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Prioritization of Scientific Sources of Water Information: The Effect Knowledge, Beliefs, and Political Identity

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Abstract

Scientists are reported to be more trusted than other information sources; yet, on essential water facts, people sometimes reject what they perceive water scientists to believe in favor of other belief determinants. This study examines the factors that affect the difference in people's stated willingness to reconsider their water beliefs in response to information provided by scientists relative to information provided by other sources. Regression analysis of responses provided by 806 Florida and Georgia residents found water science knowledge to be a consistently strong influencer of the gap in reliance on scientific information providers relative to other sources. This result is notable given criticisms of the knowledge deficit model. Pre-existing water beliefs had varying levels of influence, and political identity, which might have functioned as a decision heuristic, had little statistically significant effect. The study additionally found water science knowledge and water beliefs to not be strongly related. Higher scores on a water science knowledge assessment were not necessarily an indicator of accurate and knowledge-congruent water beliefs. Moreover, scientific water knowledge and water beliefs had different effects on participants' reliance on scientific information sources.

Keywords

messenger, communicator, source, acceptance, rejection

Cover Page Footnote/Acknowledgements

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Introduction

Communication of scientific water facts is often intended to increase the public's understanding of water issues and, accordingly, to increase their water protective behaviors. Americans' low water science knowledge scores are evidence that building water literacy is difficult (Hubbard, 2020; Lamm et al., 2015; NEETF, 1998, 1999; Robelia & Murphy, 2012). Yet, even when such efforts are successful and people *understand* water science, they do not necessarily *believe* it. In the Floridan Aquifer region, for example, some residents directly indicate that they personally believe the opposite of what they understand water scientists to believe on water-related topics (Hundemer et al., 2021). The present study examines factors that affect residents' perceived willingness to change their water beliefs based on information provided by scientists as well as information provided by less scientific institutions, such as the media and interest groups. The study posits that while the words of scientists influence the public's water beliefs, other information sources are also influential and can reduce the impact of scientists' messages.

Perceived Trust in Scientists

A person's trust in the source of information affects their judgements about the information itself, including whether the information should be believed (Metzger et al., 2010; O'Keefe, 2016). Consistently, nationwide polls identify scientists as either the most trusted or among the most trusted sources of information (Edelman, 2022; Li & Qian, 2022; Raine et al., 2019). The annual Edelman Trust Barometer (2022), for example, identifies scientists as more trusted than business leaders, national health authorities, journalists, local community members, and government leaders. Similarly, the Pew Research Center finds higher confidence that scientists will act in the best interest of the public than religious leaders, college/university professors, journalists, business leaders, and elected officials (Raine et al., 2019). On nature-related topics, scientific organizations are reported to be more trusted than the government, media, and interest groups (Wilkins et al., 2018).

At least as measured in polls, trust in scientists is relatively high, but the polls also reveal that trust is declining across a broad range of information sources. Since early 2020, trust in scientists has decreased, along with trust in all other institutions measured by the Pew Research Center (Raine et al., 2019). Moreover, the decline is not evenly distributed across the population. Specifically with regard to trust in scientists, the decline is substantially greater among Republican respondents (Kennedy et al., 2022). This partisan difference was similarly reported in a New Hampshire study examining trust in scientists as a source of information about environmental issues (Hamilton, 2014). In the study, a 23 percentage point trust difference was found between Democratic and Republican respondents (Hamilton, 2014). Thus, while trust in scientists is generally higher than other information sources, the trust gap (Priest et al., 2003) – the difference in trust levels between scientists and alternative information sources – varies by audience.

The generalizability of results from broad surveys of trust is limited not only by differences in perceptions across the political spectrum, but also by the structure and constraints of polls. Most of the polls referenced above are void of the environmental, social, and economic contexts in which scientific information is introduced. While scientists may be trusted as a general concept, the context of water issues, regional histories, stakeholder priorities, and other factors can moderate that trust. In the US Midwest, for example, trust in information sources varies across watersheds and across respondent types within watersheds (Mase et al., 2015). These limitations affect trust in scientists as well as trust in the information sources they are compared against. Polls are also limited by their lack of specificity. For example, when trust in national news and social media is assessed, there is not typically any specification of *which* national news or *which* social media the poll is referring to (Edelman, 2022; Liedke & Gottfried, 2022). As a result, respondents may specify relatively low levels of trust in media because of their lack of trust in the media other people consume, even if they have high trust in the media that they personally consume. Furthermore, responses to polls can be affected by social-desirability bias that motivates participants to respond in a manner that is positively viewed by others (Krumpal, 2011).

