stated, “in Washington State, municipal water providers are the only ones that are afforded the ability to hold onto rights to use water. Farmers in Washington have a use-or-lose-it policy.” In other words, after 5 years, the rights to all unused water must be given back to the state. Of course, given the carrying capacity analysis presented in the previous section (there’s enough water for twice the population), to what extent is the volume allocated to Spokane on paper appropriate with respect to this dilemma?

“The river and the aquifer are really one body of water.” This point of view is not standard in the local community. Interestingly enough, the recharge rate of the aquifer “could be supplemented by water from Lake Pend Oreille if needed.” However, that operation, I was told, is not necessary at the moment. And lastly, climate change is something that does need to be incorporated into future calculations. The respondent stated:

> “I do (agree that climate change has had a substantial impact on water stress in California), but I would add some comparisons between Washington and California. Washington has an incredibly strong groundwater code from 1945. They recognized that groundwater and surface water are connected. We need to make sure that we’re protecting both uses. I think that’s one of the minor differences between us and California. But even though we have this strong law that protects it, we are seeing impacts in some basins where the amount of groundwater is becoming insufficient compared to the paper water rights.”

In an interview with a farmer from green Bluff, in contradistinction from government officials, visibility of the closest neighbor can be interpreted as overpopulation. The preference for a rural lifestyle has its own pros and cons, and there’s an appreciation for the separate city and county planning levels due to the difference in community accommodations and government

involvement. Most of the rural community appreciates the quiet, less busy lifestyle and they want to keep it that way. To these stakeholders, development is perceived as a direct threat to their way of life. For this reason among others, development and conservation were interpreted as incompatible among those that were interviewed.

Currently in Green Bluff, there is a ten acre minimum per household. Every so often there is zoning debate, primarily between those who want to develop and those who do not, and about how many homes can be built per unit of land. This is a great example of the contentious nature of development in more rural, less populated regions. Spokane has also attempted to acquire ownership of water management in Green Bluff, but has so far been unsuccessful.

The water in Green Bluff initially comes from the Whitworth water district, and then is managed by a private company in Green Bluff. As one agricultural representative noted, "the residents are allowed to use a rationed amount of water per day. Anyone who goes over their allotment, is fined double what a city resident would get fined. And that is self-imposed by the community." Some people use more water on purpose because they know the extra money goes toward keeping the water system running.

A micro-drip system allows crop irrigation at a rate of one gallon per hour. This allows Green Bluff farmers who utilize this style of irrigation to target specific locations (where plant roots are), while supplying an adequate amount of water to each plant with minimal or no waste water. It also helps each farmer stay within their water rations for the day. This scenario limits the type of crops that are grown in Green Bluff to anything that can grow within the margins of allotted water. If there was ever a drought, agricultural water use is first in line to be cut off. Despite mass agricultural practices in Green Bluff, they are categorized as a residential water sector, whereas Deer Park is categorized as an agricultural water sector. Climate change was

acknowledged to an extent by this respondent. When referencing water stressed conditions in California, the farmer from Green Bluff felt like southern California had exceeded the human carrying capacity of the natural area. The farmer stated:

> "I would have to say it has to do a little with climate change but if you're talking about California, they didn't plan it out from the beginning right. They populated where there was no water and thought they could just bring it in. The aqueduct they built in the 50's and 60's set the limit for how many people they could handle and they're already past it."

Industrial water usage is continuously becoming more efficient. The emphasis behind efficiency promotion comes from the desire to decrease costs in order stay ahead or on pace with competitors. Therefore, the motivation comes from a strictly financial basis. As one respondent noted, "how do you do more with less? Because those are typically the ways you gain advantages in consumption" (Metal Manufacturing Industrial Representative). The population dynamic is not a direct factor in the production of goods. As, such, a maximum number for population in Spokane was not discussed. When addressing production demand, the response was "it will get made somewhere," which was highly indicative of the focus on competition. Competition seemed to be the primary lens with which industry perceives the relationship between consumption and production. Development was interpreted to be compatible with conservation due to the competitive nature of industry in a free market, in which innovation and efficiency are embedded in order to stay ahead of the curve. The use of recycled materials made the industrial representative less concerned about future resource availability: "As long as you're not throwing it away, there's no need to be concerned with acquiring more materials."

