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Abstract: Perceptions about water management are understudied, especially in humid regions. Yet as the population continues to grow and water demand increases, there will be a need to more closely manage water, even in humid regions. Understanding how people view water quantity, how they view paying for water supply, and how various geographic and demographic characteristics influence attitudes will be essential to managing water as a common pool resource. This project finds that among residents in rural western North Carolina there are strong correlations among water source (public supply vs. private well) and attitudes toward water management and conservation. There is a sense among these respondents that having access to an individualized water source segregates them from regional water concerns and they are therefore less likely to be willing to pay for water management or conservation measures. Additionally, those with an individualized source are more likely to believe that local or state government should not have the authority to manage what are perceived to be private sources. These results differ from a national survey, providing evidence that it may be prudent to assess attitudes locally / regionally before any attempt to implement water management or conservation policies.

Individual water: Water source as an indicator of attitudes about water management and conservation in rural regions

1. Introduction

Both popular and academic media report that water quantity is becoming a serious global concern as the population continues to grow and climate change alters current precipitation patterns. Despite this news, there remains a dearth of information on public understanding of water issues and attitudes toward water quantity and water management, especially in humid regions. The data that do exist suggest that there is a general lack of interest or concern about local water supplies both nationally (Noga and Wolbring 2013; Stoutenborough and Vedlitz 2014) and more specifically in the humid regions of the country. Participants in a 2003 focus group in Georgia reported skepticism about the seriousness of a recent drought and said that there was enough water to meet needs (Responsive Management 2003). Although concern seems to have increased by 2011, Evans et al. still found that less than half (44%) of survey respondents in Georgia believe that water quantity *is probably* or *is definitely* a problem. About 40% did say that there is a "low likelihood of their community meeting all resource needs in 10 years." In an extensive survey throughout the southeastern United States, Borisova et al. (2013) found that the majority of residents in Alabama, Arkansas, Louisiana, Mississippi, and Tennessee say that water quantity *is probably* or *definitely not* a problem where they live. Residents in Florida, Georgia and Texas were more evenly divided among those who said water quantity was *not a problem* and those who believe that it *is a problem*. Similarly, 43% of survey respondents in the Midwestern states of Iowa, Missouri, Kansas, and Nebraska said that water quantity is *not a problem* where they live. In the more humid states of Iowa and Missouri a majority said that water quantity is *not* a problem, while respondents in Kansas and Nebraska were more evenly divided among those who said water quantity is *not* a problem and those who said it *is probably* a problem (Morton et al. 2007). In the Pacific Northwest, 62% of survey respondents said that water quantity was *not* or *probably not* a problem in their community (Mahler et al. 2004).

The lack of expressed concern about the potential for water scarcity may be related to the low levels of knowledge that most people have about water systems and water supplies. Existing research about environmental knowledge finds that the average adult in the US knows very little about water (Coyle 2005). Further, public reaction to water shortages often reflects a lack of understanding about water and how it works (Smakhtin and Schipper, 2008). Cockerill (2010) found that attendees at community water education programs often had misconceptions about the hydrologic cycle and did not understand that water sources in a region may be connected hydrologically.

Existing research also shows mixed responses to how people view paying for access to water and water conservation programs. Mahler et al. (2005) found a lack of support for taxes to ensure conservation and water quality in the Pacific Northwest while a Georgia focus group supported using prices as a way to encourage conservation (Responsive Management 2003). Survey respondents in Texas did not support pricing as a conservation tool (Pumphrey et al. 2008). Although their sample size is too small to offer definitive results, Noga and Wolbring (2013) found mixed and contradictory attitudes toward pricing. Some respondents supported using price to encourage conservation, but most respondents were opposed to charging more for water generally and almost half were opposed to water restrictions. In open comments, several of Noga and Wolbring's respondents indicated that water should be free when it was abundant. At the same time 38% reported that they were willing to pay "As much as is necessary to maintain a secure water supply" for their household. A national survey in the US found that 63% of American voters are "willing to pay a little more each month to upgrade our water system" (ITT survey 2012). In California, 51% of survey respondents said they favored a proposal to address long-term water access and restore the Sacramento River delta. When told that this would cost $25 billion, however, only 36% said they would support the project (Boxall 2013).