Psychological Factors Affecting Reliance on Information Sources

Trust operates as a heuristic, or shortcut, for people to evaluate the veracity of information (Eagly & Chaiken, 1993; Kahneman, 2011). Because it is a difficult and time-consuming task to collect, analyze, and assess information, particularly on complex topics, people regularly rely on alternative methods to determine what they should believe (Eagly & Chaiken, 1993; Kahneman, 2011). Using trust as a heuristic, people do not need to evaluate the science supporting water information; instead, they can simply consider the source – if they trust the source, they may believe the information on that basis alone. Essentially the person is replacing the difficult question of, "*is this information true?*" with the simpler question, "*do I trust the source?*" (Kahneman, 2011). This behavior is reflected in research that finds people are more likely to believe climate change messages issued by scientists if they also indicate that they trust scientists on environmental topics (Malka et al., 2009). Although trust can be a powerful decision-making heuristic, it is only one of many psychological processes affecting reliance on the information provided by scientists and other sources.

While people are sometimes motivated to adopt scientifically accurate beliefs, they can also be motivated to adopt beliefs that align with their social groups. Social identity theory posits that membership in a group or category of people – such as a profession, an interest group, or an ethnic group – contributes to a person's sense of who they are, their sense of belonging, and their self-esteem (Tajfel & Turner, 1986; Turner & Oakes, 1986). Therefore, people strive to be seen by themselves and by others as legitimate members of their valued groups. The perception of legitimacy in a group depends in part on engagement in behaviors and the possession of beliefs that align with others in the group (Tajfel & Turner, 1986; Turner & Oakes, 1986). Capitalizing on this desire to conform with one's groups, some water programs have successfully increased water conservation through communication that highlights the water protective actions taken by others who are similar to the communication recipient (Lede et al., 2019; Valizadeh et al., 2022). Although this desire to conform can prompt water protective behavior, it can also lead to the rejection of scientific information. Climate science, for instance, is shown to be accepted or rejected based on the social acceptability of the ideas and the group identity of the information communicator (Esposo et al., 2013; Fielding & Hornsey, 2016; Hornsey, 2008). Similarly, an individual who may otherwise rely on information provided by a water scientist, could be motivated to reject that information to align with others in their groups.

Political affiliation is one motivator of group-congruent behaviors and beliefs. Many studies find that political identity prompts selective information exposure and processing

(Huddy, 2001; Huddy & Bankert, 2017; Kahan, 2015b; Knobloch-Westerwick & Meng, 2009). Liberals and conservatives consume different media based on the media outlet's alignment with their group ideals (Mitchell, 2014), and seek to align their views with similar others while distancing their views from the perceived opposition (Tajfel, 1982; Turner et al., 1987). As a result, liberals and conservatives are poised to respond differently to water information depending on the source. For example, liberals and conservatives have been found to change their sentiment on news reporting when the source is experimentally changed (Blom, 2021). Likewise, perceptions of a scientist's expert status vary greatly depending on the perceived alignment between the scientist's statements and message recipient's political orientation (Kahan, 2017).

The content of messages can additionally prompt rejection of an information source. Cognitive dissonance theory posits that the possession of conflicting beliefs, attitudes, values, or behaviors causes mental discomfort. As a result, people seek consistency to reduce this psychological stress (Festinger, 1962). A person who highly values the environment, for example, may find it mentally distressing to learn that their lawn watering routine causes environmental degradation. The distress occurs because their behavior conflicts with their values – it is dissonant. A person in this situation can resolve the dissonance, and the associated discomfort, by changing their water use practices. In fact, pointing out these discrepancies can be an effective strategy for promoting water conservation (Dickerson et al., 1992; Taylor et al., 2017). But instead of changing their behavior, people can also resolve their dissonance and discomfort by refusing to believe that their behaviors cause environmental degradation (Festinger, 1962). To protect oneself from feeling like a hypocrite, people can reject accurate scientific information from sources they might otherwise rely upon (Festinger, 1962).