Environmental concerns typically follows after scrutiny by the environmentally conscious or the implementation of federal or state regulations. For example, in order to maintain certain water temperatures in the river for various types of fish, this respondent's company has established a way to discharge water utilized by industry back into the ground instead of the river. That way, the aquifer is able to cool the discharged water back down to a suitable temperature before it has the possibility of entering back into the river. Not surprisingly, climate change seems to be still open for debate according to the industrial representative. This person has not seen much in terms of climate change data, but suggested that, "some of it may be alarming, but some of it really isn't."

As expected, the average consumer in Spokane is not as knowledgeable or concerned about water resources and consumption. At the moment, they have no immediate reason to be, and what's in the immediate future is typically where most people's horizon is set. Most of the interview responses were concise and without supporting evidence. Low water prices enable the average consumer to use water with modest regard for quantity, as one respondent noted: "I guess I don't really think about the water when I turn it on. I have three kids but I can always pay my water bill." Even though maximum population size in Spokane appears to be unclear, concerns regarding population growth were minimal at best: "To be honest, I don't really think about it." Population related issues are not as immediate, especially when compared to the instant gratification the average consumer experiences through material or informational acquisition consistent with a capitalist society.

Purchasing recycled goods seems to have positive connotations and has a decent presence in the market, but seems to do little beyond that in terms of altering the average consumer's sensitivity to resource related uncertainties, at least as reflected by the individuals interviewed for this study. There also appears to be a slight interest in increasing consumption efficiency

(energy for example), but the primary motivation stems from the desire to lighten the financial burden from monthly bills: “If it’ll save me some money, it seems like a no brainer.”

The average consumer seemed to be less familiar, but ultimately more comfortable with the idea of conservation not being compatible with development. On a fundamental level, the intrinsic values associated with conservation and development are indeed incompatible. Perhaps this is, ironically, more apparent for those living and working outside the purview of city management and planning, where efficient and sustainable practices are directly employed. Based on those interviewed, the average consumer is also fairly confident in city management in terms of resource consumption management: “I feel good about what the city is doing to make resources available for everyone.” This confidence in management by city officials may explain the absence of concern by everyday water users. i.e., we don’t need to worry about it because those in charge have the situation under control. Consequently, the average consumer then remains unaware and continues on with daily life as if nothing is wrong (until it is immediately problematic in their life).

From the Christian perspective, the idea of governing population size seems to be highly contradictory with what the bible says, which is, “go forth and multiply.” Christians typically have no fear of procreation and population growth because of the belief that all lives are created with purpose. This is reflected in Christian opposition to abortion of any kind. Some even go so far as opposing the use of any sort of contraceptive for the purposes of family planning. Any sort of policy that limits procreation would also likely be opposed by some denominations of Christianity, population groups whose attitudes about this question should not be discounted, as Christianity remains a category that the majority of the population in the U.S. identifies with. Christians believe that god has a larger plan that humans cannot fully understand and will ultimately facilitate solutions to population related problems. These

solutions manifest in things like the advancement of technology and human innovation, but are ultimately believed to be the will of god. In this way, development and growth have to be compatible with conservation.

For one respondent, the relationship between population size and resource consumption was acknowledged, however, this particular individual felt that god would intervene before allowing that relationship to cause profound negative impact. Christians feel like the concepts of overpopulation and overconsumption do not align with their expectations for the end of humanity, as this respondent noted: “from a biblical perspective, the story ends differently than the entire earth running out of water or something like that.” Therefore, maximum population size in Spokane was nowhere on the radar in this worldview. Similar to the average consumer, there is comfort in feeling like someone else has everything under control. The bible does indicate that god commanded his followers to take care of the planet. Therefore, recycling and conservation are supported in the Christian community, but water usage in Spokane is likely not among Christian concerns. The idea of climate change seemed to be open for discussion and debate, but again not associated with future resource complications.

