Discourse in the Water Wars

The links between frames and Policy Agendas Surrounding Groundwater Pumping in California and Texas in the 21st Century.

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Foreward

California and Texas have both experienced controversy surrounding the use of groundwater in aquifers and larger subsurface stores. Despite similar conditions both physically as well as politically they have different results when reforming and developing groundwater policy asn well as enforcing regulation and maintaining institutional health. The thesis conducts a framing analysis, part of discourse analysis, of a body of text taken from news media on the subject of groundwater pumping in both California and Texas. The aim of the thesis is to evaluate what frames sub national actors in these states use and to examine the relative value of these frames. The framing analysis uses Van Gorps inductive analysis coupled with the use of the Wordsmith program for more efficient coding as well as concordance generation.

The California Water Wars; An Introduction

On a quiet calm day in the arid Owens valley in 1924, California, an explosion ripped apart gates that regulated the flow of water from the Los Angeles aqueduct. It happened again in the year 1927, and once again in 1976 (A&E N. 2010). The repeated attacks on this vital piece of infrastructure struck at a key part of an expansive plan to supply the city of Los Angeles with water. They are considered defining moments in the California water wars. Originally the California Water Wars was an ongoing disagreement between the city of Los Angeles and farmers, ranchers, and landowners (Sahagun, 2017). It took place over the course of the 19th century, starting in 1913 with the completion of the Los Angeles Aqueduct. A feat of engineering for its time the aqueduct rerouted the Owens River to Los Angeles. Accompanying the construction was the citie's acquisition of water rights through means described in Marc Reisner's Cadillac Desert as "chicanery, subterfuge, spies, bribery, a campaign of divide and conquer, and a strategy of lies..." (Reisner, 2001).

The acquisition and diversion of the Owens River was calamitous for the economy and people of Owens Valley, reducing productivity almost entirely (Nadeu, 1995). This led to several incidents of violence. Despite this by 1926 the Owens Lake and river were almost entirely dry from overuse (Nadeu, 1995). In 1941 Los Angeles looked quickly to other sources and found Mono lake. Litigation ensued due to the damage caused to the lake's ecosystem for migratory birds, finally forcing the city to halt its diversion in 1994 (Botkin, 2012).

Litigation such as that in the case of Mono lake, confused laissez faire water rights, and ensuing political debate has become the new face of the California Water Wars. The tensions around water rights continue to this day and are shared among other U.S. states which suffer similar environmental conditions. Population and industry drive an increasingly bitter struggle to satiate the thirst of expanding megapoli (Rajeh *et al.* 2011). Among those others affected most

by such demand driven pressures is the state of Texas. The lone-star state has experienced it's own turbulent history with water rights, though lacking the incidents involving dynamite shadowing the Owens valley. Both Texas and California face an uncertain future with climate change and melting sea ice projected to facilitate longer and more frequent droughts as well as more severe flooding (Dutch, 2010). While Texas and California both face very similar (though complicated) histories with water rights and management the former is years ahead in formulating policy which should increase the resiliency of it's potable water (Escriva-Bou *et al.,* 2016). The question is why?

The use of discourse analysis in environmental and water policy has been observed over the last decade to have significant benefits to understanding the policy process, and is used with increasing frequency in expanding our understanding of governance (Hajer, Versteeg, 2005). It enables pivotal moments in the policy process to be identified and explored thereby revealing critical mechanisms to the policy process (Hajer, Versteeg, 2005). Secondly it links behavior and action to the use of language and rhetoric and observes the relationship between way information is transferred and the actions taken (Sharp, Richardson, 2001). These two characteristics enable discourse analysis to reflect on the policy process. This should in turn provide feedback which can enable more successful post hoc activity by actors attempting to overcome barriers to the implementation of policy.The California water crisis does not exist as a policy problem in a vacuum. Policy problems are instead created by policymakers and agenda setting actors who are troubled by an observed risk or inequity (Carroll, 2012). The means by which a policy problem is presented and framed has an impact on perceived responsibility of the issue; this in turn sets up rationales supporting a set of policy solutions and rejecting others.

Given it's utility and applicability to water management policy problems, this paper uses discourse analysis, specifically the concept of frames and frame analysis, to examine the policy discussion surrounding groundwater regulation in both California and Texas. This involves the framing of both the policy problem and solution by sub-national actors involved in the policy process both through the media and institutions. It therefore asks the following: *how do*

sub-national actors in California and Texas frame policy addressing groundwater pumping - and moreover have some frames been more successful than others in the progress on policy development.

California's water management is not modus operandi in the United States, In fact the current water crisis in California has been described as "baffling" by lawmakers from other states, some of which have had extensive water laws for more than 150 years (Kostal, 2016). It's seems ludicrous that one state in the same nation can be one-and-a-half centuries behind the other in it's policy and yet California today has yet to enforce any comprehensive regulations regarding the use of aquifers or river water (Miller, 2014).

Traditionally policy analysis approaches the issue of the multiplicitous defining of policy problems and solutions as being determined by either rational economic thinking or external and existant preferences (Hajer and Wagenaar, 2003; Fischer, 2003; Schön and Rein, 1994). As stated by Jang and Kang (2013) in their analysis of policy framing of waste disposal the presumption that preferences are "defined and fixed exogenously" means one can't explain "gaps between parties on how each one defines and interprets policy problems and solutions" (Kang, Jang, 2013). Through the assumption that preferences are set externally the ability to determine the influence of particular approaches to defining and interpreting a policy problem is lost. Ideally one would be able to address the group differences in problem definition and solution seeking to observe the influence of particular perspectives as opposed to others. This in turn means one can develop a theory on a policy problem which takes into account not only the outcome behaviors driven by preferences, but the popularity of preferences and values or lack thereof.

Another analytical approach is discourse analysis. In this case preferences are not fixed external context for the purpose of assessing the policy problem, but instead are created in the policy process through the exchange of information between actors (Braun, 1999). The field of discourse analysis is very broad, applied across a variety of fields using different tool sets, frameworks, and boundaries for what is considered discursive (Fairclough, 2001). However there

are general criteria which can be applied which distinguish discourse analysis from other forms of linguistic driven analysis. The first general criteria is that discourse analysis observes the framework[s] present in any content (Fairclough, 2001). That is to say that it relies on a theory to craft and organize it's observation into structure. An example of this would be observing media discourse surrounding climate change focusing on categories of communication, sound, visuals, text, syntax and coupling this with definitions of meaning. A specific sentence structure would therefore assumed to intend or to directly convey a specific meaning. Frameworks allocating structure and meaning to communication can therefore range from broad categorizations in a range of fields, to the very specific such as assessing punctuation and ascribing meaning. The definition of meaning itself is dependent on the form of discourse analysis given meaning can be vague or specific and the method of its communication independently weak or strong (Braun, 1999).

A major tool in discourse analysis for the purpose of assessing policy problems is frames. It refers to the idea that that social phenomena can be cast into a socially constructed moulds to influence perspectives and beliefs (Boin *et al.,* 2009). This can be done by members of the polity, media, social ideologues or a dearth of other actors (Boin *et al.,* 2009). More specifically frames can be a part of the categorization process in discourse analysis. They provide structure to identifying the interactions between language, policy, and relevant actors. Frames can therefore be seen as structures that have interpretive power, that is to say they they have meaning. Frame analysis tends to have several common properties across methodologies; a focus on how specific elements of languages are grouped in families or 'packages' of meaning, a categorization of these packages into 'frames' and how/where these packages are deployed (Van Gorp, 2011). Critically frame analysis does not begin by using facts and resulting interpretations, rather by broader concepts related to the information which actors can use in order to develop and define policy problems and create networks where this 'frame' is used (Ibid).

The question of how California fell so far behind in it's groundwater regulation is undoubtedly linked to the states history. Given similar conflicts across the arid west however the

failure to pass even the most basic regulations suggests that other causal links can be drawn to California's lack of policy development. Existing policy analysis of the ongoing California water crisis examine it as a case of policy failure. There are three main approaches to this end. The most common is the use of the case to discuss institutional design, wherein the government's necessary roles to maintain a functioning water market are not sufficient in the institutional structures (Casado-Perez, 2016) (Hanak, 2011) (Thompson, 1993) (Livingston, 1998). The second approach is an analysis of the institutional response to market failures in the water market (Livingston, 1995) (Casado-Perez, 2016). The third approach is diagnostic, and addresses the long history of water conflict in the state in order to explain current policy failure (Hundley, 1993)(Lund, Israel, 1992)(Null *et al.,* 2012). The implications of these studies are used to formulate policy agendas, better institutional design, and a create more expansive and comrpehensive understanding of the policy problem. These explanations are however lacking when considering the significant gap in policy development seen in California and the similarities the state has with Texas.

California and Texas are similar cases. They share a multiplicity of climate typologies, with both extreme aridity and fertile environments present. Large urban scapes are present in coastal regions, meaning strongly region specific water demand and water management solutions. They both contain a variety of climate regions, from arid deserts to fertile valleys to coastal cities, which leads to highly localized and fragmented water management (Thompson, 1999). Both states have large political conflicts over water, with similarly influential agricultural stakeholders, private property advocates, and collectives. Both states are experiencing population growth. Water resource allocation is comparable with a lower end estimate of 60% reliance on groundwater, consequently experiencing land subsidence (sinking land) as aquifers and groundwater reservoirs are emptied causing the cavities to shrink (Thompson, 1999). California and Texas consume the most groundwater in The United States (Thompson, 1999). Alongside existing similarities both states have also shared infrastructure development goals for water resources, both investing in water infrastructure improvements such as desalination plants, as well as applying water rationing to city residents in times of drought (Thompson, 1999).

Texas and California differ on an important facet of their water management. While both rely heavily on groundwater resources California doesn't currently measure or otherwise regulate it's groundwater (Hauge, 2016). In comparison Texas has regulated the measurement of it's groundwater since the early 1960's (Thompson, 1999). California has recently established new regulation to empower local districts to measure groundwater (A system which mirrors Texas), however plans of compliance with this legislation are only due between 2020 and 2022. There are no central databases for groundwater reserves or stocks in the state, and the state will need to start developing these organizational capacities from scratch (Hauge, 2016).

This difference in the regulatory structures regarding groundwater measuring are of particular importance given the opposition to direct management of groundwater in both states. Texas and California have historically allowed landowners to pump as much groundwater as they want, irrespective of season or longer droughts. There has been consistent resistance to the idea of enforceable pumping permits, restrictions to pumping or drilling. As stated by the Texas Tribune (Fox, 2018) this is "understandable when you consider recent Texas case law illustrating the continuing debate over whether groundwater management equates to a regulatory taking of a private property right."

Establishing what limits can and should be placed on pumping is critical for the survival of both California and Texas, in order to preserve a sustainable groundwater stock. Texas can look at decades of data to assist in the decision making process. The state water board has a plan in place to develop and protect the sustainability of potable water for the next 50 years (Fox, 2018). In addition the availability of groundwater data and water levels allows for research and policy analysis to be conducted. California is effectively operating blindly and has to enforce both limits and measurement. With Texas having such similar institutions, actors, climate, and historical context there is good ground to search for additional explanatory variables for the California water crisis. Given the power that discourse can have on policy development and problem definition it , as well as previous successes in applying it to environmental challenges, it is the next logical step.