There are many theories that consider the role of values in decision making including moral foundations theory (Haidt, 2012), group-grid cultural theory (Douglas & Wildavsky, 1982), and value-beliefs-norm theory (Stern, 2000). At their core, however, each theory asserts that people are motivated to make decisions that align with their values. Water science, while ideally objective, is often used by policy makers and others to promote value-laden programs and policies with ecological, economic, and social implications. This association between water science and valued outcomes can affect information processing. For example, to the extent that a person recognizes and positively views the social actions that could result from water science, they may be more likely to believe the science. However, values can also promote disbelief. If a person recognizes that a piece of water information could be used to promote programs or policy that are contrary to their values, they may engage in solution aversion and reject the science as a means of preemptively rejecting the action that could stem from the science (Campbell & Kay, 2014). Conservatives who typically favor less regulation (Day et al., 2014; Kidwell et al., 2013; Wolsko, 2017; Wolsko et al., 2016), for instance, could be adverse to water science that suggests the need for new water policies.

Demographic Considerations

Beyond psychological factors, prior studies find that demographic factors affect a source's influence. A study of communication on nature-related topics found variations in reliance on information sources based on education, race, age, and rural/urban residence (Wilkins et al., 2018). In an analysis of survey data from 1974 to 2010, education was associated with increased trust in science (Gauchat, 2012). Regarding media reliance, younger adults are found to be less likely to trust or follow the news than older adults, and more likely to get their news from online sources including social media (Mitchell et al., 2016). Trust in news media has also been found to be higher among females and African Americans, and lower among those with higher levels of education (Brewer & Ley, 2013).

The Difference Between Knowledge And Belief

Prior studies have often confounded belief and knowledge (Kahan, 2015a); therefore, this study distinguishes between the two. To illustrate how the two variables can be confounded, consider a survey that asks participants whether human induced climate change is occurring. A respondent may know that the majority of scientists agree that this statement is accurate, but they may not personally believe it to be true (Kahan, 2015a). How, then, is this person to answer the question – with their knowledge or with their belief? The researcher does not know whether the respondent relied on their belief or knowledge to answer the question and, consequently, the findings of such a study can be misleading. If the researcher aims to measure belief, they should directly ask about the respondent's beliefs. If the aim is to measure knowledge, they should ask the respondent their perceptions of what climate scientists believe (Kahan, 2015a).

Knowledge and beliefs are distinct constructs with the potential to affect people in different ways. The influence of knowledge is often discounted because of its association with the deficit model of communication. The model, which posits that with more scientific literacy people will make more scientifically-informed decisions (Miller, 1983), is widely criticized as an overly simplistic representation of human behavior (Ecker et al., 2022). While it is now abundantly proven that knowledge is not the only (or primary) influencer of human behavior, attitudes, and beliefs, the role of knowledge should not be dismissed. Many studies find knowledge to be a factor affecting decision making on scientific and environmental topics (for example, Owens, 2000; Sturgis & Allum, 2004). In addition, water science knowledge may moderate other decision influencing factors, such as values. For example, a person with knowledge of the relationship between water and the things they value (economically, environmentally, or socially), may behave differently, have different attitudes, and adopt different beliefs than a person without such knowledge (Dewey, 1916; Fischer, 2000).

In contrast, belief is directly connected with each of the psychological factors discussed earlier. People tend to trust those who they perceive to share their values and beliefs (Tajfel, 1982; Turner et al., 1987). Therefore, the information sources that a person relies upon depends on what they already believe (Tajfel, 1982; Turner et al., 1987). Cognitive dissonance has a similar effect – the desire to minimize dissonance motivates people to maintain existing beliefs or only adopt new beliefs that are consistent with what they already believe (Festinger, 1962). Although measurement issues have, at times, muddied our empirical understanding of the distinct effects of knowledge and belief, each has the potential to influence people's attitudes, behaviors, and information acceptance.