The perspective exhibited by a city council member seemed to be a bit more neutral in regard to the topic of population and resources. According to this respondent, “overpopulation occurs when the resources that people are accustomed to, or access to a variety of goods, becomes limited to the point where some can’t access clean water and safe food.” Technology is seen as an acceptable means for introducing new, more efficient ways of conducting resource extraction. The importance of the Spokane Aquifer has recently become even more significant given recent circumstances related to the latest contamination of the Airway Heights water supply:

> "We had an agreement with them, and so we have been basically supplying the water to that community. Now they're hoping to use some technology to clean the contamination, but that is going to take years. But I think this issue has really raised the awareness at the city of Spokane about how important protecting our well sites are."

For this respondent, conservation was understood to be compatible with development, depending on the style of development practice, "I think it depends on how you develop, and the technologies you have in place to minimize environmental impact." Modern development seems to be more environmentally aware. The feeling about water consumption in Spokane was quite optimistic due to a slight decrease in overall consumption, despite an increase in water accounts. Because of this, population growth was seen as something that Spokane has plenty of room for: "We want to see population grow in Spokane. We have capacity within our city. We have a lot of space." Reflecting "growth machine" politics (Jonas and Wilson, 1999), this embrace of growth is not surprising, considering its role in underpinning enhanced revenue streams for the city government. The idea of population growth was also considered less a burden on resource consumption when the emphasis of growth is placed on infill and increased population density. Building upon existing infrastructure equates to more people in a condensed area but costs less, reduces suburban sprawl, and does not add to outdoor watering consumption.

Agricultural and municipal water purveyors operate by a different set of standards and regulations with the municipal being more rigid:

> "Spokane Valley use to be a bunch of farms. But then in the 50's, 60's the Valley began to suburbanize. Now you actually have a city. So in the Valley it's very complicated because there's probably like 10 or 12 purveyors of water, and many of them started as

> agricultural purveyors. Now they've turned into purveyors of almost urban like services, and it's caused some issues. In some of these areas they don't even meter."

The politics in water management are guided by paper rights, but also by the necessity to have somewhat of a reserve:

> "Providing excess water to outside communities when they struggle is a priority, but agreements with these communities have to include parameters. If the Spokane River is experiencing low flow, Spokane has to reserve the right to say no to the agreement in order to preserve water for its own citizens."

Climate change was interpreted as something that needs to receive adequate consideration as well: "Oh I believe strongly that we're starting to see a lot of ecological changes and trends due to climate change. And it's being experienced differently in different regions."

Analysis and Discussion

The interview responses revealed interesting relationships to current water and population statistics in Spokane. Each person that provided responses understood that water is a crucial part of human existence, but had varying degrees of concern. Water managers were typically more knowledgeable than non-water managers and had more to offer in terms of justifying their responses. The complexity of water relationships and public perception is deeper than originally anticipated. All participants insinuated wanting to respect the balance between natural resources and human impact on resource extraction. However, there were differences on what their definitions of that balance meant.

The water carrying capacity for humans in Spokane is highly ambiguous. There is room for growth, but there was no consensus on how much. Growth is accepted as something that will happen regardless, which guides the overall attitude about growth towards the optimal way to deal with it, rather than identifying growth as part of the problem. Spokane has grown by roughly one or two thousand people annually since the 1970s. Before carrying capacity can be assessed in Spokane, an agreement among city officials will have to be reached regarding the appropriate way to go about measuring it. This has only begun to occur recently, although water and population projections are incorporated into county planning. Assessing city carrying capacity is still looming and will need to be conducted in order to enhance the survivability of future generations.

At present there are not many concerns regarding current and future water use in Spokane. However, there was mention of improper or over usage of water for lawn maintenance, tension between promoting the idea of water conservation, the business of selling water, and public disposition on water resources. Indeed, there needs to be a balance between not only resource

consumption and ecological impact, but development, economic influence, resource allocation, and population growth as well. Too often these components are not observed as part of not only a larger, inter-connected Spokane region, but world system as well.