Associated with knowledge levels and attitudes about pricing are attitudes about personal and public responsibility and behavior regarding water. Focus group participants in Georgia believe that industry and agriculture contribute more to water resource problems than individuals and there is a lack of appreciation for the collective actions of homeowners on water quantity. Additionally, these focus group participants reported distrust of state government to regulate/enforce water conservation measures (Responsive Management 2003). Delorme et al. (2003) report similar findings in central Florida, where focus group participants were reluctant to acknowledge their own role in creating water issues. People do not have an accurate sense of how much water they likely use on a daily basis (Coyle 2005; Cockerill 2010; Noga and Wolbring 2013). Additionally, Noga and Wolbring (2013) found that respondents who believe water is a private resource were more likely to say that water management is a local or individual management concern and less likely to see a need for conservation. While Jones et al. (1999) did not find significant differences in environmental beliefs between rural and urban residents in Southern Appalachia, others have found some distinctions among rural and urban resident attitudes about water scarcity and management throughout the southeast (Pumphrey et al. 2008; Borisova and Adams 2010; Evans et al. 2011). What the existing literature does not offer is insight into how a water source (e.g. municipal supply vs. private well) may influence attitudes about water quantity management.

Better understanding how people view water quantity, how they view paying for water supply, and how various geographic and demographic characteristics may influence attitudes will be essential to managing

water as a common pool resource (CPR). Ostrom et al. (1999) note that "CPRs include natural and human constructed resources in which (i) exclusion of beneficiaries though physical and institutional means is especially costly and (ii) exploitation by one user reduces resource availability for others." Gardner, Ostrom and Walker (1990) differentiate between CPR situations (i.e. the existence of water as a common pool resource) and CPR dilemmas. The latter include the additional requisites of a suboptimal outcome for the users and the existence of constitutionally feasible alternatives. These alternatives are such that "(a) a set of strategies exists in which total discounted benefits exceed total discounted costs including production, investment, governance, and transaction costs and (b), given existing rules for institutional change, there exists a necessary consensus for such a change."

For many water managers, preventing CPR dilemmas is a crucial objective. Economic and field experiments have uncovered norms that are associated with improvements in CPR use. Ostrom (1998) surveys much of this early literature and discusses the importance of reciprocity as a basis for building reputations and nurturing trust. Norms may be easier to maintain in situations where objectives are shared and deviations are easily monitored and sanctioned (e.g., small farmers sharing a water source or fishermen in a small village). Without a shared vision of conservation and sustainable resource use a situation can evolve into a dilemma or further into what Hardin (1968) described as the "tragedy of the commons" wherein the resource is depleted as users consider only their own marginal benefit of additional consumption.

A challenge for water managers is that the characteristics of CPR situations are underappreciated and therefore the potential for a situation to become a dilemma is not acknowledged. First, users do not always understand or accept that their use subtracts from what is available to others. Second, one method of 'excluding' users or limiting use of a scarce resource is via pricing. Being an essential element for life, it is neither feasible nor desirable to exclude individuals from water use, but there is evidence that under some conditions pricing can positively influence conservation efforts (Kenney et al. 2008; Zetland 2011). Moreover, water prices may affect not only how much water is used, but also *how* water is used. Water use for drinking and cooking may not change much as price increases, but outdoor uses may fall substantially. Zetland (2011) reports the price elasticity of demand for domestic consumption ranges from -0.2 to -0.4 for indoor uses from -0.7 to -1.2 for outdoor uses. Thus, a 10% increase in water rates would reduce outdoor consumption by 2 to 3 times more than indoor consumption. The corollary is that lower prices (and zero prices) can lead to what some categorize as luxury uses, such as swimming pools and bigger, greener lawns.

Municipal water is typically priced, but in many rural areas only a small fraction of households pay a unit price for water. Consequently, the common pool nature of water sources may be even more salient in rural areas where individuals may have private wells and fail to appreciate that they share an aquifer with neighbors. The perception that because a well or spring is privately maintained it is therefore a private resource is misguided. This perception may impinge on efforts to adjust policies and management strategies to address increasing stress on water resources (e.g., taxes, metering and watering restrictions). This study looked explicitly at how an individual's water source might influence their attitudes about water management.

1.1 Study Area Characteristics

The study area includes two counties, Ashe and Watauga, in western North Carolina. Located in the southern Appalachian Mountains, elevation varies from 2,500 and 5,500 feet (762 m to 1676m). This region is classified as temperate rain forest and, although the terrain influences precipitation locally, rainfall averages between 40 and 50 inches (100 and 150cm) per year (Gaffin and Hotz nd) and snowfall totals routinely reach 50 inches (130cm) annually (Ray's Weather Center). The headwaters of four large watersheds flow from these counties into three different states: South Carolina, Virginia, and Tennessee (USEPA 2014). Watauga County has a total population of about 52,000. This includes four incorporated towns, ranging in population from 192 people to 17,000 people. There are also 11 unincorporated communities in the county. Ashe County's total population is about 27,000 including three incorporated towns with populations ranging from 158 people to 1600 people. There are 17 unincorporated communities in Ashe County (U.S. Census 2010).