California's current water debate takes place in a complex network of actors where according to a UCLA water management report still consists of "municipalities, investor-owned utilities, non-profit mutual water companies, private water supply companies and many types of special districts, and private pumpers" (CCSC, 2015) All of these actors hold water pumping rights (CCSC, 2015). The prioritization of water resources can be observed to differ between actors, where water management policy can be framed in terms of welfare, environmental concerns, liberty, productivity, security and others (Austin, 2017). The variance in positions taken on water management and division in the policy process observed in California indicate gaps between actors in the problem definition stages and policy solutions.

This paper takes a different approach from existing literature on the subject and instead, through the use of discourse analysis, examines the means by which sub-national actors in California and Texas frame water policy - and the relative success in these frames in addressing the policy problem. Due to the power of states rights in water regulation in the United States, as well as the documented power of stakeholders and state policymakers in California and Texas (both states have a strong independent governance history and present from the rest of the country) sub-national actors are the focus of frame analysis (Thompson, 1999). Their importance is further seen from the consequences longstanding disagreements and conflicts have on policy development. The agricultural lobbies in both states are examples of this, wielding significant political influence (Thompson, 1999, Risner, 2001).

The Environmental and Regulatory Context of California and Texas Groundwater Pumping

Geology and Geography

Texas'

This section gives a brief overview of the various geographic regions and climatological classifications of the state of Texas. This will be critical to understanding references made in local media as well as references made in the literature to decisions behind water management and the differing pressures per region. Texas is an environmentally diverse state, with regions ranging from the very arid to humid (Britannica, 2018). It is home to ten climate typologies, eleven ecological zones, and more than a dozen different soil regions (Britannica, 2018). Coastal plains which advance inland from the Gulf of Mexico receive significant annual rainfall and are home to marshes and rolling dunes closer to the coast. North are more plains receiving similar amounts of rainfall, but with rolling landscapes peppered with pine forests (Britannica, 2018). The largest share of the country is dominated by the great plains, which are in the centre and north-west. The most arid regions are found here (Britannica, 2018). Between the great plains and the coastal plains is an area colloquially known as the Hill Country, geologically this is a transition zone and receives a moderate amount of rainfall (USGS, 2017).

You can characterize the Texas climate into three broad categories; "continental steppe, mountainous, and modified marine" (Britannica, 2018). Continental steppe seen most on the great plains sees very low humidity and large fluctuations in temperature. Mountainous climates see increased though unpredictable patterns of precipitation with cooler overall temperatures. Lastly the modified marine category sees the greatest diversity of climate with areas ranging from humid to arid (USGS, 2017).

California

California has mountainous terrain across it's coastal regions (McNamee *et al.* 2018). Towards the East from the coastline the mountains flatten out into a massive central valley, which experiences little precipitation. East again from the central valley are the Sierra Nevada mountain range which act as a wall for the East of the state to the central and northern parts regions (McNamee *et al.* 2018). Northernmost regions have mountainous terrain, and in the south and east are large plains interrupted occasionally by low lying mountain ranges (McNamee *et al.* 2018). The most significant of California's climate phenomena is the transition of humid air from the Pacific, in a south easterly direction across the state (McNamee *et al.* 2018). This creates a significant gradient of average annual precipitation with the highest being found in the North and the Lowest in the South (McNamee *et al.* 2018). The lack of precipitation in the South can cause forest fires to develop in dry summers, a common environmental problem in both Texas and California (Tedford, 2017). Northern coasts in California experience stable temperatures year-round with substantial precipitation. In the very South-East an arid steppe and desert region dominates the landscape.

Drought and Flooding, California and Texas

Texas and California both periodically experience periods of harsh drought. Texas currently has 20% of it's land mass locked in severe drought conditions with the worst effects being found in the central and coastal plains (Gammon, 2015). California is currently in far worse shape, with 46% experiencing severe drought conditions (Gammon, 2015). Texas has however in the past experienced even worse incidents with a 2011 peak of 88% of all landmass experiencing severe drought conditions (Gammon, 2015).

Management and Classification of groundwater

Texas

Texas classifies groundwater as the property of the landowner, therefore any aquifer, reservoir, groundwater found underneath a piece of land is under the sole ownership of the landowner (Texas Commission on Environmental Quality, 2010). If groundwater exists it is treated as any other natural resource found on private land (ie oil, gold, gas, etc.) and its use is dictated by the landowner (Texas Commission on Environmental Quality, 2010). This mode of governance originates from the english common law rule pertaining to natural resources, which Texas is the only state to still implement fully (Texas Water Development Board, 2011). There are territories however where this rule is not applied, called groundwater conservation districts (GCD's) (Texas Commission on Environmental Quality, 2010). Here permits can be required to drill, through landowner rights to water are still explicitly stated (Texas Commission on Environmental Quality, 2010).

There are in many areas of Texas two limitations which can be applied to the pumping rights of the landowner, pumping with the purpose of harm, and pumping which is used in an overtly wasteful way (Texas Commission on Environmental Quality, 2010). The former addresses the risk of a landowner pumping to remove a shared resource with the express intent to harm his neighbour whilst the latter addresses negligence in the use of the resource. Importantly no distinction is made between surface water flows and groundwater aquifers or larger reservoirs (Texas Commission on Environmental Quality, 2010).

Groundwater Conservation Districts (GCD's) are areas earmarked for local groundwater regulation which are based on the Groundwater District Act (1949) and a further bill in 1985 (Texas Commission on Environmental Quality, 2015). It allows areas to be designated as "critical groundwater areas" (Texas Commission on Environmental Quality, 2015) This enabled regulatory bodies to push for the formation of districts in high risk areas where groundwater could be regulated (Texas Commission on Environmental Quality, 2015). GDC's are able to

regulate the pumping and consumption of groundwater and can supercede the ownership rights of the landowner through placing restrictions or outright altering them (Texas Commission on Environmental Quality, 2010). The most common example would be pumping limits.
GCD's exist in Texas through legislative action, institutional intervention by the Texas Commission on Environmental Quality (TCEQ), local citizenry initiatives, or through defaulting by processes of redistricting (Texas Commission on Environmental Quality, 2010). An important facet of the groundwater management in Texas is that despite its use of English common law more than 91% of the state requires some form of measurement of groundwater pumping (Texas Commission on Environmental Quality, 2010).

California

Similar to Texas California has used english common law in the regulation of it's groundwater (Smith, 1984). It also however appropriates a 'reasonable use' rule to cases involving correlative rights similar to the expectations put in place by the GCD's in Texas (Smith, 1984). In California's case however groundwater rights are held between landowners sharing the water source in a system of "co-equal and correlative rights" (Smith, 1984, Hutchins, 1977). Any non-landowner entity is considered adjunct and their rights are therefore secondary, in other words the state can't supercede the rights of landowners (Smith, 1984). Local counties control groundwater pumping and is categorized into; "definite underground streams", "underflow of surface streams", and "percolating water" which filters far down into the soil, replenishing aquifers (Sawyers, 2007, Hutchins, 1977).

Rights have been split into three categories aso, with overlying, appropriative, and prescriptive rights (Hutchins, 1977). Overlying rights concern the rights of the landowner where the groundwater is located at the riparian level, appropriative rights apply where groundwater is pumped for non-overlying use or below riparian levels, and prescriptive rights (similar to squatters rights with land use, in that it involves adverse use of another's resource) (Sawyers, 2007, Hutchins, 1977). The landowner remains the priority and is most defended while appropriative rights depend on the surplus water available and is done on a first come first served

basis (Sawyers, 2007, Hutchins, 1977). The current management of groundwater has only recently been written into law (2014) with expected application and enforcement to occur well beyond 2020 (SGMA 2014, California Agriculture 2018). Before this occurred the legal landscape was the wild west of the United States when it came to groundwater pumping rights (Sawyers, 2007, Hutchins, 1977, Reisner, 2001). Practically speaking therefore California at this time has no enforced groundwater pumping measurement, control, nor does it have large districts where groundwater is managed and measured such as Texas (Sawyers, 2007, Hutchins, 1977).

Institutions

California

In California, no single agency has comprehensive authority to define or regulate groundwater at a state level (SGMA 2014, California Agriculture 2018). State courts can resolve individual conflicts concerning shared water allocation, and in some cases have jurisdiction to limit pumping when adjudicating river basins (SGMA 2014, California Agriculture 2018). State courts however are limited to defining the presence, scope and classification of any rights the groundwater user may hold (SGMA 2014, California Agriculture 2018). In cases where a water basin has been adjudicated they do have the ability to limit groundwater pumping in cases of scarcity (SGMA 2014, California Agriculture 2018). The California State Water Resource Control Board (SWRCB) currently has authority under the state constitution ("for reasonable use and waste prevention") to regulate groundwater (Joshi, 2005). Local and regional water management by counties is left effectively to municipal police, who in turn can pass local ordinances which target monitoring and management of groundwater (municipal police however prioritizes local public health and safety rather than wider environmental concerns) (Joshi, 2005). Local agencies are expected to collaborate with any public entities which service water basins or who's jurisdiction is within the boundary of the larger groundwater basin (Joshi, 2005). Critical to California's groundwater regulatory deadlock state law (and therefore the state) is superseded

by county and municipal regulation (and therefore local municipal governments) as no statewide regulatory structure is currently enforced (Joshi, 2005).

Texas

Texas has the Texas Commission on Environmental Quality (TCEQ) which oversees the regulatory and monitoring process of managing the states groundwater (Texas Commission on Environmental Quality, 2010). Additionally Groundwater Conservation Districts are responsible for their local region/county/territory and set their own regulatory standards within the bounds of state law (Texas Commission on Environmental Quality, 2010). The TCEQ is the central repository for data gathered by GCD's and independent watchdogs and research institutions (Texas Commission on Environmental Quality, 2010). GCD's are most often created through local legislature wherein institutional frameworks are laid out including financing, management procedures, and key candidates (Joshi, 2005). However in Texas GCD's can also be created through landowners drafting a collective appeal to the TCEQ (Joshi, 2005). This can be difficult given a majority of landowners within the proposed GCD must support the proposal, and even then property right infringement is a risk (Texas Commission on Environmental Quality, 2015). In cases where the district/region in question is at a higher risk of drought or long term water shortage and landowners do not show initiative and propose a GCD themselves the TCEQ has the authority to create a GCD (Texas Commission on Environmental Quality, 2010). GCD's are run by locally elected officials who are not permitted to have ties or affiliation with other political entities or organizations (Texas Commission on Environmental Quality, 2010). Importantly many of the largest, and oldest GCD's are themselves landowsers involved heavily in agriculture, to be expected given the elections take place from within the local community in the district) (Johi, 2005). GCD's gain income via property tax, construction and management fees on infrastructure such as wells, and pumps (Joshi, 2005). GCD's do not however handle legal cases between landowners regarding a water dispute, this is instead left to the state courts (Joshi, 2005).