There were a mix of answers regarding the relationship between development and conservation. There was a general understanding that these two concepts are oppositional at a core level, but even a few water managers were somewhat optimistic about them being increasingly compatible in the modern era. Increased efficiency may decrease the ecological impact of new development (allowing for that and more development), but any additional development adds to the overall sum of ecological impact, regardless if the impact is small or large, which is, again, akin to treating obesity by merely loosening the belt.

In general, population growth in Spokane was clearly not an issue for both water managers and consumers. Population growth has not had a significant effect on anything accept maybe slightly tougher competition in the job market. The topic of population is typically absent from social media, news, pop culture, and everything else constantly being bombarded at citizens in an effort to facilitate consumption. If people are relentlessly being conditioned to consume under the current capitalist mode of production, it follows that knowledge and awareness of the population-resource relation runs counter to this basic capitalist necessity, possibly rendering it even a threat to the system's necessary reproduction on ever expanding scales.

Water managers appear to be interested in increasing usage efficiency for future development and ecological well-being. Consumers, on the other hand, seem to be more concerned with matters unrelated to water. Consumers are confident that the city has everything under control. The possibility of policies that may limit water use in the future are nonexistent, at least at the moment. Residing in an ideal location for water resources can make

it easy for the everyday user to take water for granted. Water managers understand that recent increases in efficiency have lowered the burden on resource consumption in recent years. They may be relying on this idea too heavily. As far as consumers are considered, who are preoccupied with the complexities of daily life, comprehension of the relationship between population size and resource consumption is not a priority.

Development and conservation conflict with each other because development (along with the population and resource consumption realities it implies) is the very reason for why conservation has become increasingly important. Conservation is about ensuring future uses of particular resources in an undiminished capacity, to counter the very ills generated by development. To achieve "conservation," the idea of using less is promoted to increase consumption efficiency in ways that are supposedly "sustainable." But a paradox is generated when whatever is saved through conservation is then reallocated for further development (Anderson, et al., 2016). Both water managers and consumers alike seem to reject this concept as something that requires serious re-evaluation from a critical point of view. When development continues to unfold after conservation efforts have been made, conservation then becomes a constant necessity, to perpetually be conserving more and more and more, generating greater and greater efficiency. In short, continued progressive conservation becomes a permanent feature of modern society just to preserve the buffer (between sustainable conditions and over-consumption) that is relentlessly attacked to the extent that development continues to progress as well.

The geopolitics of water in Spokane add yet another dimension in water relationships. The city of Spokane has the legal rights to twice as much water than it currently consumes. The specific amount Spokane was granted on paper appears to have been decided somewhat arbitrarily and without proper supporting ecological research. That being said, in recent years,

Spokane city officials have finally begun to incorporate an element of environmental awareness into city planning. Yet, the dangers of population growth, which are intimately tied to environmental limitations, have yet to surface in any way that warrants attention. It seems that population concerns are still relatively new, and therefore, somewhat uncharted. One area where the population question has more substantively emerged is in relation to economics. The tension between the environment and the economy hinders the progress of conservation when the small water purveyors in the Spokane Valley remain profit oriented, in place of conservation promotion, another manifestation of the inherent contradiction between profit-driven development and conservation.

Water managers dependent upon the same watersheds do hold regular discussions regarding usage and consumption. This facilitates various stakeholder meetings and agreements that ensure water consumption equality and, to an extent, conservation. The allocation of water will no doubt continue to remain at the center of debate and contention in these kinds of planning processes as the local population grows, and less water is forced to be divided among more and more consumers. But for now, efficiency is the strategy commonly embraced by planners and resource managers. Although well intentioned, it ultimately fails to acknowledge that efficiency is a temporary solution to a growing problem. Efficiency cannot be relied upon forever. There is an absolute limit to how much water can be conserved, as people, of course, require a certain amount of it to survive on a fundamental level.

"Sustainability," as the term is so readily utilized today, may be the answer to balance between consumption and conservation. But does the greed inherent within the capitalist political-economic system (particularly in the global north) allow this objective to be met? Sustainable consumption, within the scope of this project, is only possible when the impact on natural resource consumption does not cause a resource further deterioration than has already

been sustained by past and current consumption practices, which is not consistent with how capitalist economies function, as systems based on perpetual growth in production and consumption. Before true sustainability can be attained, a balance must be reached between growth and consumption, and realistic objectives have to be set.