This region is characterized as being poorer than the rest of North Carolina. The median household income in the state is $45,215 while the median income for Ashe County residents is $33,656 and $33,148 for citizens in Watauga County (US Census 2014). Additionally, about 20% of the Ashe County population and 32% of Watauga County is classified as impoverished compared to about an 18% poverty rate for the entire state.

Historically, these counties have been characterized as politically conservative and anti-government. Additionally, a distinction between urban and rural has long marked social and political relations in this region (Williams 2002). In 2014 in Ashe County 42% of registered voters are Republican, 33% are Democrat and the remainder are Libertarian or Unaffiliated. In Watauga County, 33% are registered Republicans, 28% Democrat and 39% Unaffiliated (NC State Board of Elections 2014). In the 2008 presidential election, however, Watauga County supported Obama while Ashe County supported McCain. In the 2012 election, Romney garnered almost twice as many votes as Obama in Ashe County, with only

two very small precincts supporting Obama. Watauga County favored Romney by a narrow margin of 859 votes. The results, however, were split sharply with the largest town, Boone, supporting Obama (55% of Boone voters) and the rest of the county supporting Romney (NC State Board of Elections 2014).

2. Methods and Sample Representativeness

A survey of 51 questions, including demographic questions, was mailed in May 2013 to a random sample of 3000 residents in either Watauga or Ashe County. The surveying protocol included a primary mailing, a post card reminder, and a second mailing to all non-respondents of the first wave. The survey was closed in July 2013. From the 2413 useable addresses 714 responses were received for a response rate of 30%. Survey results were entered into SPSS for analysis. There were 194 surveys with qualitative comments included in the responses. These were transcribed into Excel and coded for reference to multiple issues, including, perceptions of water availability, conservation practices, willingness to pay for conservation measures and the role of government in water management.

The average age of respondents was 61 years, 56% were male and the average annual income was $62,000. Education levels for the two counties were 24% with a high school degree or less, 18% with some college but no degree, 10% with an Associate's Degree, 24% with a Bachelor's Degree, and 24% with a graduate or professional degree. Comparing this sample to US Census data from the targeted counties shows that these respondents tend to be older, slightly more educated, and have higher income than the general population.

In addition, 50% of respondents reported that their ancestors lived in this region, 97% are white, and 92% own their homes. According to the US Census Bureau (2014), more than 95% of the population in these counties is white and 78% of residents in Ashe County own their own homes, while 55% of those in Watauga County own their homes. The survey asked respondents to report their water source and 52% report having their own well, 12% their own spring, 19% share a well and 17% are on a municipal water supply. In Watauga and Ashe Counties, 36% and 19%, respectively, of the population is actually served by a public supply with the rest having access to a private source of some kind (Kenney et al. 2009; HCCOG 2010). The available data do not further delineate private sources into springs and private or shared wells. Figure 1 provides a map of the study area and the water source types among respondents.

3. Results

The general results from 13 attitudinal statements offer mixed messages on preferred options for water management (Table 1). For example, there is support for spending public money to acquire new water sources (statement 5) but a one-time fee on water during drought is not supported (statement 11). A

majority are concerned that drought will limit water availability (statement 13) and support limiting growth to address scarcity (statement 3) but the majority also express a preference for any water restrictions to be voluntary rather than mandatory (statement 2). There is, however, no equivocating in how these respondents feel about the government role in water management: 73% disagree or strongly disagree that the state should have authority over water supplies and 50% say that local government should not have that authority (statements 9 and 10). This differs from Stoutenborough and Vedlitz (2014) who found support for government management in a national survey, which suggests that assessing regional attitudes is important.

3.1 Water source preferences and attitudes

Parsing these data by household water source reveals distinctions among those who rely on a municipal supply or a shared well compared to those with a private well or a spring. First, except those who have a shared well, the majority of respondents would keep their current water source even if offered the opportunity to change sources. Respondents with private wells or springs are extremely likely to prefer their existing source (Table 2). For those who say that they would prefer a different source, private wells were the most preferred option.