Consumption patterns

California

Consumption of water in California is dominated by the agricultural sector, with 40% of available water being used (PPIC, 2018). Urban use is comparatively low at only 10% (PPIC, 2018). The remaining 50% flows through the environment and is characterized as environmental water use (PPIC, 2018). This includes protected rivers which have been isolated for their natural beauty or ecosystems, water that is needed to maintain the wetlands of protected areas, and lastly a minimum water level needed to maintain downstream water purity for industrial/agricultural/urban use (PPIC, 2018). During dry years however the distribution between urban, agricultural, and environmental categories changes as less water is left over for the latter (PPIC, 2015). Agriculture is a significant part of the state's economy, with thousands of jobs depending on the success and activity of the agriculture industry. It is therefore a priority in resource allocation in times of scarcity.

Due to trends in manufacturing and production in the agriculture industry water use has been decreasing steadily over time as economic productivity has risen (Hanak *et al.* , 2011). Similarly population growth has been occurring whilst urban water use has been decreasing (PPIC, 2018). Water saving technologies, pricing incentives, and initiatives to reduce water use for gardening have been the main causes for this decrease (Hanak *et al.* , 2011). Despite these increases in productivity California still consumes far too much groundwater. The agriculture industry, the biggest human driven consumer of water, sources mostly from groundwater even during droughts (Hanak *et al.* , 2011). This has become increasingly problematic as a shift to perennial crops necessitates water use throughout the entire year, every year (Hanak *et al.* , 2011).

Texas

Agriculture in Texas takes up more than 50% of the total annual water consumption in Texas (this figure does however include irrigation for large green spaces such as parks and golf courses) (TWDB, 2015). Urban (municipal) water use as in California comes in second with

34% with manufacturing at 8%, power generation from hydroelectric dams at 4%, water for livestock at 3% and finally mining at 1% (TWDB, 2015). Unlike in California there is no or limited data available on how this pertains to the environmental water supply (TWDB, 2015). What is significant is as in California the largest share of water consumed is groundwater, at 56% in Texas (TWDB, 2015).

Most of the groundwater in Texas is consumed in the Western and Southern parts of the state which experience the most prevalent ground water driven irrigation (Steward, Allen, 2016). As in California the agriculture industry is experiencing increasing yields while maintaining or reducing water consumption to the extent that litres per year use per acre is now less than that of homeowners. (TWDB, 2015).

Groundwater levels are expected to experience a reduction of approximately 32% (Mace *et al.* 2007). Overuse of large aquifers has led to pumping far outstripping the annual replacement rate (Mace, *et al.* 2007). Groundwater is also more frequently being used by cities in the centre of Texas due to surface water supplies being affected by long term drought (Mace, *et al.* 2007). The population of Texas is expected to double by the year 2070 driving more demand towards already dwindling groundwater reservoirs. (Mace, *et al.* 2007). As with California therefore agriculture and increasing urbanization are the main drivers for the increasing pressure placed on groundwater resources (Mace, *et al.* 2007).

Common discourse on groundwater rights in Texas and California

Groundwater as property Right

California has experienced long discussions regarding solutions to groundwater management challenges. The debate is often framed from the perspective of the property rights of the landowners first, rather than discussions on the scientific, environmental benefits or otherwise (Carroll, 2012). A clear example of this can be seen in the case of Cadiz Inc. where the renewable resources company proposed to capture and then store groundwater being affected by salt pollution and drought (Sizek, 2018). The aim of the project is to improve the sustainability of the remaining groundwater in the Mojave Desert region in Southern California (Sizek, 2018). Opposition to the Cadiz water project has been focused on the rights that Cadiz holds to transport water through areas where it is not a landowner, and that property rights of landowners (Sizek, 2018).

In Texas similar disputes occur between GCD's and landowners. In cases such as the Edwards Aquifer Authority (EAA, one of the largest and influential GCD's in the state) debate surrounded the concept of 'taking' property rights away from landowners when the EAA fulfilled its obligations to limit groundwater pumping rights (Malewitz, 2015). The EAA was created when a state court responded to the danger that unregulated groundwater pumping was having on endangered species, in the ensuing debates however discussion pivoted from the environment to property rights, despite the EAA having a mandate to restrict pumping under the Texas Constitution (Malewitz, 2015). The property rights angle was a political hot potato, to the extent that the Texas supreme court opted to not review a decision made in favor of the landowners in an appeals court case (Malewitz, 2015). The appeals court justice stated the rights of landowners

was greater than “the importance of protecting terrestrial and aquatic life, domestic and municipal water supplies, the operation of existing industries and the economic development of the state.” (Ballotpedia, Texas Fourth Court of Appeals, 2015) What made this decision particularly controversial was that the EAA was well within its constitutional mandate ever since the conservation amendment to the constitution in 1917 (TWDB, 2015, Malewitz, 2015). It serves as a powerful example of the property rights narrative in Texas.

Groundwater as an Environmental Issue

California

Environmental linked discourse is used frequently in discussion n California groundwater pumping. Environmental agencies and the state government involve both ecological harm and climate change in discourses such as the Cadiz water project (Hauge, 2016). However it is acknowledged that regarding groundwater the presence and scope of environmental discourse is limited, with even the SGMA panel discussions such as that of the Californias Irrigation Institute have shows that “one of the questions that agricultural water users around the state are weighing is the degree to which implementation of SGMA, climate change, market forces, and other regulatory forces such as the Irrigated Lands program may shape how they use water and may drive a fundamental adjustment in ag[ricultural] water use to bring supplies in balance with demands,” (speaker David Miller) “There are a lot of different perspectives and different scenarios about what could happen” (Maven’s Notebook, 2017). The discussion is centred around the impact of property rights, and economics, rather than direct references to environmental safety or sustainability (Maven’s Notebook, 2017). In the Cadiz project for example environmental agencies have pursued the argument that mitigating harm of an unknown quantity is a strong argument in favor, but this is quickly overtaken by the larger debate on property rights (Sizek, 2018).

Texas

Texas law and political discourse does little to discuss environmental concerns pertaining to groundwater, but instead refers to the preservation of groundwater as a resource and it's safekeeping from damage (TAGD, 2006). Laws target those who have rights to water, with environmental concerns being delegated to a case by case basis to which the state legislature is responsible (TAGD, 2006). While there are larger environmental discussions related to environmental concerns there is no evidence for a direct link between discussions on groundwater pumping and environmental discourse.

Groundwater as a Security Issue

California

Discourse on security pertaining to groundwater is common in the State of California, especially in relation to drought susceptibility and service vulnerability to scarcity (Fischhendler, 2015). As stated by Bales and Fischer (2016) the drought has illuminated weaknesses in both the institutions and data needed to efficiently and fairly allocate water. The state acknowledges that unmet data needs to characterize groundwater conditions, operate water-supply infrastructure, achieve water-conservation goals, reduce energy use, and promote water transfers (PPIC, 2018, Cantor *et al*. 2016)". The discussions surrounding water security in California pertains to any water related risk including health crises, economics, and supply side challenges (Cantor *et al.* 2016).

Texas

Texas law refers to the safety and security of it's groundwater resources though it does so whilst prioritizing the property rights of landowners who oversee it (Wythe, 2017). Outside state law entities such as the Water Security Initiative at Texas A&M University (a research initiative to investigate the disputes and challenges surrounding water in California) frequently refer to groundwater in Texas in terms of security. The WSI T. A&M has collected a team of experts in

the field of water policy (Wythe, 2017). Reviewing discussions surrounding water security in Texas they found that research despite being traditionally done by sector (ie. agriculture, municipal, etc.) is just as useful if done from the perspective of security (Wythe, 2017).

"The security approach gives us a different view of how to look at water as a resource,""I don't know if it will get us to any different outcomes or conclusions, but we have to go down this road to see because the approaches we currently take don't always give us definitive answers and quite often don't give us helpful answers."

Gabriel Eckstein, WSI T.A&M

Research Design and Methods

Discourse Analysis and Framing

This thesis has adopted the inductive-deductive analytical process conceptualized by Van Gorp (2010, 2012). The distinctive subjective characteristics of frame analysis are removed through a cultural approach to take the natural biases in contextual use of language out of the analytical process as a confounder (Van Gorp 2010, 2012). Van Gorps methodology provides both a quantitative and qualitative system of frame analysis (Van Gorp 2010, 2012). The design is intended to counter the chaotic realm of frame analysis methodology and provide a systematic means to extract frames from written media. It is important to note that this methodology differs from traditional discourse analysis found in linguistic studies (Touri, 2014). The analysis put forward by Van Gorp aims to assess the original purpose of framing analysis this being the means by which; *"framing devices and reasoning devices work together under the heading of an overarching idea,"* (D'Angelo, Kuypers, 2016). It's purpose is to develop insights into the simultaneous use of many textual characteristics which can be described as having a systematic and repeatable structure (Van Gorp 2010, 2012).

Under the umbrella of discourse analysis, which stems from Foucault's thesis on discourse and power relations, frames would stand for the external preferences of influential actors which tend to be elite in political and economic terms (Alvesson *et al.* 2000). The aim of this thesis is not to link frames to a greater power structure or long term hegemonic process but rather to provide multiple viewpoints through which to understand the policy problem. The constructionist analytical process laid out by Van Gorp was developed for this purpose.

Design and Methodology Stage 1: "Inductive Phase"

1. Source Material Collection

Articles and policy documents for analysis were used, and found through google for both California and Texas. The search term was "groundwater + state name + pumping". Articles from media were limited to only those produced in the state in question by recognized and mainstream publications. This was defined as any publication which services statewide. Official policy documents were taken from both the state level and municipal level. Articles were selected based on three categories;

1) The document/article refers to groundwater or groundwater pumping in the state of interest.
2) The document/article relates to events/discourse in the last ten years
3) The document/article is easily retrievable - not behind a paywall

Ten documents were selected for California, and Ten for Texas. The number chosen is large enough to support a robust frame analysis, whilst operating within the acceptable timeframe for this research. Both Texas and California have in addition to these ten texts two legal documents containing the policy language relevant to the issue of groundwater pumping.

News media alone does not reveal all the potential frames found about an issue (Van Gorp 2010, 2012). Policy documents were included to gain an understanding of the frames which can be found in resulting policy. In addition documents selected from media sources should contain quotes or statements by stakeholders so as to contain frames from actors outside news media.

2. Coding the Source Material

Texts are analyzed without a predefined subset of keywords or phrases to identify. Elements within the texts are compared within the context of the topic (Van Gorp 2010, 2012.) This process identifies indicators which may influence the readers interpretation of the text. The focus is on the storytelling choices that have been made in the text, what framing and reasoning devices have been used, and collecting these choices in an empirical and systematic manner (Van Gorp, 2012). This is combined into keywords, phrases, and syntax choices, or 'codes.'