The distinction between knowledge and belief is more than theoretical – it has practical implications for science communicators. While knowledge deficits can be directly addressed through science education, efforts aimed at modifying a person's beliefs are both practically and ethically complex (Priest, 2018; Smith & Siegel, 2004). Beliefs are a product of many interacting individual and cultural factors and, therefore, changing them requires more strategic interventions than science education alone (Dahlstrom & Ho, 2018; Priest, 2013, 2018). Strategic approaches are not only more difficult to implement, but they also risk becoming coercive and infringing on free will (Dahlstrom & Ho, 2018; Priest, 2013, 2018). These challenges are beyond the scope of this manuscript but are inherent in the decoupling of knowledge and belief.

Research Objective

Each of the factors described above can influence the processing of water information, but none offers a clear expectation for the degree to which water beliefs are susceptible to influence, nor the communicators that can successfully exert such influence. This study aims to clarify both. The overarching objective of this research is to determine the perceived reliance upon scientific water information sources relative to other sources, and how their influence varies based on the information recipients' water knowledge, preexisting water beliefs, and political identity. The analysis focuses on three research hypotheses:

H1: Participants will perceive themselves to be more reliant on information provided by scientists than other sources including the media and interest groups.

H2: There will not be a strong relationship between water science knowledge and belief. Specifically, water beliefs that are both scientifically accurate and aligned with perceptions of water scientists' beliefs will not be associated with substantially higher scores on a water knowledge assessment.

H3: Knowledge, belief, and political identity will each significantly affect perceived reliance on science-producing information sources relative to other information sources. Specifically, knowledge and belief will be associated with a significant difference in perceived reliance on scientific institutions (scientists, health organizations, and college/university science professors) relative to the media (local news, national news, social media), interest groups (business leaders, agricultural groups, and environmental groups), and other information sources (the military, elected officials, and religious leaders).

Regional Water Context

This study was conducted with residents of Florida and Georgia, two states with a common reliance on the Floridan aquifer system (Hodges et al., 2014, Marella and Berndt, 2005). Displayed in Figure 1, the Floridan aquifer system is the primary freshwater source for Florida and South Georgia, providing drinking water for approximately 10 million people (Marella & Berndt, 2005), maintaining unique ecosystems, and supporting major agriculture and tourism operations. Yet, population and industry demands on the aquifer are affecting water quality and availability, along with the aquifer's capacity to meet competing societal needs (Hundemer & Monroe, 2021; Sullivan & Monroe, 2021).

The quality and quantity of aquifer water is disproportionately affected by land use in the aquifer's unconfined regions – those areas where there is no protective clay layer limiting the movement of water and contamination from the surface to below ground (Cooper & Monroe, 2021). Particularly in these areas, human activity such as land fertilization and septic systems can impact groundwater and, consequently, the many rivers and springs fed by the Floridan aquifer system (Cooper & Monroe, 2021). Due to increased nutrient levels, many Florida springs exceed the state's ecosystem-protective numeric nutrient criteria (FDEP, 2010, Katz, 2004, Katz et al., 2009). High nutrient concentrations have also been recorded in Georgia rivers where there are fewer nutrient regulatory standards (Allums et al., 2012, FDEP, 2010, FDEP, 2012, Hallas and Magley, 2008). These characteristics of the Floridan aquifer system informed selection of the water topics examined in this research.

Figure 1

Extent of the Floridan aquifer system. Area south of the black line is underlain by the aquifer system. Credit: U.S. Geological Survey, Department of the Interior/USGS.

Methods

A sample of 806 voting age residents of Florida (n=402) and Georgia (n=404) was recruited via Qualtrics and surveyed between November and December 2020. The recruitment method, which requires respondents to opt-in, precludes calculation of a traditional response rate; however, 76% of Floridians and 75% of Georgians who began the survey also completed it. Participants were unaware of the survey topic when they opted-in, reducing self-selection bias. Recruitment was based on age (18-34, 35-55, and over 56) and residency in Florida or Georgia. Additionally, within the Georgia sample, there was a required minimum of 20 percent responses from residents of the less populous southern counties that overlie or are in close proximity to the Floridan Aquifer.

In the survey, participants were evaluated on their personal beliefs on four regional water topics (listed in Figure 2), their perceptions of scientists' beliefs on those topics, and their willingness to reconsider their personal beliefs depending on the provider of new information. The four water topics were selected because they are points of scientific consensus – fertilizer and septic systems are sources of water pollution in both states (Berndt, 1996; Cooper & Monroe, 2021; Sullivan & Monroe, 2021), climate change will impact the availability of water in both states (Environmental Protection Agency, 2016a, 2016b), and in 20 years there will not be enough surface and ground water to meet demand throughout both states (Missimer et al., 2014; Declaration of Water Resource Caution Areas, 2014).