The Washington State Growth Management Act (GMA) mandates that "fast growing cities and counties" in the state of Washington must develop comprehensive plans that takes natural resource consumption and population growth into account. As McCaskill (2017) notes, "The comprehensive plan is implemented through capital investment and development regulations." This act was a response to mounting concerns around unplanned growth and the related environmental and economic implications by Washington State legislature. The GMA has set a great example for other states to follow in the field of growth management (Terplan, 2017). California does not have a GMA, but has gained a new perspective in terms of social class equality in development as a result.

As of Jan 18, 2018, Washington State has a new law, based on a decision by the Washington State Supreme Court in 2016, devoted to streamflow restoration (D.O.E., 2018). In 2016, the court found Whatcom County non-compliant in upholding GMA requirements designed to maintain a minimum amount of water in nearby streams. This is commonly referred to as the "Hirst Decision." This decision "changed how counties decide to approve or deny building permits that use wells for a water source" (D.O.E., 2018). The primary issue in this scenario is that too many wells in a given location can have a significant impact on water levels in nearby streams. There has to be a certain amount, or minimum, of water in order to maintain a healthy habitat for fish and other wildlife. This new law will dictate when a water level in an individual stream requires a temporary reduction in water allocation in order to maintain streamflow integrity.

The Spokane County Comprehensive Plan lays out clear objectives for the aquifer and how to go about achieving each one. Those objectives include: “aquifer degradation prevention, development impact prevention, ensuring adequate water quantities for Spokane residents, providing public information, regulation enforcement, and the protection of critical aquifer recharge areas” (Spokane County Planning, 2012). Each objective is followed by a list of policies that support objective achievement. However, given the map showing potential points of contamination in Spokane, some comprehensive policies may prove ineffective. The comprehensive plan at the city level says there will be a “focus on moving land use activities that have the potential for groundwater pollution away from being over the aquifer” (Spokane City Planning, 2017). Storm water, which also has potential to contaminate ground water, has recently been addressed with the installation of an updated storm water drainage system, but it ultimately leads back into the river. Some storm water is treated prior to re-entry into the river and some is not.

The idea of water conservation is included at the city level, but more data needs to be collected by local scientists in order to refine existing water policy. For example, under water conservation the city comprehensive plan states, “Prudent use of water should be practiced until more is known about the capacity of the aquifer” (Spokane City Planning, 2017). At present, there is no policy that forces or incentivizes consumers to use less water. Ideally, a policy will not be necessary. Regardless, there does appear to be some degree of disconnect between the water manager world and the non-water manager world. The water manger world is aware of the benefits of conservation, while the non-water manager world is not. Although there are policies in place that support objectives to sustain aquifer integrity and consumption for years to come, the effect on the current water scenario in Spokane does not appear to be optimal. Is it possible that the text on water conservation in the comprehensive plan has created

a somewhat false comfort in having good intentions, without the appropriate actions to match? Or is the non-water manager world in need of a realty update? Spokane citizens must be made aware of the impact that current water consumption trends have on local ecology. “Prudent” water use does not exist in Spokane at the moment. If the general public is not aware of the actual risks involved with possible water shortages, they are likely to consume in a manner that underestimates the impact of water scarcity (Blanchard-Boehm, 2008).

The compromise of a natural resource that is integral to the survival of society has to be prevented at all cost. During 1845-1849, Ireland experienced one of the worst famines in history, often referred to as the *Irish Potato Famine*. As Mokyr (2017) notes, “by the 1840s, potatoes had become a key part of the national diet due to their high crop yield, low cost, and high caloric value. Unfortunately, farmers had become less diverse in the genetic variety of potatoes grown, in favor of the few highest producing ones.”. This made potato crops vulnerable to disease. A wide genetic variety helps to defend against the spread of crop blight. “In 1845, a strain of Phytophthora arrived accidentally from North America” (Mokyr, 2017), which led to devastating crop failures.