These data suggest a preference for an individualized water source, perhaps reflecting a belief that this offers more control over the supply. It may also reflect a perception of reduced cost, as those currently on a municipal supply receive regular water bills while those on wells do not. There may also be latent concerns about water quality and a perception that wells and/or springs are 'better.' Those on shared wells may suffer from the 'worst of all worlds' in that they are responsible for managing their water source, but not as individuals; they must directly deal with others in managing the source. In contrast, those on a municipal supply have no direct management responsibility, but they do pay a bill and have no control over the supply. They are, therefore, well aware that they are dependent upon others to ensure a consistent, clean water supply and that they share the water source with others.

Differences in general perception of water management based on an individualized compared to a public water source is also apparent in how these groups responded to several of the attitudinal questions (Table 3).

Respondents with individualized water sources (private well, spring) are less likely to support metering, spending public money, and having local public official authority over water supplies. This reinforces the suggestion that there is a sense of control and a sense that the water is a private resource among these respondents. The individual water holders are also the most confident in their existing water source to

provide for all of their needs and least likely to support paying additional fees during a drought. Among the qualitative comments, 31 people explicitly noted that they have an individualized source and many of these subsequently concluded that this segregated them from the management or conservation issues featured in the survey.

> "My own situation (w/a private well) puts my household and me at a distance from many of the controversies associated w/ water supply. But I am still concerned about this issue and sympathetic w/ a conservation approach."

> "While I have a private spring box I believe that water conservation is important to everyone including myself and others who have a spring for water usage. I believe water usage is on the rise and freshwater availability is on the decline."

> "It would have been easier to answer some of these questions if it stated that they applied to municipal water, private wells on private property or both. Private wells where no municipal water is available should be considered differently."

> "I was concerned about the water problem, so I bought a small cabin with gravity fed spring water and wood burning stove."

One respondent returned the survey but did not complete it, noting on the first page that the survey was "not applicable – have own well." Several respondents left attitudinal questions blank and noted "private well" or "own well" in the margins, with the implication being that because they have a private source, these questions about managing water were not relevant to them. Several respondents also noted specifically that metering was not relevant or not feasible for anyone not on a public water source.

Given these responses, it is likely that others had a similar reaction, but simply did not respond at all to the survey. These data reflect a lack of understanding of common pool resources and the extent to which a perceived individual water source is segregated from other water users.

3.2 Attitudes toward government involvement

As Table 1 shows, there is a general lack of support for government involvement in water management. Those with individualized water supply are especially reluctant to support measures perceived as impinging on individual management authority (Table 3). Qualitative comments included on surveys provide additional depth to making this distinction. Of these comments, 61 were about government

involvement in water management with most concluding that less government is better. Additionally, 14 people explicitly noted that government had no role in water management on private property. Representative examples include:

> "For persons who own their land and use private wells or springs on their own property…If wells and springs are maintained properly - commissioners and government should leave them alone!! Most of mountain people who have had access to their own water supplies have knowledge needed to protect and maintain these water sources. We have for years. Most of problems are in town and city supply. Persons with private water supplies should NOT have to pay for town."

> "I don't think that people who have springs or private wells should have to pay any "water fees" because these people have paid to have a well dug or maintained their spring. The gov or county isn't going to pay for things that stop working e.g. well pump. I conserve my water and I don't want co/state/gov telling me how much water I can use."

> "My well gives pure, good water. I take care of my family's water needs. I resent it when anyone says I have to pay for THEIR water needs, or when they try to regulate my land use for THEIR benefit."

> "I personally take water conservation seriously. I also strongly believe that water that originates on my property is mine to manage and use. That it is not the role of the federal government to claim jurisdiction over any water that originates on private land. This also includes state or local government as well. The private land owner has an obligation to protect his H20 supply and manage it in a responsible manner."

There was a single comment relevant to sharing a well, where the respondent noted that the survey, "does not consider residents who share wells in neighborhoods w/ POAs. I pay one flat fee for my water (annual). Testing, maintenance and treatment conducted by POA - contracted out. As a single person, flat rate is same for me as it is for families. They have more to laundry, wash, cook (more water use). I feel water fees should be set accordingly."

There were no similar comments made relevant to municipal supplies. However, 20 respondents did express concern about growth in the municipal areas and/or with the local university and the impact this has on driving increased water demand. These responses may reflect some sense of understanding that water use by one entity (e.g. a city) potentially affects others. The comments, however, do not seem to

reflect an understanding that the cumulative impact of many individual wells may also affect the water supply.