2.1 A Brief Overview of Coding

In the analytical process of coding there are several types of elements to examine which are broadly listed below and have been widely discussed in discourse and lexical studies (Chilton, Paul 2004, Fairclough, Norman 1995, Johnston, H. 1995);

1. Word groups; These are words which share a common context either through a cultural background or other forms of normative standards. An easy example would be words which are commonly employed in legal text, or jargon sourced from a specific field such as graphic design. Word groups are significant due to their use throughout a piece of text creating a specific reasoning device, (speaking in business language versus military jargon when discussing a natural disaster).
2. Grammar use; The delineation of subject and object in sentences, pronoun choices, tenses, active or passive phrasing, adjectives and adverb use.
3. Literary devices; Assessing the presence of similes, metaphors, proverbs, idiomatic expressions, and allegorical or rhetorical language. The manner by which they are used within the story or argument being presented in the analysed text creates associations, in turn shaping and legitimizing a particular narrative.
4. Context of indirect and direct speech; Quoted text or paraphrased text can be used in a different context than the original, and therefore original phrases must be examined if possible to ascertain the original context and if this matches the current use of the phrase found in source material used for analysis.

5. Evidentialities and modalities; The latter refers to statements using “should” or “could.” The former refers to words or phrases which create the assumption of factuality. Linked to this is whether the evidentialities are coupled with factual information in the same text or if the phrases exist as the argument. An example of this would be “*everyone knows* climate change adversely affects groundwater resources.” This is a powerful device as it can create normative maps of facts whether they are actually supported by the larger body of science or not.

2.2 Coding with Wordsmith

Maria Touri (2014) built on the Van Gorp model with a more quantitative approach to coding through the use of Wordsmith Tools. Wordsmith is a collection of programs which is used to assess the behavior of specific phrases or words in text. In addition Wordsmith can extract word clusters and pairs, or pair likelihood in a sentence or juxtaposition. The Keywords function when compared to a standard lexicographic library can isolate the most frequently used words and terminology. Importantly it also allows the user to create concordances, which are wordlists presented within the context of where they are used. This significantly improves the coding process once keywords have been identified.

This thesis integrates the use of keywords and concordances in the same manner as Touri (2014), to enrich and speed up the inductive process. Wordsmith tools allows greater diagnostic oversight over the texts taking the use of devices and keywords into context.

Stage 1.

A list of keywords is produced via the Keywords program in Wordsmith. The source material of both California and Texas are processed into a wordlist, and then compared to a larger control word frequency list generated from the British National Corpus (2007). While other studies such as those reviewed by Touri (2014) have used wordlists specific to the publication or publications

being analysed in the source material there does not appear to be a statistically significant difference between a specific wordlist and a general one when assessing the comparative frequency of keywords compared to a neutral non subject specific control corpus (Touri, 2014).

Stage 2.

Words from the Keywords analysis of the source material which had a high frequency compared to the standard word list are displayed in list form. The higher the statistical significance of the word the higher it's 'keyness' and therefore it will appear higher on the list (Touri, 2014.) Keyness is dependent on the frequency the word appears in the assessed source material, the running words of the total source material, the comparative frequency of appearance in the larger reference word list used, and the number of running words from the reference word list Touri, 2014. Wordsmith then applies a chi-square test and a Log Likelihood test. Lastly the list undergoes a process of lemmatization, which is where inflected forms of words which appear to be significant are combined into one item for analysis, and are considered as one word (Touri, 2014).

3. Codes into constructs of meaning

Patterns of codes are in this step linked to ideas and meaning. In step two each text has its own codes. In step three these codes are compared and combined into categories. Once codes have been grouped and sorted into axes of meaning (thus the term axial coding) literature can also be examined to enrich contextual understanding (for example the use of water wars in Texas and California has a different context relating to violence) (Touri, 2014, Van Gorp 2012).

4. Constructing a Frame Matrix

Reasoning and framing devices are put into column entries whilst frame packages are represented by row entries (Van Gorp 2012). Every row must contain collection of codes which relate to the same function of the frame (for example defining pumping rights as a security issue)

(Van Gorp 2012). Not all codes and elements from step three are represented here as only some can adequately reflect the broader frame (Van Gorp 2012). In this step combinations across columns are looked for in order to identify and name frame packages which are mutually exclusive to one and other in order to successfully delineate frames from each other.

5. Evaluating frame packages

Frames need to be evaluated for their completeness and their relative dominance in the source material. When frame packages have been listed they need to be cross referenced with source material to make sure texts match with available packages. If a text can't be matched with any then one of two outcomes has occurred:

A) The text is frameless
B) The text has an unidentified frame - in this case source material must be recoded as there are one or more frames missing from the analysis.

Van Gorp puts forward three further criteria for the purpose of evaluation of a frames suitability;

A) The breadth or "thickness"of the description of the frame; The frame package should be describable through the use of a list of framing and reasoning devices, indicating the frame communicates a specific meaning (Van Gorp 2012).
B) The degree to which the frame is abstract.
    a) And therefore the applicability for the frame to be used when defining other issues

    In order to be abstract enough to be suitable frames Van Gorp suggests they must be applicable in the definition of other issues, the perspective therefore must be abstract enough to be applied successfully out of the context of the specific issue. This makes it a frame as it can be used on a variety of issues to give a specific meaning or perspective (Van Gorp 2010.)

For the purposes of this study given support in the literature for three dominant frames in public discourse on groundwater pumping coding would be performed with a focus on variations on

each discourse found in the two states. Variations are to be expected for definitions of property rights discussions, environmental problems, and security and these need to be related to the specific context found in each state. The coding process remains in line with Van Gorp within the limits of discourse on groundwater as discussed in the literature. In the rest of the inductive analysis codes were used to generate frame packages as single units, comprised of devices which were then used for the quantitative analysis in the deductive stage.

Design and Methodology Stage 2: "Deductive Phase"

The deductive stage of analysis is dependant on the framing packages developed in the first stage by coding as these packages can be consistently counted. Consistent and specific framing packages mean a quantitative analysis is possible within the more qualitative realm of discourse analysis. (Pan & Kosicki, 1993.) To observe the frequency to which the derived framing packages are used a quantitative content analysis is performed on the source material.

1. Organizing the Frame Matrix

Van Gorp lays out four guidelines for successfully organizing a matrix of frames for analysis; (Van Gorp, 2012)

1. Limiting the "deductive phase" to mutually exclusive frames. This greatly reduces the likelihood that a frame will be misidentified, and therefore increase the reliability of the analytical process.
2. Ensure the coding process facilitates the least amount of personal interpretation of the content. He suggests operating under yes/no questions related to the presence of framing packages.
3. Have more than one coder to review material. (Given the scope of this thesis this was not achievable)
4. Focus on framing devices in each package which are used most

2. Examine clustered coded devices

This process involves looking for frame packages themselves from clusters of devices rather than performing analyses for every specific framing device separately. This introduces a challenge however as clusters of devices must be defined, given some devices may be used too infrequently to constitute as part of a specific framing package, but could be interpreted as part of the cluster regardless (Van Gorp, 2012). Van Gorp (2005) used a homogeneity analysis to determine the relevance of each device to a frame package. When devices occurred regularly or simultaneously with each other they were close together on the generated plot, and far away from each other if they did not. Devices that fall out of range and are therefore not part of the package can be examined with respect to other frames, or may suggest an unobserved/unused frame (Van Gorp 2010).

3. Measuring the frequency and weight of frame packages

In this step the frame packages are measured and weighed. Each observed text is processed to count the number of framing devices that belong to each particular frame package. The more devices belonging to a particular package the stronger the frame, and the more likely the reader will bind with the perspective (Van Gorp, 2012). This process generates a series of indexes reflecting the frequency of devices in the text(s) and therefore exposes frame single or shared frame dominance. While with large datasets this can be used to measure the change in application of frames over time, here only a snapshot of frames is observed to limit the scope of this thesis.

Results and Discussion

The Keyword function in Wordsmith allows not only the comparative analysis of word use from the control and sample, but also between samples. For the control the British National Corpus was used (BNC), this is a collection of texts (processed as a word frequency list) with a high degree of variation intended to match the broad spectrum of real world language use as closely as possible across many subjects. Between-sample comparative keyness is more significant data for the purpose of this study. It works as mechanism with the purpose of exposing different devices interacting with the same subject. Fig. 1 and Fig. 2 are the top five keywords of bot the Texas and California texts compared to the BNC. Fig. 4 shows all keywords that occur with statistically significant ($p<.01$) higher frequency in California when compared to Texas, and Fig. 5 does the same for Texas when compared to California. As previously discussed Keyness is not simply frequency, and represents the salience of the keyword. A p-value limit of .01 was used in Wordsmith to capture a broader spectrum of keywords, instead of the default $p<0.000001$which generated only the most highly significant keywords.

Fig. 1: An Overview of Keywords in the Texas Source Material

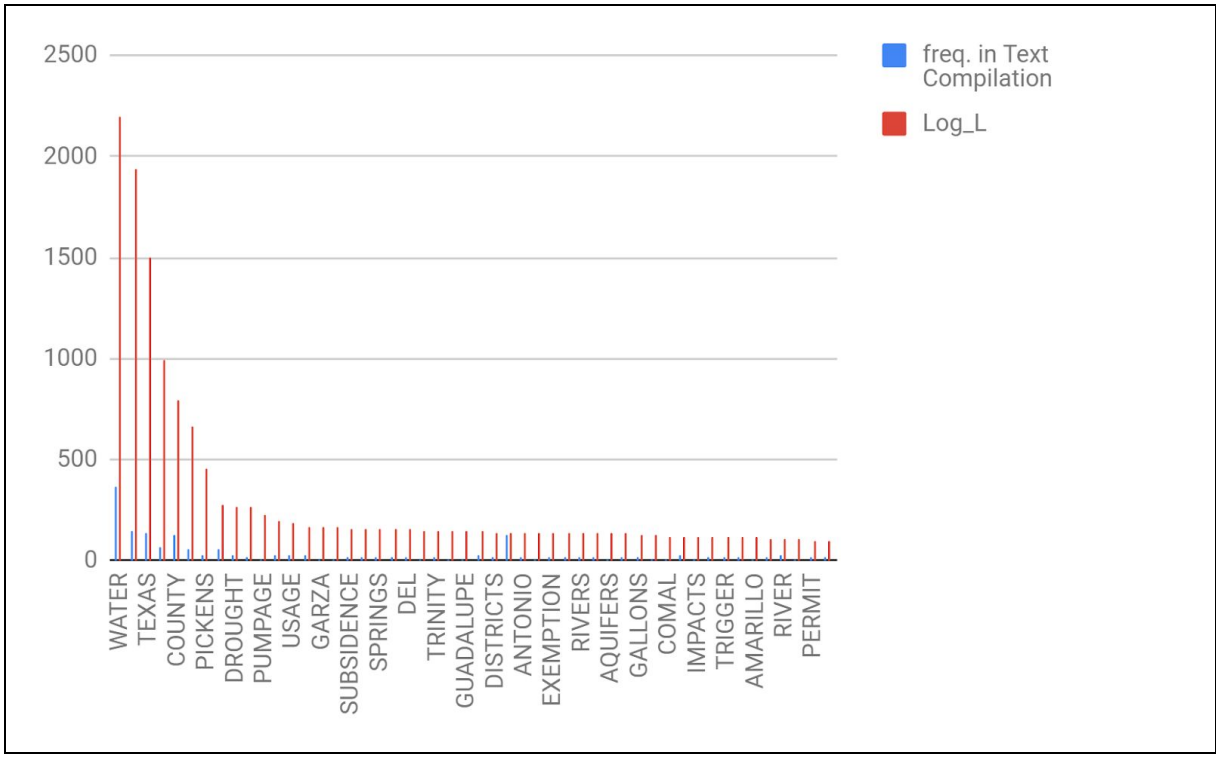

Fig. 2, Top Five Keywords in the Texas Sample Compared to the Control

N	Key word	freq. in Text	%	Texts	freq. in	RC. %	BIC	Log_L	Log_R	P
1	WATER	362	1,91	1	34.134	0,03	2.177,82	2.196,23	5,80	0,0000000000
2	GROUNDWATER	145	0,77	1	286		1.915,68	1.934,10	11,38	0,0000000000
3	AQUIFER	71	0,38	1	95		971,52	989,94	11,94	0,0000000000
4	COUNTY	127	0,67	1	10.972	0,01	773,80	792,22	5,93	0,0000000000
5	PUMPING	61	0,32	1	496		642,09	660,50	9,34	0,0000000000