This degradation in potato crops caused local food supplies to be insufficient for the needs of the entire Irish population. Many died of hunger as a result. Others were malnourished and struggled to fight off illness, which also lead to death. Typhus played a significant role in that regard. Some cornmeal and other supplies were imported from neighboring countries, but it was not a substantial amount. The lower social classes suffered more severely than the upper. Nearly one million (one eighth of Ireland’s population) people died as a result of the famine. The economy, in which the potato was a major factor, suffered as well.

Present-day population related problems present issues that cannot be solved easily. And raising the issue of population typically gives the elite class an excuse to enact policies against the poor. That is the danger with Malthusian influenced ideas. During the potato famine, for instance, England ultimately provided very little aid to Ireland, drawing on Malthus as a justification, as Ireland was supposedly "overpopulated." In this way, Malthusian ideas have a way of supporting and justifying the class-biased politics of rejecting pro-welfare policies and practices, a mode of rationality that continues to be invoked in support of such decisions today (i.e., the neoliberal retrenchment of social welfare programs and policies). However, this project urges the acute awareness of falling into this kind of politics, and is about conservation and resource protection for the current population of the planet, which includes everyone. Water may not be vulnerable to blight, but it is vulnerable to contamination. The aquifer also should be consumed at a quantity that does not flirt with the carrying capacity threshold.

The best tool for measuring Spokane's human carrying capacity is still up for debate. This project uses the recharge rate as a measuring tool but does not assume that it is the best approach. Consensus must be reached on the best local measuring unit based on the characteristics of the surrounding natural area. One possible approach might be to consider carrying capacity for all living creatures that affect and are affected by human lifestyles and activities. Currently the Redband Trout is struggling to maintain its population in the Spokane River. The Redband population has significantly declined over the past few decades (Gerber, 2017). This is due to heavy impact from human activities and consumption (Gerber, 2017). If the Redband Trout and other wildlife in the river are to be maintained, there is clearly no more room for growth in human impact and consumption until the Redband Trout population recovery occurs. In this context alone, water is already over-allocated in Spokane, perhaps not for humans directly, but for other living organisms with which we share the environment.

Within the people interviewed, there is a small degree of societal concern for river wildlife; the needs of the local human population clearly outweigh the needs of the fish for most people. This disregard for wildlife in the river suggests a subtle, subconscious placement of the human species above all others. Human hubris achieves new heights in this way. Analysis of carrying capacity estimation, based on the local water supply, has to account for all living organisms that rely on it. Wildlife endangerment is not a new concept, however it continuously receives inadequate attention. The endangerment stems from the much deeper issue of population growth and the associated impact from resource consumption. More light needs to be shined on the fact that humans are not the sole consumers of natural resources, and in fact share the planet with myriad other life forms. If high summer water consumption were to be mitigated, would it replenish the Spokane River to an acceptable level that would not only be suitable for fish, but also allow continued human population growth without posing further threat to preferred water levels of river wildlife? Perhaps, to a certain point. But this resolution could only exist after a notable shift in public attitude towards water conservation, which has not yet occurred. It would be further interesting to examine the extent to which this relative refusal to acknowledge population growth as a problem in society is reflected in the scientific community as well.

Another intriguing topic related to population growth comes from advancements in agricultural technology. Advancements in agricultural practices had to be made in order to keep up with rising food demand emanating from population growth (Carr, 2009). Unfortunately, many of these new practices had to be implemented before the full extent of their potential impacts could be realized. Celiacs disease, among other malabsorption related diseases, have only recently come into existence while the origins remain unclear. Is it possible that these stomach related issues stem from the advancement in certain agricultural practices? According

to Dr. Stephanie Seneff, a senior research scientist at the Massachusetts Institute of Technology (MIT), Glyphosate could be to blame for the disease. Glyphosate is an ingredient commonly found in herbicides used in modern agriculture, and is used "just before the harvesting of many of the non-organic wheat crops, in order to reduce the amount of residue that needs to be cleared" (Seneff, 2014). The use of glyphosate cuts down on the amount of crop lost to sorting out usable and non-usable product during the harvest. The maximization of crop yields stems from the heavy demand placed upon it by growing population size. Unfortunately, the use of glyphosate to aid in crop yield maximization, may prove to have unforeseen consequences. If this theory proves to be true, it would be solid evidence that population growth could easily grow beyond the means of what human innovation and technology can remedy (akin to a wizard that's lost control of their wand), and that humans need to slow down and gain a firm grasp on the full extent of what the current level of population growth means.