3.3 Perceptions of the physical water supply

Respondents with springs were most likely to say that there is less water available now than 10 years ago and least likely to say that they did not know whether available water had changed (Table 4). Looking to the future, those with shared wells or springs are much more likely to express uncertainty about future water availability. When asked where they receive information about their water source, those with springs were most likely (62%) to say that they monitored their source personally. Therefore, these respondents are likely more familiar with the flow of their spring and know its history and/or variability and hence are less comfortable predicting future conditions. Conversely, half or more of respondents with private or shared wells reported that they do not receive information about their supply from any source. Although neither of these groups claims to be well informed, those with shared wells are more likely to say that they do not know about water conditions, past or future. This may reflect recognition that they do not have sole control over the use of their source and this increases the uncertainty. Not surprisingly, 61% of those on a municipal supply report that their utility is the primary source for information. Those on municipal supplies who report that there will be more water in the future may be in communities that have recently acquired a new supply and therefore the information they are receiving about the supply indicates more available water. It may also reflect a confidence in the utility to ensure that more water is available to serve any increased demand.

3.4 Paying for public conservation measures

To further explore the influence of a respondent's water source on their attitudes about water management, we developed a contingent valuation scenario on a county-wide water conservation policy. Respondents were given this statement:

> *Suppose that to implement water conservation measures county residents would pay a one-time payment of $A per household in higher county taxes. The money would be used to provide rebates to residents for the purchase of low flow toilets or rain barrels to help save water at home. The money would also be used to re-vegetate creek banks and install permeable pavement where feasible. These measures reduce runoff from storms and help with recharging the groundwater supply. The goal of the program is to provide more water security in the county and to ensure a more stable water supply that can ease stress during droughts. Suppose that this proposal to approve the tax and provide conservation measures will be on the next election ballot. Remember, if the proposal passes you would make a one-time payment of $A in higher taxes and you would have $A less to spend on*

other things. Also remember that if the referendum passes the conservation measures would be implemented and more water would be available in your county during times of drought.

Within the survey $A took on the randomly assigned values of $5, $20, $40, $80 or $150. We asked respondents how they would vote on this proposal with three choices FOR, AGAINST or DON'T KNOW. One problem that arises when coding dichotomous choice contingent valuation questions is how to address "don't know" responses. We follow the conservative approach and code all "don't know" responses as "no" responses (Groothuis and Whitehead 2002; Caudill and Groothuis 2005).

In the contingent valuation scenario the qualitative variable *yes* is equal to one if the respondent answered FOR. Table 5 shows four logit specifications on the likelihood of a *yes* response. In the first specification we include only water source as an explanatory variable, in the second specification we include attitudinal dummy variables created from attitudinal questions in Table 1. Each dummy variable is coded as *yes* if the respondent either agreed or strongly agreed to the attitudinal question. The third specification includes both water source and the attitudinal dummies. The fourth specification includes demographic variables as well as both the water source variables and attitudinal dummies.

We find that for specification 1 water source matters. Individuals who have either municipal water supply or a shared well are more likely to vote yes on a public conservation policy than an individual on a private well, which was the excluded category. Individuals with springs are not statistically different than individuals with private wells. Our results suggest that people with their own well or spring perceive the resource as private while individuals with municipal water or a shared well perceive the resources as collective.

Specification 2 includes only the attitudinal dummy variables. Respondents who either agree or strongly agree to attitudinal statements: 5 - **Public money** should be used to develop new water sources; 7 - It is important to **meter** water use; 8- Any **development** decision should include assessing the impact on water; 9- **Local** public officials should have the authority to make water management decisions; and 11 - During serious droughts I would support a one- time **fee** assessment, all are more likely to vote yes on the public water conservation proposal. We also find that respondents who either agree or strongly agree to attitudinal statements: 2 -Household water restrictions should be **voluntary** and 6 -In water planning the health of the **economy** is more important than protecting the environment, are less likely to vote yes on the referendum on public conservation measures.

Specification 3 includes both water source and the attitudinal dummy variables. These results show that the influence of all attitudinal variables remain the same in sign and statistical significance, while the influence of water source becomes statistically insignificant for municipal water but remains positive and statistically significant for respondents with shared wells. Our analysis suggests that once attitudinal differences are controlled, only individuals with shared wells are more likely to vote yes on a public conservation measure. This might indicate that individuals with shared wells feel (or fear) water scarcity more than respondents with a different water source. This aligns well with the results in Table 2 showing that shared wells are the least preferred of all sources.