Fig. 3, Top Five Keywords in the California Sample compared to the Control

N	Key word	freq. in Text	%	Texts	freq. in	RC. %	BIC	Log_L	Log_R	P
1	WATER	136	1,89	1	34.134	0,03	804,91	823,33	5,79	0,0000000000
2	GROUNDWATER	21	0,29	1	286		228,96	247,37	9,99	0,0000000000
3	COUNTY	35	0,49	1	10.972	0,01	178,25	196,66	5,47	0,0000000000
4	FLOODPLAIN	10	0,14	1	23		131,83	150,24	12,56	0,0000000000
5	AGENCY	22	0,31	1	5.645		113,82	132,23	5,75	0,0000000000

The top five keywords for both Texas and California compared to the control BNC frequency list had Water and Groundwater as first and second respectively, with County being in the top five of both lists. Aquifer and Pumping in the case of California, and Floodplain and Agency in the case of Texas were the odd ones out. These were contextual to the geography present at both locations as reviewed earlier in this thesis, and a brief overview of concordances did not deliver any obvious indications for specific reasoning devices or frames. Therefore the analysis progressed directly to cross case analysis, and an analysis of concordances of Water, and Groundwater.

Fig. 4, All positively ‘Keyed’ words in the California Sample compared to the Texas Sample

N	Key word	freq. in Text	%	Texts	freq. in Text	RC. %	BIC	Log_L	Log_R	P
1	CALIFORNIA	27	0,38	1	1		51,55	61,72	6,15	0,0000000000
2	SACRAMENTO	18	0,25	1	0		36,30	46,47	140,36	0,0000000000
3	VALLEY	14	0,19	1	1		19,27	29,44	5,21	0,0000000548
4	METHYL	11	0,15	1	0		18,23	28,40	139,65	0,0000000959
5	FARM	13	0,18	1	1		16,83	27,00	5,10	0,0000002007
6	FEE	13	0,18	1	1		16,83	27,00	5,10	0,0000002007
7	FLOODPLAIN	10	0,14	1	0		15,65	25,82	139,51	0,0000003728
8	YARD	10	0,14	1	0		15,65	25,82	139,51	0,0000003728
9	EXPERIMENT	10	0,14	1	0		15,65	25,82	139,51	0,0000003728
10	WILL	47	0,65	1	43	0,23	14,24	24,41	1,53	0,0000007771
11	CONTEST	9	0,13	1	0		13,06	23,23	139,36	0,0000014316
12	RETHINKYOURYARD	8	0,11	1	0		10,48	20,65	139,19	0,0000055044
13	SALMON	8	0,11	1	0		10,48	20,65	139,19	0,0000055044
14	PESTICIDE	8	0,11	1	0		10,48	20,65	139,19	0,0000055044
15	DEPARTMENT	13	0,18	1	3	0,02	9,88	20,05	3,51	0,0000075517
16	PROTEST	10	0,14	1	1		9,59	19,76	4,72	0,0000087927
17	AGENCY	22	0,31	1	13	0,07	8,81	18,98	2,16	0,0000132262
18	SANTA	7	0,10	1	0		7,90	18,07	139,00	0,0000212822
19	BROMIDE	7	0,10	1	0		7,90	18,07	139,00	0,0000212822
20	CRUZ	7	0,10	1	0		7,90	18,07	139,00	0,0000212822
21	PAJARO	7	0,10	1	0		7,90	18,07	139,00	0,0000212822
22	BOB	9	0,13	1	1		7,21	17,38	4,57	0,0000306735
23	MANAGEMENT	19	0,26	1	11	0,06	6,53	16,70	2,19	0,0000438643
24	BUREAU	10	0,14	1	2	0,01	6,12	16,29	3,72	0,0000543903
25	KAREN	11	0,15	1	3	0,02	5,61	15,78	3,27	0,0000712007
26	CHARGE	6	0,08	1	0		5,32	15,49	138,77	0,0000829761
27	IRWMP	6	0,08	1	0		5,32	15,49	138,77	0,0000829761
28	BEAUTIFUL	6	0,08	1	0		5,32	15,49	138,77	0,0000829761
29	BECOME	6	0,08	1	0		5,32	15,49	138,77	0,0000829761
30	WATERSHED	6	0,08	1	0		5,32	15,49	138,77	0,0000829761

Fig. 5, All positively ‘Keyed’ words in the Texas Sample compared to the California Sample

N	Key word	freq. in Text	%	Texts	freq. in Text	RC. %	BIC	Log_L	Log_R	P
1	TEXAS	136	0,72	1	0		77,32	87,49	141,88	0,0000000000
2	AQUIFER	71	0,38	1	0		35,51	45,68	140,94	0,0000000000
3	RIO	47	0,25	1	0		20,07	30,24	140,35	0,0000000353
4	SAYS	48	0,25	1	1	0,01	13,53	23,70	4,19	0,0000011238
5	DISTRICT	53	0,28	1	2	0,03	11,91	22,08	3,33	0,0000026169
6	GRANDE	32	0,17	1	0		10,42	20,59	139,79	0,0000056962
7	DFC	31	0,16	1	0		9,77	19,94	139,75	0,0000079742
8	PUMPING	61	0,32	1	4	0,06	9,35	19,52	2,53	0,0000099726
9	PICKENS	28	0,15	1	0		7,84	18,01	139,60	0,0000219333
10	CITY	58	0,31	1	4	0,06	7,81	17,98	2,46	0,0000223614
11	OIL	26	0,14	1	0		6,56	16,73	139,49	0,0000431668
12	MEXICO	23	0,12	1	0		4,63	14,80	139,32	0,0001197435
13	VERDE	23	0,12	1	0		4,63	14,80	139,32	0,0001197435
14	VAL	23	0,12	1	0		4,63	14,80	139,32	0,0001197435
15	GMA	23	0,12	1	0		4,63	14,80	139,32	0,0001197435
16	STUDY	32	0,17	1	1	0,01	4,04	14,21	3,60	0,0001638612
17	DISTRICTS	22	0,12	1	0		3,98	14,15	139,25	0,0001684947
18	EDWARDS	20	0,11	1	0		2,70	12,87	139,11	0,0003344827
19	PASO	20	0,11	1	0		2,70	12,87	139,11	0,0003344827
20	DEL	20	0,11	1	0		2,70	12,87	139,11	0,0003344827
21	ODESSA	20	0,11	1	0		2,70	12,87	139,11	0,0003344827
22	TWDB	20	0,11	1	0		2,70	12,87	139,11	0,0003344827

The California sample keyed against Texas generated thirty keywords while the Texas Sample generated twenty-two. Excluding for place, person, and institution names however produces interesting results, with California keeping more than half its keywords at seventeen, and Texas just under one fourth at five. They are as follows in order of Keyness;

California: *Valley, Methyl, Farm, Fee, Floodplain, Yard, Experiment, Salmon, Pesticide, Department, Protest, Bromide, Management, Charge, Beautiful, Become, Watershed*
Texas: *Aquifer, District, Pumping, Oil, Study,*

In the next stage of the analysis a random sample of five concordances based on the top five keywords were then extracted using Wordsmith, comparing word Keyness against the control , random samples of ten concordances of all significant keywords of the cross case analysis were also examined. To properly contextualize the use of the keywords, and allow for an examination of potential framing devices, the sentence before the keyword sentence and after the keyword sentence were also assessed. A random sample of five was chosen to realistically limit the scope of coding.

Keywords and the accompanying concordances which envelope them are the two main analytical processes by which data is generated in order to sort devices into frame packages. As elaborated on by Touri (2014) "one of the biggest challenges that analysts face is detecting the frame in a given text." Discursive analytical processes suffer greatly from being context specific and not repeatable for the purposes of further experimentation(Van Gorp, 2010). Useful therefore for theory generation in case studies but vague in the methodological approach. This is particularly an issue when it comes to coding and the creation/description of framing packages wherein the interpretation of meaning is vulnerable to high amounts of subjectivity (Van Gorp, 2010).

Through processing keywords comparatively between California and Texas we gain an understanding of the underlying approximate intent of the texts. It empowers a quantitative approach to generating expected loci for framing devices. Through the use of concordances these keywords are accompanied by the context which contains longer form reasoning devices and grammar choices. The perspective/intent behind the keyword is therefore captured directly through Wordsmith. The additional quantitative step added to the coding process means keywords analysed in the texts are statistically significant and therefore their salience to potential

frames is higher. Open coding was then applied to the concordances in order to generate a frame matrix and identify separate frame packages.

Texas

Fig. 8 Aquifer Concordances

Concordances	Open Coding
"However, the aquifer contains a lot of water that can't really be produced in legal or practical terms. The problem is the springs go dry when the aquifer is still 95 percent full. So as long as we are going to maintain at least minimal natural spring flows for the sake of endangered species, recreational economies, downstream ecosystems, and downstream economies, then the large amount of water below the level of the springs is essentially unavailable.""	**Word Groups** - legal, practical; at least, minimal, economic and environmental language, **Grammar Use** - use of 'we', for the sake of, essentially, **Literary Devices** **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - expectation of maintaining minimal natural spring flow
"I can agree that many GCDs were created in response to movement of water from rural to urban counties; however, the motives were to prevent the unfettered pillaging of water without any regulatory constraints or concerns about the impact on local landowners and natural resources. In other words, GCDs were created to protect private property rights of every landowner, not just those who want to pump the aquifer to extinction and sell that water for a profit."	**Word Groups** - language of war/destruction **Grammar Use** - unfettered pillaging, **Literary Devices** - pump the aquifer to extinction **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - assumption of intent behind GCD's - natural resource and local landowner protection
""This is a shared resource," Granados says. "We are working on the same region, on the same aquifer, with the same amount of water. So the policy of having the biggest pump wins, that's not sustainable." Last fall the U.S. and Mexico signed an agreement about how they'll manage the Colorado River in times of intense drought."	**Word Groups** - collectivism - shared, same, same, same, sustainable (alluding to common pool resources) **Grammar Use** - use of 'they', externally placing responsibility on U.S. **Literary Devices** - idiom; having the biggest pump wins **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -

"His 24,000-acre Mesa Vista Ranch, where he has owned land since 1971, sits atop rich water deposits in a virtually untapped portion of the great Ogallala Aquifer under the Panhandle region. State law says the water is his to do with as he wishes."	**Word Groups** - rich, untapped, great (contextual language - panhandling region) **Grammar Use** - subject focus on landowner and property, **Literary Devices** - do with as he wishes (play on idiom) **Context of indirect and direct speech** - **Evidentialities** -
"The real trick is groundwater use, and the fact that there are so many more of us now." Primary threats to aquifer- dependent species are intermittent loss of habitat from reduced spring flows, water pollution, and competition from non- native, invasive species. The good news is there are efforts underway to plan for drought and wisely manage the groundwater that sustains people and wildlife, such as the Edwards Aquifer Recovery Implementation Plan."	**Word Groups** - environmental language **Grammar Use** - trick, threats, wisely, sustain **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - Threats are discussed but not supported by facts post-hoc.