Figure 2
Topics and format of water belief questions

Topics assessed
Fertilizer [IS or IS NOT] a source of water pollution in my state.
Septic systems [ARE or ARE NOT] a source of water pollution in my state.
Climate change [WILL or WILL NOT] impact the availability of water in my state.
In 20 years, there [WILL or WILL NOT] be enough surface and ground water to meet demand throughout my state.

Format of Question A (Personal belief)
Which statement most accurately reflects your thoughts?
- I think fertilizer IS a source of water pollution in my state.
- I think fertilizer IS NOT a source of water pollution in my state.
- I don't know enough to answer.

Format of Question B (Perception of water scientists' beliefs)
Which statement is most accurate?
- Most WATER SCIENTISTS think fertilizer IS a source of water pollution in my state.
- Most WATER SCIENTISTS think fertilizer IS NOT a source of water pollution in my state.
- I don't know enough to answer.

The topics were introduced to participants in random order. On each topic, participants' personal beliefs were assessed with the question, "*Which statement most accurately reflects your thoughts?*" (see format of Question A in Figure 2). The subsequent question (Question B in Figure 2) assessed participants' perceptions of water scientists' beliefs. Responses to these questions were used to sort beliefs into the six cases identified based on the factual or counterfactual nature of the personal belief and the accuracy or inaccuracy of perceptions of water scientist's beliefs. For easy reference, each case has been assigned a simple name; however, the simple name may not reflect the complexity of perspectives included in that case.

As laid out in Figure 3, beliefs were classified as *Rightly Directed* in cases where the individual's personal belief as a) accurate and b) perceived to be in alignment with what water scientists believe. Beliefs were *Misdirected* when the individual's personal belief was a) inaccurate; however, the individual b) perceived the belief to be in alignment with what water scientists believe. *Abstainer* beliefs existed where the individual a) did not a hold a personal belief and b) perceived themself to know what water scientists believe. Beliefs were *Unsupported* when the individual a) possessed a belief about the topic despite b) thinking they did not know what water scientists believed on the topic. *Uncommitted* beliefs were those in which the individual a) did not possess a belief about the topic although they b) thought they knew what water scientists believed on the topic. Finally, *Contrarian* beliefs existed when the individual a) possessed a belief on the topic but b) thought water scientists believed the opposite.

A third question for each topic (Figure 4) assessed participants' self-perceived willingness to modify their beliefs based on new information from a variety of sources (presented in random order). Selection of information sources was based on the sources assessed in prior polls and studies (Edelman, 2022; Raine et al., 2019) and a content analysis of water information sources from regional news reporting in the Floridan Aquifer region (Hundemer et al., 2022).

Figure 3

Six cases of water beliefs constructed from the combination of personal beliefs and perceptions of water scientists' beliefs

Personal beliefs	Perceptions of water scientists' beliefs		
	Accurate	**Inaccurate**	**I don't know**
Factual	"Rightly Directed"	"Contrarian"	"Unsupported"
Counterfactual	"Contrarian"	"Misdirected"	
I don't know	"Uncommitted"		"Abstainer"

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Figure 4

Format of Question C, willingness to reconsider beliefs based on information source

Format of Question C (Willingness to reconsider beliefs based on information source)

If you were to receive information from any of the groups below saying that fertilizer <IS or IS NOT> a source of water pollution in your state, would <the information affect your personal views** or would you reconsider your personal views***>?* Answer for each group.

	*Yes, it would affect my views*** or *Yes, I would reconsider****	*No, it would not affect my views*** or *No, I would not reconsider****
Scientists	O	O
The military	O	O
Religious leaders	O	O
College or university science professors	O	O
Local news	O	O
Business leaders	O	O
Elected officials	O	O
Health officials	O	O
Agricultural groups	O	O
Environmental groups	O	O
The national news you usually read/ watch/ listen to (if any)	O	O
The social media you usually read/ watch/ listen to (if any)	O	O

*If the respondent asserted a personal belief on the topic, the presented text was the opposite of their personal belief. If the respondent indicated that they did not know enough to answer the personal belief question, the presented text was randomly assigned.