Specification 4 includes water source, the attitudinal dummy variables and demographics for additional controls. The results reveal that the influence of attitudinal dummies does not change, but the influence of being on a shared well becomes statistically insignificant. When both attitudinal and demographic variables are included water source does not affect the probability of voting for public conservation measures. This suggests that water source influences people's attitudes towards water but does not influence the likelihood of voting yes directly.

Again, the qualitative comments written on the surveys offer additional insight. There were 34 separate comments made about the conservation tax question with most of these being short notes emphasizing their negative response by writing, 'NO' or a similar anti-tax sentiment. Among the more expansive comments, three expressed support for the idea; another six expressed support for conservation, but not necessarily a tax; five stated their lack of faith in government to implement such a program; seven expressed a reluctance to pay for others; and two stated it is irrelevant for those with their own well.

4. Discussion/Conclusion

Overall these data suggest that having an individualized water source is a strong indicator of attitudes toward water management and conservation. Generally, those with private wells or springs do not see themselves as integrated and/or affected by water management issues beyond their individual source. Subsequently, they are less likely to welcome government management and do not support paying fees or taxes to support water conservation or other management efforts. Many of these individuals do, however, express an awareness of the need for conservation and confidence in their ability to conserve to protect "their" resource. Those on a municipal supply seem to have a greater sense of water as a shared resource and hence are more likely to support various management measures, including paying for conservation approaches. This is further enforced by the data showing that those on shared wells are a unique group, as they have a responsibility for ensuring their own water supply, but do not have sole authority over that supply. This seems to generate a greater sense of uncertainty about their water source and water

conservation. This aligns with existing research on community water management efforts in the developing world. Vasquez (2013) found that urban residents in Guatemala preferred municipal and private water services and did not value community-managed systems. Harvey and Reed (2007) find that community management is highly problematic and "Just because a community owns a facility does not necessarily mean that it will acquire a sense of responsibility for its management, nor does it guarantee a willingness to manage or pay for its [operation and management]."

These results raise concerns about how successful any attempt to manage water as a common pool resource might be. As long as people perceive that water can be a private, individualized resource, there will be little support for generalized programs to protect or ensure a future water supply. The fact that the most individualized water sources are also the most preferred sources reinforces the findings that there is not an appreciation of water as a common pool resource. In the region studied, the strong anti-government sentiment exacerbates the perceived private vs. public dichotomy. Our work also supports the need to do local and regional assessments, as these results differ markedly from a national survey on public attitudes about water management and drought. Stoutenborough and Vedlitz (2014) found that among about 2600 respondents throughout the United States, there was expressed support for local and state government to manage water resources and support for shifting water from rural areas to cities. Clearly, this is not the case in western North Carolina. Additionally, in humid areas there is not an immediate concern and hence no serious pressure to reframe the public perceptions about water resources. As the population continues to grow, however, and water demand continues to increase, the perceived ability to segregate water into private and public sources may pose serious consequences to water management and conservation efforts in this region.

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Table 1: Responses for all attitudinal questions. Scale is 1-4 with 1 being strongly disagree (SD); 2 being disagree (D); 3 being agree (A); and 4 being strongly agree (SA).

Statement	Mean	Std Dev	D/ SD	A/ SA	DK
1. Water **conservation** is an issue that I have thought about frequently in the past year. (n=702)	2.9	.833	27%	66%	7%
2. Household water restrictions should be **voluntary** rather than mandated by the government. (n=702)	3.1	.866	19%	77%	5%
3. Community **growth** should be limited to manage water scarcity. (n=696)	2.9	.866	25%	68%	7%
4. I am **satisfied** that my current supply provides sufficient water for my use. (n=705)	3.4	.599	3%	96%	1%
5. **Public money** should be used to develop or acquire new water sources. (n=692)	2.9	.820	22%	68%	10%
6. In water planning the health of the **economy** is more important than protecting the environment. (n=692)	2.0	.884	24%	71%	6%
7. It is important to **meter** water use so that we know how much water we are using. (n=699)	2.8	.810	27%	64%	9%
8. Any **development** decision should include assessing the impact on the water supply. (n=695)	3.4	.564	7%	92%	3%
9. **Local** public officials (city/county) should have the final authority to make decisions about how our water supply is managed. (n=696)	2.3	.892	50%	40%	10%
10. **State** public officials should have the final authority to make decisions about how our water supply is managed. (n=697)	1.9	.762	73%	17%	9%
11. During serious droughts, like the one in 2007/2008 in North Carolina, I would support a one- time **fee** assessment on my water use. (n=696)	2.0	.870	65%	27%	8%
12. There is **enough water** in the mountains of western North Carolina to meet future needs for all the people and business for the next 25 years. (n=704)	2.6	.860	24%	38%	39%
13. I am concerned that **drought** will limit the amount of water available to me or my community (n=702)	2.7	.775	32%	58%	11%

Table 2: Cross tabulation of respondents self-reported water supply source and responses to the survey question: "If all of the following sources were equally available to you for your household supply which would you prefer?"