Coding the concordances of the Keyword Aquifer exposes several themes and reasoning devices in the discourse. Word groups are found to be largely economic, environmental, and contextual/historic. There is also one instance where a concordance was steeped in the language of war and chaos (unfettered, pillaging.) The discussion surrounding underground water resources seems focused therefore on an economic and environmental perspective, with water resources being seen as an area of conflict. Sustainability is mentioned more through the lens of common pool resource preservation for future use, rather than environmental protection.

Through examining grammar use the relationship between environment and economic dynamics is further developed where even in instanced when environmental word groups are used people are still placed first as the subject. Moreover the resource and owners of the resource are always the focus of the sentence, with any environmental damage being a digression from the main narrative. Literary devices are focused on the relationship between pumper and resource. Evidentialities are targeted at the protection of local landowners and the resource, not the environment. The sustainable language is therefore economic in intent. Reasoning devices are

delivered through a local resource protection problem definition, with a solution being effective resource management, the danger being resource depletion/stress. No direct religious, or moral foundations are alluded to.

Fig. 9 District Concordances

Concordances	Open Coding
""Most groundwater districts are created, then spend four or five years trying to decide how to deal with the resource. This study is giving us a real step up, and it gives us data whether a district is created or not, to be able to have these arguments when other people come in and want to talk about movement of water and say it's not going to have any effect."	**Word Groups** - deal with resource, movement of water (resource use) **Grammar Use** - use of 'created'(clear intent) coupled with 'trying to decide'(clear lack of intent) use of 'these arguments', **Literary Devices** - personification of GCD's **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - when other people come in; assumption of unavoidable direct discussion
"Clay Dissler, who told the council and court he was a landowner on the outskirts of the city and who said his family first came to the county in 1895, asked wanted to know if the bill would allow' the city to use as much water as it wanted to. "I'm not against a water district. We probably need one."	**Word Groups** - water use **Grammar Use** - allow, as much as it wanted, **Literary Devices** - historical couching with the word landowner **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - a 'should statement regarding the need of a water district (modalities)
"Times Staff Writer Headwaters Groundwater Conservation District and the City of Kerrville narrowly avoided a lengthy dispute Wednesday concerning groundwater pumping limits in a Kerrville subdivision. Headwaters and the city reached an agreement after board vice president Paul Siemers proposed reducing the acreage covered by a non-city well permit, averting a reduction in the city's service area and, therefore, its groundwater pumping limits."	**Word Groups** - escalated rhetoric - narrowly, lengthy, averting **Grammar Use** - dispute, agreement, are both subjects in their respective sentences **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -
"You could pump as much as you wanted to grow' crops and so forth. "The rationale that	**Word Groups** - rationale, permitting, pumpage, (permissive language in the context

was offered for that was, it may be somewhat unusual, but it's not unheard of, but it's somewhat unusual to exempt agricultural usage from permitting by the groundwater district, but it's justified here, because, as the county judge said, the annual pumpage for irrigation in this county has always been very low."	of legislation) **Grammar Use** - juxtaposition of pump and grow, repeated use of word but (skepticism), **Literary Devices** - and so forth- idiom **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - rationale for pumping without a license, evidence for low pumpage?
"While it cannot prevent the drilling of wells outside its borders, the district could refuse to accept Richmond and Rosenberg's plan for finding alternative water supplies. "Here we have a proposal to convert to something that's not really an alternative water supply," a lawyer who represents the district, Greg Ellis, said. "It's the same aquifer. It's just 15 miles west.""	**Word Groups** -supply - resource perspective **Grammar Use** - refuse to accept - subject and object, active language **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - 'could' modality for rejection of alternative water supply plan

District was less enlightening in terms of themes, though reasoning devices are still clearly present throughout the discourse in the text. Word groups are limited to adjectives indicating escalation or conflict, and permissive words in the context of legislation and the use of the resource (no economic or environmental signalling attached). One interpretation of this focus on permissive word groups is the focus on the authority of regulatory bodies mentioned. This is to be expected given the more administrative context the concordance of District can be expected to be found in, due to its relation to procedures of governance. Grammar use is distinct in its focus on regulatory presence and its decision making and governance capacity. The subject is always related to the process of regulatory affairs, most often in this case the subject is the dispute, or disagreement, or insignificant decision making capacity.

Literary devices are limited, though regulatory bodies are personified in one instance. The frequency was not enough however to develop intent. Evidentialities relate to either the need for regulatory bodies for the protection of groundwater, or the unavoidability of a difficult or tense decision making process relating to the water management. Two reasoning devices can be taken from the text, though less clearly than the previous keyword. Problem definition is presented as

the regulatory process itself, as well as the presence/capacity/authority of the regulatory bodies. Solutions are not present, and as with the previous analysis no direct religious, or moral foundations are alluded to.

Fig. 10 Oil Concordances

Concordances	Open Coding
""“You can say whatever you want to, but there has to be regulation somewhere,” Cardwell said. “The next world war isn’t going to be about oil, it’s going to be about water.” Byron Hodge, a Del Rio attorney and a Val Verde County landowner, spoke next and said he wished to address the differences in the legislation as proposed by the city and the county.”	**Word Groups** - world war, allusion to conflict **Grammar Use** - has to be, somewhere, **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - World war about water
“Not without making at least one more big splash. At 72, the blunt-talking Dallas wheeler-dealer, whose takeover attempts terrorized Big Oil executives in the early '80s, is once again swimming upstream, bucking the currents of conventional wisdom and creating controversy. This time it is water, not oil and gas. that Pickens covets. ”	**Word Groups** - colloquial language, economic theme **Grammar Use** - object is water, subject is pickens **Literary Devices** - big splash, swimming upstream, bucking the currents, wheeler-dealer **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -
“The Brazos River is home to the Texas fawnsfoot and the smooth pimpleback, two mussel species that are candidates for the endangered species list. The new assessment doesn’t bode well for industries, politicians and river authorities hoping to avoid regulations that come with an endangered listing. If the mussels are considered endangered, FWS could set limits on how much water can be drawn from the rivers, portending immense consequences for the numerous oil and gas operators, farmers and cities that depend on the rivers for water.”	**Word Groups** - environmental, coupled with economic actors, **Grammar Use** - bode, avoid, portending, that depend, (active threat on) subjects negative impact on object **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - immense consequences without supported fact

““If you go to El Paso and go down to the courthouse and see what the most suits that are filed are, you know what they are? They’re divorces,” offers Bramblett. “You go to Odessa and Midland, that ain’t the way it is. The most suits filed there are people suing oil companies over polluting the water.” Water use in fracking operations has reportedly risen six-fold in the Permian Basin since 2011, from five billion gallons to 30 billion gallons per year in 2017. ”	**Word Groups** - coloquial tag (ain’t,) **Grammar Use** - offers, active rather than passive **Literary Devices** - rhetorical device (you know what they are?) **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -
“GCDs are required to take these potential impacts into account, not just economic considerations to the largest pumpers. Sequeira argues that groundwater should be regulated just like oil and gas. The goal of oil and gas regulation is to ensure every single drop is eventually produced and sold. That cannot be the goal for aquifers, both because we need them as a perpetual supply of water and because not only does our entire economy depend on an adequate supply of water, our very lives depend on water.”	**Word Groups** - need, depend, depend - indication for security/safety **Grammar Use** - **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context and paraphrased speech **Evidentialities** - not just economic - assumed to be standard, should be regulated (modality) Cannot be the goal, we need them

Word groups observed in the concordances of the Keyword Oil were as with Aquifer environmental and economic. In addition language in terms of war, conflict, survival, safety and security were present as it relates to the management of resources both in the present and future, with need being strongly emphasised. Colloquial language was present however it’s frequency of use was low and therefore did not provide a strong case for underlying themes, contexts or intent. The use of grammar in the concordances refined the relationship between word groups. The use of regulation as the subject with the object being war, therefore the consequence of a lack of regulation being linked to conflict stresses the importance of water resource management. Similar conflict and ominous wording placement is use in the context of environmental word groups which stress the object (environmental legislation for the protection of endangered species) damaging or threatening the subject (agriculture industry and farms.)

Literary devices consist of idioms relating to the economic aspects of water and general markets. In addition a rhetorical device is used to emphasise the frequency of libelous action against polluters of the water resource. This is neither linked to an economic, or environmental frame. Rather in context it reflects emphasis on property rights violations. Evidentialities present relate to potential consequences, and are hyperbolic; certainty of a world war about water, certainty of large economic consequences, certainty of aquifers being necessary for 'literal' survival. These devices target the need for regulation, sustainability, of groundwater through again in economic terms. Reasoning devices were presented by defining the problem as a resource security issue, with a focus on landowners and economic actors. Solutions were presented as being linked to legislation, in favor and support of economic actors and landowners long term interests. The danger to this was presented as either too much legislation causing negative impacts, or too little causing resource depletion. Effective management for economic resource security was thus the main theme. As before no religious or moral allusions were made as part of these devices.

Other keywords of the Texas comparative analysis were removed due to them being almost exclusively colocates and present in assessed concordances already, as were water and groundwater. It was therefore decided that it was unnecessary to recode for these keywords.