**Text presented to those who asserted a personal belief on the topic.

*** Text presented to those who indicated that they did not know enough to answer the personal belief question.

In addition to water beliefs, scientific water knowledge was assessed using the Ordinary Water Science Knowledge (OWSK) Assessment, a 40-item test scored using a Rasch model (Hundemer et al., 2021). The OWSK is designed to assess water science knowledge at a level that would enable a resident of Florida or Georgia to competently participate in water discussion and make voting decisions on water topics.

To minimize unnecessary influence on survey responses, political identity was measured at the end of the survey. The measurement index (Figure 5) utilizes a composite of liberal-conservative ideology and the alignment of one's positions with dominant political parties, each of which has theoretical relevance to the study. While political party alignment can encourage group-congruent beliefs (Cohen, 2003; Hornsey, 2008; Kahan & Braman, 2006), liberal-conservative alignment is a reflection of values that can function as a decision heuristic (Douglas & Wildavsky, 1982; Kahan & Braman, 2006). In general, multi-item measures of partisan identity are preferred because they more comprehensively reflect partisan identity (Huddy et al., 2020). In calculating a score for the index, equal weight was assigned to Question 1 and the combination of Questions 2 and 3. Scores range from -8 (strong left orientation) to +8 (strong right orientation). Individuals with scores less than -1 were classified as "left-leaning." Scores of greater than 1 were "right-leaning." And from -1 to 1 (inclusive) were "moderate."

Figure 5
Questions comprising political identity index

1. Which of the following best describes your views?
   [Very liberal (-4), Liberal (-2), Moderate/Independent (0), Conservative (2), Very conservative (4), Other _____, I don't know]

2. How often do your positions on issues align with the positions of DEMOCRATS?
   [Always (4), Often (3), Occasionally (2), Rarely (1), Never (0), I don't know]

3. How often do your positions on issues align with the positions of REPUBLICANS?
   [Always (4), Often (3), Occasionally (2), Rarely (1), Never (0), I don't know]

Relationships between water belief cases, water science knowledge, and political identity were assessed in SPSS version 26 using Pearson's correlation, box plots, and descriptive statistics. Linear regression was conducted in SPSS to examine the influence of belief case, water science knowledge, political identity, water topic, and demographic characteristics (education, gender, age, race, ethnicity, and county size) on perceived reliance on scientists relative to other information sources. Three regression models were developed which varied in the dependent variable. The first model examined factors influencing the gap in perceived reliance on scientific information sources (scientists, health officials, and college or university science professors) relative to media sources (local news, national news, and social media). The second model examined the gap in perceived reliance on scientific information sources relative to interest group sources (business leaders, agricultural groups, and environmental groups). The third model examined the gap in perceived reliance on scientific information sources relative to all other assessed sources, which included media, interest groups, the military, elected officials, and religious leaders.

Results

The survey was completed by 806 residents of Florida (n=402) and Georgia (n=404). Among participants, 59.2% identified as female and 40.2% identified as male. Most participants identified their race as "White" (70.8%) or "Black or African American" (19.9%). Twelve percent identified their ethnicity as "Hispanic or Latinx." Based on the index of political identity, 38.1% of the sample identified as politically left-oriented, 30.0% as right-oriented, and 31.9% as politically neutral.

Overall Perceived Reliance on Information Sources

Table 1 displays, in descending order of influence, the information sources participants indicated would most affect their personal views on water topics. In this analysis, individuals' responses to each topic (fertilizer, septic tanks, climate change impact on water, 20-year water futures) were treated as separate data points, analyzed without distinction. Among assessed information sources, participants indicated that they were most likely to reconsider their personal beliefs in response to new information from scientists, supporting our first hypothesis. After scientists, and in declining order of participants' wiliness to reconsider their beliefs, were health officials, environmental groups, agricultural groups, and college or university science professors. Participants were least willing to reconsider their beliefs in response to new information from the military, elected officials, social media, religious leaders, and business leaders.