	Water Supply preferred*			
	Municipal	Private well	Shared well	Spring
Water supply have				
Municipal	59%	22%	2%	13%
Private well	9%	74%	1%	14%
Shared well	22%	45%	25%	5%
Spring	6%	14%	1%	77%

*p<.01

Table 3: Cross tabulations of responses to attitudinal questions by water source. Question scale included Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) and Do Not Know (DK)

Statement	**Municipal**	**Private**	**Shared**	**Spring**
2 conservation voluntary*	25% SA 39% A 20% D 9% SD	39% SA 41% A 12% D 5% SD	37% SA 37% A 16% D 5% SD	44% SA 38% A 4% D 6% SD
4 sufficient water**	35% SA 59% A 3% D 3% SD	56% SA 47% A 1% D 0% SD	37% SA 55% A 4% D 1% SD	57% SA 37% A 2% D 4% SD
5 public money*	24% SA 57% A 8% D 5% SD 6%DK	16% SA 49% A 17% D 9% SD 10% DK	23% SA 47% A 16% D 5% SD 9% DK	10% SA 46% A 22% D 5% SD 17% DK
7 meter**	34% SA 56% A 3% D 4% SD 3% DK	11% SA 45% A 26% D 8% SD 10% DK	21% SA 54% A 12% D 3% SD 10% DK	10% SA 31% A 35% D 10% SD 14% DK
9 local public officials*	7% SA 46% A 29% D 9% SD 9% DK	6% SA 31% A 32% D 22% SD 10% DK	9% SA 36% A 29% D 14% SD 12%DK	1% SA 20% A 35% D 26% SD 11% DK
11 drought pay**	9% SA 33% A 31% D 21% SD 6% DK	2% SA 17% A 38% D 34% SD 9% DK	5% SA 31% A 34% D 24% SD 6% DK	0% SA 14% A 25% D 16% SD 15% DK

*p=.015 ** p=.001

Table 4: Percentage of respondents indicating the status of their water supply in the past 10 years and predicting the status for the next 10 years.