California

Fig. 11 Floodplain Concordances

Concordances	Open Coding
" "Our previous results have shown that the food-rich floodplains appear to act as an important pit stop for juvenile fish, where they can fuel up on their downstream journey to the sea." Unfortunately for hungry salmon, more than 95 percent of natural floodplain wetlands have been eliminated by the development of the Central Valley for farms and houses. In	**Word Groups** - eliminated, habitat endangered, juvenile, environmental group **Grammar Use** - subject is salmon while object is development, negative, **Literary Devices** - pit stop, fuel up, **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -

previous years, this experiment has shown that off-season agricultural fields can provide critical floodplain habitat for endangered fish."	
""Fish have little opportunity to reap the benefits of floodplains because they are nearly all cut off from river channels," said Louise Conrad, PhD, of the California Department of Water Resources. "The Yolo Bypass is one of the last remaining active floodplain areas in the Central Valley. Enhancing the opportunity for salmon to access and use its floodplain areas could make a huge difference for salmon while also helping to recharge groundwater and improve flood safety.""	**Word Groups** - environmental word group **Grammar Use** - use of 'while' secondary to primary goal **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** -
"The experiment suggests that floodplains on farmland can also be thought of as "surrogate wetlands" that can be managed to mimic the Sacramento River system's natural annual flooding cycle, which native fish species evolved to depend upon. Agricultural run-off water is used to flood the fields for the duration of the experiment. This recycled water fuels the floodplain food web before being flushed back into the Delta ecosystem through agricultural canals, adding to the food supply for all fish living in the system."	**Word Groups** - environmental word group **Grammar Use** - use of fuels and flushed (through agricultural canals) - again secondary **Literary Devices** - surrogate wetlands, **Context of indirect and direct speech** - direct speech in correct context, paraphrasing and indirect speech. **Evidentialities** -
""California's water supply for both people and fish will be more secure when our water policy works with natural processes in the floodplain, instead of against them," noted Dr. Katz. "This work leverages ecology as technology and points us toward efficient and cost effective real-world water solutions that support both fish and farms.""	**Word Groups** - environmental word group, **Grammar Use** - secure, but for whom? both people and fish - then, both fish and farms, equivalence, primary goal **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - current policy working against floodplains

Concordances for Floodplain have word groups relating to the environment (habitat, endangered etc.) which are used repeatedly in text. As a part of this word group words such as critical are also present placing emphasis on concepts of risk and the environmental word as a whole.

Discussion observed in the concordances therefore is focused almost entirely on an environmental perspective, where words such as secure do not relate to the security of landowners or economic actors and their resource but rather the health of the environment itself. Grammar builds on the placement of environmental word groups, subjects in sentences are the environmental attributes or denizens, objects are economic activities such as development and farming. The Subject is in several cases being negatively influenced or affected by the object, or prevented from an action due to the presence of development (ie reaping the benefits of floodplains.) When security of water resources is mentioned in the concordances the use of 'while', 'both' and 'and' is used to equate the protection of nature with the natural resource security of people who need it. Thus the focus is for the resource to be secure for both nature and human activity, with nature being given at a minimum equal importance in the discourse.

Literary devices are few, idioms were infrequent with no clear purpose or theme behind their use. It could be argued the use of 'surrogate wetlands' hints at a religious 'gaia reasoning device as this is common in environmental discourse, however with only one example of this a clear metaphor can't be established.

A significant evidentiality in the context of the environmental discussion is that current policy is working against the floodplains. This is significant as it refers to policy not as a neutral entity but rather as an antagonist, with no supporting evidence provided to this fact. Reasoning devices are environmental in perspective with a focus on human influence as the negative/problem catalyst. Problem definition centres around describing the state of environmental health and the threats it faces. Solutions offered are effective resource management for the environment, as well as human interest. The danger to this solution are the human interests themselves (agriculture, farming, development) thus indicating limiting human interest is part of the solution. There is no economic rationale, nor is there a rationale of security given for solutions. It can be argued that unlike in discussions in Texas the discussions surrounding environmental preservation do contain a moral foundation and therefore an evidentiality that plays out throughout this text (we protect salmon for the sake of protecting salmon).

Fig. 12 Protest Concordances

Concordances	Open Coding
"The Santa Cruz County Farm Bureau distanced itself Wednesday from a mailer encouraging people to protest a proposed fee for pumping water from private wells. In a two-step process, well owners or those who use their water can protest in writing or at a hearing on May 19. If more than 50 percent say no by that date, the proposal is dead."	**Word Groups** - political **Grammar Use** - distanced and 'a', piece itself distances Farm Bureau from mailer **Literary Devices** - proposal is dead, allegory **Context of indirect and direct speech** - indirect speech **Evidentialities** - proposal being dead is more than 50% say no, reaction to pumping fee
""We were shocked to see the mailer prepared in a manner in which it appears the Farm Bureau is asking people to submit a protest vote," Eiskamp said. Wednesday, in a press release, he described the Farm Bureau as" a neutral party on this issue." Though the agency decided to go to voters with the proposal in February, the Farm Bureau has yet to take a position. Eiskamp said it might make a statement within the next week. agency, which is charged with resolving groundwater overdraft in the Pajaro Valley, has been the subject of bitter disputes in the agricultural community for years."	**Word Groups** - bitter, disputes (aggressive connotation) **Grammar Use** - use of 'we', **Literary Devices** - **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - appearance of non neutral farm bureau being so clearly a shock,

The Keyword protest did not have five randomly sampled concordances available due to a high number of collocates of the same keyword. When coding for word groups we found words like 'bitter' juxtaposed with 'disputes' 'charged'(itself a significant keyword removed from analysis due to being a collocate keyword) and 'shocked.' The discussion centered on groundwater resources from the perspective of politics, though this was the context and not informed through any use of devices. The presence of a wordgroup with an aggressive or conflict related connotation informs the reader that the political discourse surrounding groundwater is not calm.

The grammar used in the concordances also clearly distances itself away from this contentious discourse with the indefinite article 'a' when referring to a controversial mailer, and 'we' when describing the shocked reaction. The subject are the actors who are in the process of reacting to what the Farm bureau has done (object.) Regulatory initiatives in this piece are never the subject, these being actors, and either the subject or additional secondary subjects in the sentence. Literary devices consist of allegorical references to policy initiatives (proposal is dead). The use of dead in the context of passing legislation communicates a finality once the proposal does not pass. If it fails then nothing is likely to come after and future legislation on the subject of private pumping is therefore not to be expected.

Evidentialities build on this as the 'death of the proposal is taken as a certainty not a likelihood. No evidence is provided for this, however there is an assumption that it will be an all or nothing situation with a permanent outcome. Another evidentiality which was enlightening was the shock the farm bureau was not neutral in the debate on pumping fees. The assumption therefore is that the farm bureau has no reason to pick a side in pumping fees on private land. Reasoning devices are sparse with no clear problem definition, except for the issue being itself contentious, or solution within the context of the proposed legislation. No religious or moral foundations and themes have been observed.

Fig. 13 Management Concordances

Concordances	Open Coding
"Forslund said DWR is required to publish guidelines on how to prepare a groundwater management plan, but hasn't done so yet. He recommended that the county continue to review the possibility of preparing the plan "with an emphasis on how it might impact river flows and watershed management" in the affected areas. He added there may be grant funding opportunities if the county gets involved "and it may be a lever to talk about what's in the	**Word Groups** - yet, review, possibility, might, may, if, may (conditionals), no economic or environmental indicators for language related to water or management **Grammar Use** - object of interest; watershed management and river flows **Literary Devices** - lever **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - "it's not a small amount" not supported by further supplied information

creeks in relation to what gets exported — it's not a small amount.””	
“A better idea, he said, would be to implement a tiered rate that would make water more expensive for the heaviest users. far worse than any fee people are going to pay,” Calcagno said. “If the Pajaro Valley Water Management Agency doesn't survive, there's nothing but trouble ahead, Monterey County Supervisor Lou Calcagno said without the agency to manage the diminishing groundwater supplies, the courts could step in and decide how much water could be pumped.”	**Word Groups** - threat; survive, trouble ahead, **Grammar Use** - subject in last sentence being agency to manage the object of diminishing groundwater supplies **Literary Devices** - step in, idiom **Context of indirect and direct speech** - direct speech in correct context **Evidentialities** - ‘could’ modality regarding court interference

Coding the concordances of the Keyword Management expand upon the problem definition and solution reasoning devices seen only in vague terms in the previous analysis. Word groups consist of conditionals such as “yet, might, may, if, may” in reference to potential management of groundwater. No economic or environmental word groups are present as perspectives or priority indications. Language of danger and catastrophe is also present (‘threat’’survive.’) Water management is presented as an area of conflict but no clear pair of problem/solution devices is linked when examining the word groups in context. Grammar shows through choice of the sentence subjects that the main focus is the groundwater management agencies, with the groundwater itself being the object upon which the agencies must act upon.

Literary devices consist of a couple of idioms however they bear no thematic attachment to water or any metaphorical device. Evidentialities are limited to a discussion on the extent of groundwater pumping, facts are not supported but the suggestion is strong that the pumping is severe. They focus on the use of the resource, as with word groups no environmental or economic perspective is added. Reasoning devices consist of two problem definitions; Inaction of the DWR (the regulatory body responsible for groundwater in Texas) and the survival of the Pajaro Valley Water Management Agency. Writ large therefore it consists of the inaction or

destruction of regulators and therefore their lack of presence. The solution as indicated in the text is simply action and survival to preserve something, with no clear path to success, a very low bar. The threat is simply the status quo. While no religious or moral allusions can be interpreted one can argue the underlying message of survival is embedded in moral foundations (ie this issue needs fixing for the sake of human life.)

As with Texas keywords of the California comparative analysis were removed to avoid colocates in concordances used for analysis as were water and groundwater.

Building a Frame Matrix

Frame Package	Problem Definition	Solution	Consequence/ danger	Moral foundations	Language choices and vocabulary
T. 1	Local resource protection is needed for peoples security	Manage resources effectively, support landowners and small businesses	Resource depletion and stress, economic loss, survivability	N/A	legal, practical, economies, shared, same, sustainable, sustain, economic vocabulary, Environmental vocabulary
T. 2	Regulatory process of groundwater management and regulatory actors are a danger to people's safety/security	Manage resources to the benefit of locals and businesses, avoid stringent environmental legislation /overregulation but also avoid resource depletion	Resource depletion, economic loss, survivability	N/A	Danger, need, depend, environmental vocabulary coupled with economic vocabulary
C. 1	Human influence impacting	effective resource management for the environment,	Dangers are agriculture, farming, land	Moral directive to protect the	eliminated, habitat endangered,

	environmental health	as well as human interest.	use, human activity	environment	juvenile, environmental vocabulary
C.2	Inaction/removal of regulatory bodies which preserve groundwater	Maintain, revitalize regulatory bodies which preserve groundwater	Maintaining the status quo	N/A	survive, trouble ahead, yet, review, possibility, might, may, if, (conditionals) Political vocabulary

Reflecting on Texas

The first frame package developed from the analysis of the Texas concordances falls neatly under a security-driven discourse. Emphasis is placed on both the security and longevity of the resource and of the landowners and economic actors involved. Solutions proposed as part of this package are from the perspective of increasing the efficiency of use for the sake of the resource itself as well as the continuing security (economic and otherwise)of pumpers. Threats and dangers also fall on both sides of the court, with both economic loss and resource loss being tied together as one. Effectively this creates an economic motive and perspective for resource sustainability through the framing of groundwater pumping as a security issue.

This fits neatly into Texas law, which approaches its groundwater management through the preservation of economic access by landowners whilst taking external pressures such as droughts and declining water levels into account. This is additionally promoted through regulatory systems in the state which delegate water and groundwater management to counties who act with a high degree if autonomy. The appeals process to create regulatory systems, which can be driven by landowners as well as by adjacent GCD's. Given groundwater regulation having such multiplicitous stakeholder involvement a security driven narrative for a commons good like

groundwater seems logical, as all actors have impact on both the regulatory process as well as it's consequences good and bad.