Conclusion

Results and definitive answers on this subject are difficult to come by. The impacts of population growth on the natural environment have to be further mitigated. And mitigation has to be accomplished before this situation swells too large to address without suffering on a massive scale. The responsibility for accomplishing this task falls on society as a whole. Mitigation can be achieved, but it requires a reconstruction of societal values in favor of substantive sustainable living (which necessitates much more transformative action than merely sustaining business as usual). Therefore, a cultural shift is needed in Spokane in an effort to reconcile ecological tension.

Falling in line with Harvey's (2010) recommendation to move away from the current model of capitalism, the principles of "Degrowth" (which promote ecological economics, as well as opposition to consumerism and capitalist values), offer a viable blueprint for society to utilize in an effort to embrace a more practical way of life (Mastini, 2017; Alexander, 2018). Sustainable consumption practices are encouraged in an effort to minimize human consumption impact, which tends to have negative connotations initially. However, degrowth does not equate to large scale sacrifice or decrease individual well-being. Individual morale does not necessarily have to be tied to the accumulation of wealth, as we have been conditioned to presume via capitalist propaganda. Rather, degrowth encourages devoting more time and energy to the arts, family, nature, and community (Mastini, 2017). Are we not a society that lives for the weekends? A society constructed under the degrowth paradigm devotes more time to activities outside of one's occupation, which, in theory, promote an increase in morale. Degrowth offers a way to refocus human energy away from the hegemonic centered benefit, and decreases middle

class reliance on economic prosperity (Mastini, 2017). In short, if not to fuel the capitalist system, why precisely do we need growth?

Some Spokane water managers also indicated that a shift in culture is needed, and there's no reason it couldn't be mobilized in the manner of degrowth principles. These ideas have certain affinities with other alternative models for organizing society, such as the kind of "democracy at the work place" advocated by Wolff (2012; also see Harvey, 2014) based on the Mondragon Corporation in Spain. Here, the workers collectively own and manage the corporation, and collectively vote on wages, who to hire as the managers (and what they should be paid), what to produce, and what to do with the corporation's collective profit. To Wolff (2012), a "shared sacrifice" system tends to mark such productive enterprises where all the undesirable tasks are shared on a rotating basis so that everybody is freed-up to pursue the jobs in the corporation that are most fulfilling to them individually (rather than necessarily the most productive of surplus value). Moreover, if any one productive unit proves unprofitable, those workers are absorbed elsewhere in the corporation rather than being laid off.

There's a long history of these kinds of non-capitalist modes of organizing society, with many hopeful and even successful examples in the world today (Wolff, 2012). This idea, which is fundamentally based extended democracy into the economic realm, could potentially garner considerable support in a country like the US, where democracy represents an American ideal. I could also be mobilized in the name of enhancing human fulfillment and stimulating the creative potential that arguably resides in each of us, rather than a system that subordinates these values to the tune of maximizing profit for a select few at everybody else's expense (and the necessary growth in production and consumption that this system implies). It would also not take too much effort to meld these ideas with the principles of degrowth.

To some degree, a shift in agricultural water consumption culture has already been initiated through the implementation of the "no till" strategy. Instead of turning over the soil to prepare a seed bed, farmers place seeds directly into the ground with specialized drill (Kramer, 2016). This leaves weeds and other stubble in place which "acts like a mulch, shading the plant and keeping the soil cool and moist (Kramer, 2016). Such practices could certainly be articulated and promoted within the broader context of a cultural shift toward degrowth.