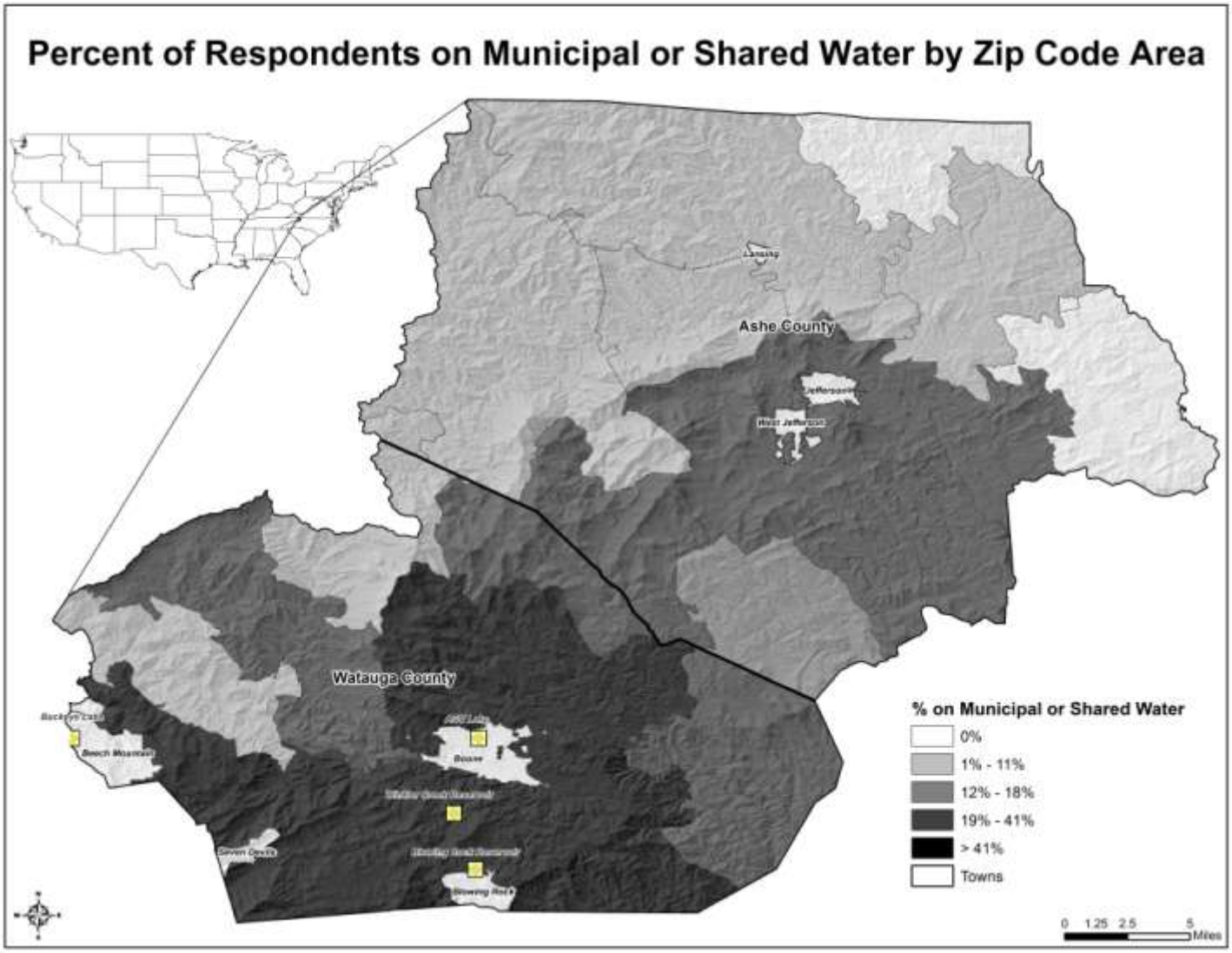
	Perception of water supply*							
	No change		**More water**		**Less Water**		**DK**	
Water Source	Past 10 yrs	Next 10 yrs	Past 10 yrs	Next 10 yrs	Past 10 yrs	Next 10 yrs	Past 10 yrs	Next 10 yrs
Municipal	32	22	6	11	22	31	40	36
Private Well	36	25	5	2	23	34	36	39
Shared Well	39	25	2	4	13	27	45	45
Spring	35	22	6	1	36	33	23	46

*p<.01

Table 5: Determinants of Voting for Public Conservation Policy

Variable	(1)	(2)	(3)	(4*)
Constant	.9725 (.00)	-1.392 (.04)	-1.535 (.03)	-2051 (.05)
Log WTP Bid	-.386 (.00)	-.429 (.00)	-.437 (.00)	-.452 (.00)
Spring	-.436 (.12)		-.108 (.74)	.076 (.82)
Shared Well	.863 (.00)		.547 (.03)	.423 (.11)
Municipal Water	.750 (.00)		.164 (.60)	-.006 (.98)
C1 Conservation		.323 (.14)	.333 (.13)	.300 (.19)
C2 Voluntary		-.651 (.00)	-.641 (.00)	-.586 (.01)
C3 Growth		.219 (.33)	.226 (.33)	.286 (.23)
C4 Satisfied		.662 (.15)	.752 (.10)	.759 (.12)
C5 Public money		.561 (.01)	.560 (.01)	.571 (.01)
C6 Economy		-1.127 (.00)	-1.153 (.00)	-.968 (.00)
C7 Meter		1.332 (.00)	1.268 (.00)	1.189 (.00)
C8 Development		.886 (.04)	.869 (.05)	.910 (.05)
C9 Local		.427 (.03)	.408 (.04)	.385 (.07)
C10 State		-.344 (.19)	-.324 (.22)	-.142 (.60)
C11 Fee		1.06 (.00)	1.01 (.00)	.910 (.00)
C12 Enough water		.075 (.72)	.053 (.80)	.136 (.55)
C13 Drought		-.160 (.46)	-.121 (.57)	.006 (.97)
Log Likelihood	-420.694 (.00)	-336.459 (.00)	-333.841 (.00)	--318.627 (.00)

N=651 *specification (4) includes controls for income (+ and significant), education dummies (+ and significant), gender (female + and significant), county (insignificant), home ownership (insignificant), and a missing income dummy (- and significant). The missing income dummy variable controls for individuals who did not report their income in the survey.


Percent of Respondents on Municipal or Shared Water by Zip Code Area
Ashe County
Watauga County
% on Municipal or Shared Water
0%
1% - 11%
12% - 18%
19% - 41%
> 41%
Towns
0 1.25 2.5 5
Miles