Despite a functional frame given the regulatory and economic context of Texas it is not translating into successful policy (Bray, 2015). The main issue one can't resolve is that in many cases the interests of the landowners as well as economic conditions of the agriculture sector can not be reconciled with the prevention of resource depletion. As Bray (2015) points out in his review of Texas groundwater law and the regulatory process this sets up the state for failure. What can be observed both in his review, as well as the reviewed literature on the history of debate on groundwater use in Texas, is that despite this inherent incompatibility the narrative itself has been widely used and accepted when examining Texas Law.
Similarly the second framing package derived from the source material in Texas pertains to security, but rather than setting up the need for regulatory processes to preserve security (both of the resource and of actors) it casts regulatory processes as a threat. The focus therefore is on either de-regulation or regulatory reform. The priority however remains unchanged, both the security of the resource and the security (economic) of the landowners and economic actors are important for they are one and the same. Environmental regulation is a danger however regulation for sustainability of long term use of the resource is a necessity for survival.

In effect this is the opposite side of the coin and shows that the frames taken from this analysis centre on two aspects of groundwater pumping, the preservation of security for actors and the resource they depend on. The frames differ only in that the regulatory process is painted as having a negative or positive effect, however the foundational assumptions of which priorities must be upheld are the same. If these can be agreed upon then discourse whilst still facing the challenge of balancing two unbalanceable needs can occur in the policy debate and attempts can be made to drive policy to meet these two demands. This may hold some explanatory power when observing reasons behind the complex regulatory network Texas uses to manage groundwater, with extensive management and measurement tools available for researches

coupled with very light pumping restrictions and laissez faire attitudes to water preservation at a local level.

Reflecting on California Frames

The first frame package from the analysis of the California concordances portrays groundwater firstly as an environmental health issue. Priority is given to the environment and the protection of groundwater security for its sake. Solutions are proposed in this package as directly targeting groundwater management such that environmental health, such (ie the health of a particular species, or a particular habitat) benefits and is secure, while couching this priority with references to human interests benefiting from regulation. Importantly human benefit is positioned as a side effect rather than primary goal. Dangers included in the package involve human activity, such as agriculture, farming, and land use. Therefore negating any clear conception of the byproduct benefits put forward as consequences to environmental regulation. If basic forms of economic activity are threats, and the regulation deals with threats, then in what form does the human benefit occur? There is therefore no clear rationale for human motivation to focus on environmental protection put forward in this package. What remains in the frame is the underlying assumption that environmental protection is a evidentiality. A moral foundation which in itself should spurr action and policy reform.

This frame fits into the Sustainable Groundwater Management Act (2014.) The new legislation approaches groundwater management with both economic and extensive environmental considerations (SGMA 2014.) It reduces or infringes upon landowners and existing pumping rights to at is considered by some to be extensive (Maven's Notebook, 2017). This legislation however is still not in effect and there is no guarantee that deadlines for its regulatory reforms and infrastructure improvements will be met (Maven's Notebook, 2017). Until the creation of the SGMA California's groundwater had for all intentions been unregulated. What is of particular note with this frame package is that it does not contain references to property rights or economic

efficiency and gain. As reviewed in the literature these are popular means by which to discuss issues surrounding groundwater pumping.

California is in both it's consumption pattern of water as well as its distribution of agricultural production similar to Texas and so similar perspectives on groundwater regulation and pumping right are to be expected. A key insight provided by this frame is tandem with observing the regulatory process in pre-SGMA law which unlike Texas did not give laissez faire pumping rights on private property, but rather restricted those pumping rights to reasonable use. Accounting for what defines reasonable use was functionally impossible however given the lack of data on pumping and water levels in aquifers. The regulatory restrictions were therefore greater in California than in Texas yet it was Texas that had the infrastructure and institutional foundations to support monitoring and enforcing groundwater restrictions.

The institutions in California were unable to enforce and effectively regulate pumping and this contextualizes the presence of the second frame developed from the California concordances. The problem in this case is defined as the inaction or removal of regulatory bodies, rather than over or underregulation. The danger is therefore framed as the danger to the existence of regulatory bodies themselves, which is itself the status quo. Regulatory bodies need to be revitalized and remade for purpose. It is critical that the frame addresses institutions rather than institutional decision making as this is conceptually a step backwards from the discourse in Texas which involves institutions as a matter of course despite strong groundwater rights advocates.

Conclusion

On the Salience of Frames

The need for institutional structures to be both well established and trustworthy is critical to their legitimacy and effective governance (E Democracies, 2013). The development of California frame packages from this analysis shows that discourse involves institutions at a surface level. It suggests that part of the reason California has struggled with it's groundwater pumping rights is a conflict over institutional existence rather than policy. In order for future water policy on groundwater to be successful in California those institutions must first pass muster in the court of public opinion before debates can effectively be had on the means and methods of groundwater preservation. If this does not occur it can make discourse difficult, as foundational assumptions carried by frames, when different, mean discourse is unlikely to result in mediation as arties are not addressing the same topic, simply the same problem.

This is because various parties are operating from different 'islands of understanding. In Texas both frames taken from the text operate along the axis of resource protection and economic security. They differ in defining how to solve the issue (more regulation vs. less.) In the case of California frames show either huan activity to be the main danger, or the status quo of institutions. This sets discourse on two seperate and non-intersecting axes, one containing human activity, the other attacking institutions. The first therefore takes institutions as a given, while the latter assumes they are not functional in their current state. In effect this constitutes two groups speaking past each other.

This mismatch in discourse raises some concerns for California's future. The SGMA having been signed into law in 2014 has set various deadlines over the course of the coming ten years. Regulators are already warning that some of these deadlines may not be feasible and actors (both small non commercial landowners and large agricultural groups) have stated that they shall strive

to comply, despite likely failing to meet deadlines (PPIC, 2018, Cantor *et al*. 2016). This is dangerous. If the SGMA fails to be enforced and if institutional legitimacy is not established and it's structures not adhered to, when for so long existing non-functionally enforceable regulation has been status quo, it gives the frame far more power in discourse in the future.

Both frames are also relevant in California's political context. Strong political pressure exists especially in urban areas, which due to changing demographics are voting blocks with the most influence, to regulate environmental health under strict conditions (Maven's Notebook, 2017). Agricultural actors whilst still making up significant portions of the California economy are finding themselves increasingly left out of the loop of influence on the policy agenda (Maven's Notebook, 2017). Dialogue and the resulting environmentally driven regulatory reforms which end up being un-enforceable under the given deadlines and therefore further reduce the legitimacy of institutions already struggling with enforcement. The fault lays in this case not specifically at the feet of the agriculture industry who in pure economic terms may not comply quickly (or simply keep the industry afloat) enough to cope with such an institutional restructuring. As Dr. Dan Howes, senior irrigation engineer at California Polytechnic State University, put it;

"So how do we solve it? We either get more water or we reduce how much we're consuming. If we reduce how much we're consuming, does that mean that we are going to lose yield overall? Is that going to be a negative to our economy in the state? Is it going to be a negative to jobs in the state? All the way down the line to the consumer, is it going to cost more for food in the future? Those are kind of the big questions." *Dan Hows, Cal Poly, 2017*

This context makes it easy for anti-regulatory frames to take hold, especially once economic impacts begin to be felts outside the industry profits in areas such as food prices. The SGMA, if fully complied with would require up to 40% of farmland to remain fallow in some areas (Caroom, 2017). The existence and awareness of an ant-institutional frame by policy makers and

political actors, instead of for example an anti-SGMA frame or frames opposing specific regulatory measures is therefore incredibly salient for long term institutional health.

Unfortunately policy makers are also in a position where they no longer have much choice but to attempt stronger enforcement to preserve California's remaining groundwater. The intense droughts over the last few years have tied the hands of political actors, with urban areas suffering heavily from reduced water consumption (PPIC, 2018, Cantor *et al*. 2016). Enforcement capacity and trust building has to therefore occur whilst anti-regulatory frames remain in play in public discourse, with the former likely exacerbating the latter. Awareness of the various perspectives given this situation is therefore made all the more important as discourse can be facilitated through reframing by policymakers and other actors to aid in stabilizing the process of regulatory reform.

Van Gorps Methodology

Unlike the steps laid out by Van Gorp, the full deductive phase was not completed for this thesis. Frames were not re-assessed nor were clustered code analysis completed. Frames were also not weighted. These processes must occur, having developed frame packages using the steps laid out in the inductive phase, over a larger sample of text. Frames can not be weighted across the body already assessed. The purpose of this thesis was to assess the presence of frames used by sub-national actors and evaluate their merits for the benefit of California's groundwater policy challenge.

The methodology as laid out by Van Gorp does however suffer from some flaws. Inductive frame analysis are due to their context specific nature and the presence of bias by coders, difficult to reproduce. The use of wordsmith did reduce this so an extent by focusing on statistically significant keywords which indicate areas the coder can focus upon, this is a general weakness with qualitative research which frameworks such as those of Van Gorp attempt to

address. The coding process in addition is very time consuming, which in the scope of a thesis makes it infeasible to use inductive coding on a larger body of text.

In defence of Van Gorps model however, vicariously therefore qualitative research, the development of a collection of frames can generate valuable insight into perspectives which exist in the policy making process. This does several things. Firstly it creates insights into alternative perspectives which for policy makers and regulators can reveal they themselves are attempting to counter the wrong frame of perspective when pushing their own agenda. This generates a broader range of targets for successful discourse such that two groups are no longer talking past each other but with each other (ie policy makers can argue against a position using the same foundational priorities as those against the position). This redefines, or perhaps more accurately defines common ground for debates which can then act as constructive to the public understanding of problems and policy development. In addition frame packages provide insight into the means by which salient political issues are covered by News Media and other actors.

Future Research, Limitations, and Recommendations

The extent to which this Thesis could generate results which can stand the test of time is strongly related to the time which it has to allow for extensive coding and a larger library of articles. The time and scope of this project are therefore linked. An initial recommendation therefore would be to use the frame packages developed as part of this thesis and weight them through deductive coding as proposed by Van Gorp over a far larger body of work. Larger inductive coding initiatives over a larger period of time would also provide more framing devices and narratives which have survived and thrived over time, as well as those that have not.

Another approach which may provide additional perspectives would be a focus on discourse between different economic actors with competing interests, such as agricultural actors or specific lobbying groups. This would identify more frames though many of these would be less

influential insight could be gained into the evolution and ‘natural selection’ of frames in order to understand what made them successful.

Despite providing valuable insight into the discourse surrounding groundwater pumping in Texas and California, as well as providing an additional explanation for California's long term policy failure more research into this approach is needed before concrete conclusions can be gathered. This in addition should be coupled with the study of more diverse media involving TV, Radio, and other sources which collect statements by actors as well as providing more avenues in to the assessment of general public discourse on the groundwater pumping political debate. Wordsmith was a clear benefit to expanding Van Gorps model as this allowed salient concordances to be picked up. A similar approach could be taken with phrases when analysing texts at a ‘big data’ scale. This thesis in sum highlights the importance of discourse analysis for effective governance and economic security, through an inductive frame analysis of California and Texas groundwater pumping debates. Frames used by sub-national actors have been generated and analyzed. There is a clear need to involve discourse analysis further in public policy research, and in cases such as that of California a thorough understanding of frames, specifically the fundamental values and perspectives which are at their core, s critical to the safety of institutions and resources.

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