Table 1
Willingness of message recipients to reconsider personal beliefs in response to new information from the indicated information sources

Information source	Percentage of personal water beliefs perceived to be open to reconsideration based on information from the source
Scientists	74.4%
Health officials	65.8%
Environmental groups	64.1%
Agricultural groups	62.8%
College or university science professors	61.1%
The national news you usually read / watch / listen to (if any)	46.0%
Local news	45.8%
The military	35.8%
Elected officials	32.9%
The social media you usually read / watch / listen to (if any)	32.4%
Religious leaders	29.2%
Business leaders	29.0%

Scientific Beliefs and Knowledge

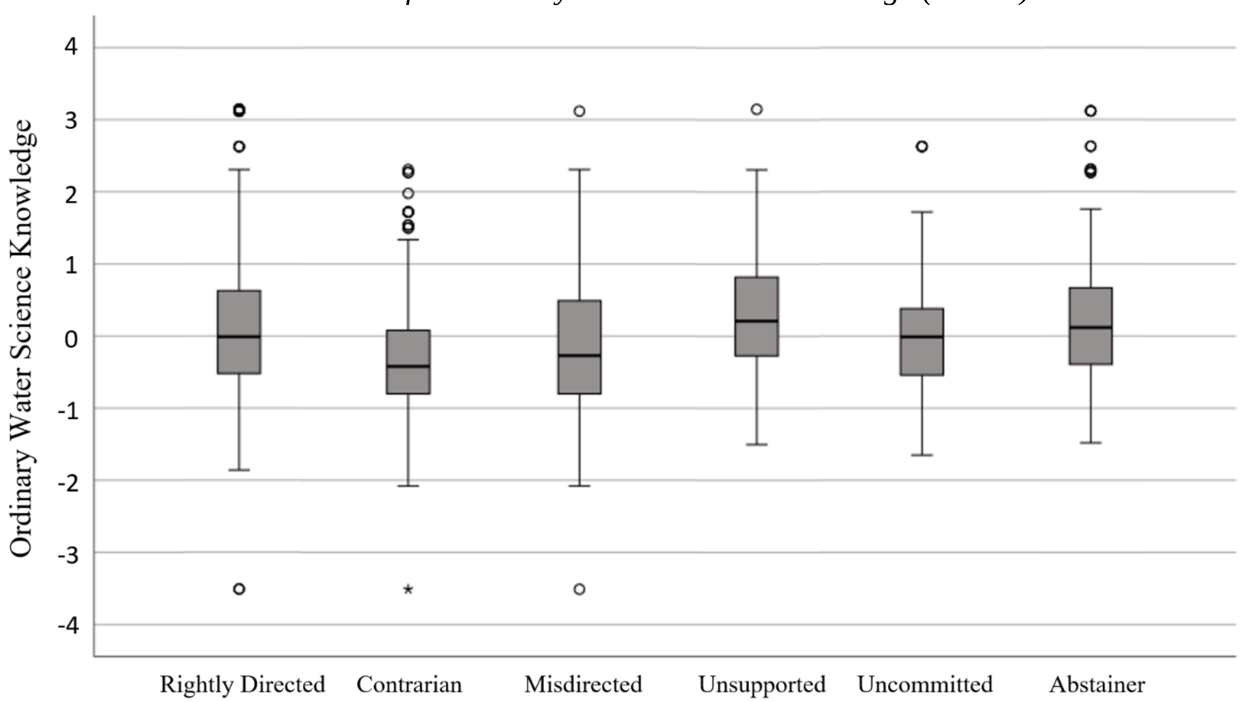
As described in Figure 3, existing beliefs can be divided into six cases based on the factual or counterfactual nature of the personal belief and the accuracy or inaccuracy of perceptions of water scientist's beliefs. The percentage of beliefs in each category is detailed in Table 2. By a substantial margin, Rightly Directed was the largest of the six cases, constituting 40.0% of water beliefs. Notably, 9.3% of participants were Contrarians who thought they knew (accurately or not) what water scientists believe but chose to personally believe the opposite. Another 4.6% (the Uncommitted) thought they knew what water scientists believe but indicated that they do not know what they personally believe. Eleven percent (the Unsupported) claimed a personal belief while indicating that they do not know what water scientists believe on that same topic.