In addition, Spokane residents must learn to water their lawns more effectively (or replace lawns with a landscape that does not require watering). Watering in the middle of the day, when it is hot and most of the water is lost to evaporation, is a complete waste of time. Lawn watering is most effective during the hours when the sun is not visible. That being said, most front lawns are purely aesthetic to begin with. How many people actually use their front lawns for activities, much less survival? The back yard is where most of society conducts outdoor activities in favor of privacy. Therefore, why not better encourage alternative front of house aesthetic styles such as rock gardens or added pavement for more parking? Asserting this type of alternative will no doubt be received reluctantly by the public, but this is the type of culture shift that is necessary in order to achieve conservation objectives that can have real impacts. If water consumption stress in the summer was reduced, it would aid in Redband Trout recovery as well as secure a vital natural resource for many more years to come.

The capitalist effect on global, regional, and local economies has to be placed into a realm with limitations. The endless growth that capitalism requires to operate effectively, if allowed to continue, is based on consumption growth so large that humans will ultimately facilitate their own demise at some undetermined future date (Harvey, 2014). Capitalism has to be entirely reconstructed in order to figure out how to stabilize itself without a continuous goal of increasing profit margins in the name of endless accumulation of capital. Up to this point in

history, humans have struggled to realize when enough is enough. If that point in resource consumption has not yet occurred, and there are plenty of arguments to support that it has, then it is surely not far off. If capitalism cannot abide by this new paradigm then it must be jettisoned in favor of a new, evolved economic strategy without relying on forever growth in resource consumption in order to survive. The capitalist mode of production strikes a direct tension with the notion of conservation. As it manifested in small scale water purveyor businesses in Spokane Valley, capitalism undermines any progress towards conservative objectives through the necessitation of profit generation in order to maintain itself – conservation simply allows the system to continually plough forward indefinitely, to overcome the resource barriers it invariably confronts. Perhaps if all of the small water purveyors in Spokane Valley combined to become one sole water Purveyor for the entire city, or worked together within a broader collective unit (see Wolff, 2012), the reliance on profit would decrease enough in order to allow room for conservation.

There are policies in place now intended to secure aquifer integrity. It is hard to conceive of a policy that governs population size that is not fraught with considerable political and moral problems. However, whether we like it or not, we may be closer to the point of having to consider such possibilities than we realize if the potential issues stemming from rampant consumption remain underestimated. But what will this potential policy entail? Without a good example to draw from it's difficult to extrapolate. Since immigration has a significant effect on population growth in Spokane (and in Washington State) – fertility rates are already low across the U.S. – one potential policy could deal with the maximum number of people allowed to relocate on a yearly basis, in an effort to stay below a certain amount of total population. Such quotas have a long history in U.S. immigration policy, and perhaps might eventually need to be

considered on an individual state basis (despite the difficulties presented with enforcing such policies).

Whether this conversation is comfortable or not, the main point is that it may be a discussion that policy makers find themselves having sooner than anyone planned. Indeed, the point of raising "alarm" in this manner is to call serious attention to current population and resource consumption related issues in order to be proactive now without being forced to turn to even more draconian policies down the road. Therefore, it follows that a culture shift might be quite necessary now, even though Spokane appears to be well endowed with water resources. Don't we want to keep it that way?

In addition, the ideal culture shift has to put an emphasis on responsible family planning and consumption awareness. Unfortunately less consumption is diametrically opposed to the healthy functioning of a capitalist society. A high quality of life is the standard in the developed world. Convincing society that lower consumption levels can be achieved while maintaining nearly the same standard in quality of life is where the difficulty lies. The lack of immediate need for concern facilitates a dismissive attitude toward any immediate action. Development, at least under the capitalist mode of production, and conservation are directly and inherently contradictory, unless we're able to perpetually innovate our way out of this dilemma, which points us to a future of space colonization or horrific world wars, famine, etc. Do we face this inevitability head on, and fundamentally rethink our entire mode of existence now to cultivate what might be a less expansionary, more sane mode of existence, an existence where human society can live in balance and possibly even harmony with minimal impact on its surrounding environment, resources, and life forms? The answer should be an emphatic yes.

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