Table 2
Percentage of beliefs that are open to reconsideration by belief case

	Perceptions of water scientists' beliefs		
Personal beliefs	Accurate	Inaccurate	"I don't know"
Factual	"Rightly Directed" 40.0%	"Contrarian" 5.9%	"Unsupported" 6.9%
Counterfactual	"Contrarian" 6.0%	"Misdirected" 14.1%	"Unsupported" 4.1%
"I don't know"	"Uncommitted" 3.3%	"Uncommitted" 1.3%	"Abstainer" 18.4%

The box plot in Figure 6 illustrates the relationship between each of the belief cases and scientific water knowledge (OWSK scores). While OWSK scores were relatively low among Contrarians, the Misdirected, and the Uncommitted, a broad range of scientific water knowledge was represented in each belief case. Unsupported beliefs were associated with the highest OWSK scores, exceeding Rightly Directed beliefs. This supports our second hypothesis that there would not be a strong relationship between water science knowledge and belief type.

Figure 6
Box plot depicting by belief case the median, the range of the central 50% of responses, and the minimum and maximum values for Ordinary Water Science Knowledge (OWSK) scores

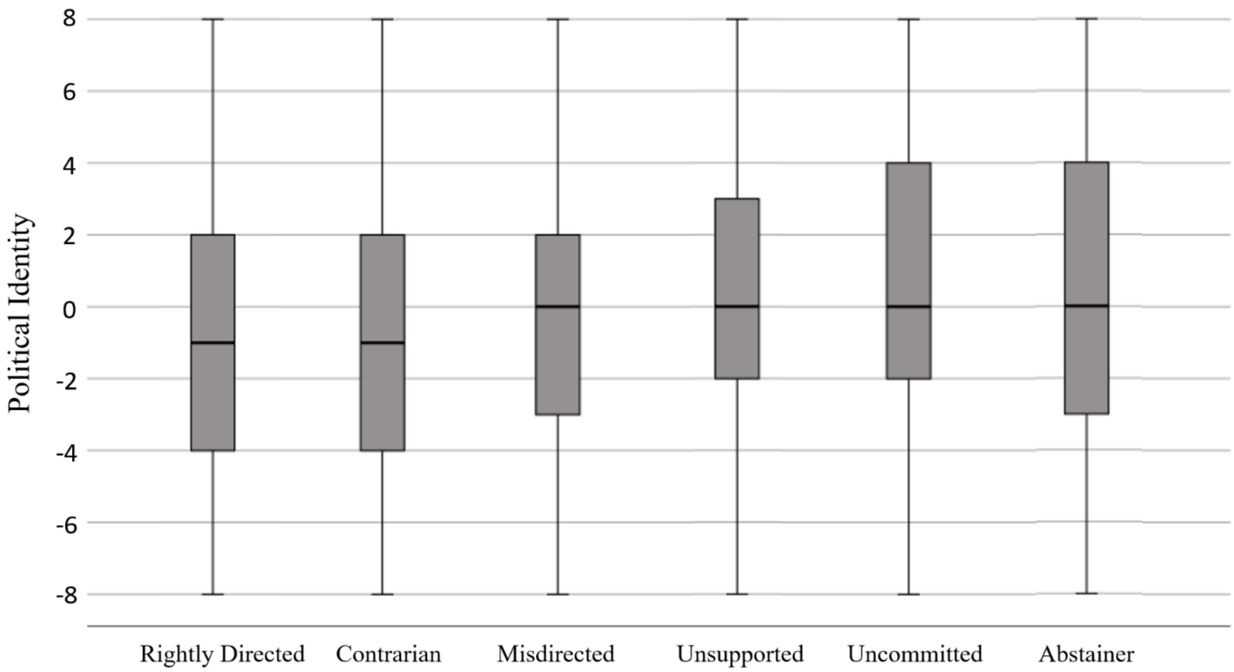


Political Identity, Scientific Water Knowledge, and Water Belief Classifications

The box plot in Figure 7 illustrates the range of political identities associated with each belief case. The interquartile range indicates that Abstainer, Uncommitted, and Unsupported water beliefs were more politically right-leaning, while Contrarian, and Rightly Directed water beliefs were more politically left-leaning. Using a Pearson's correlation, a positive relationship was found between right-leaning political identity and water science knowledge, $r(3224) = .162$, $p < .001$.

Figure 7

Box plot depicting by belief case the median, the range of the central 50% of responses, and the minimum and maximum for political identity scores



Factors Affecting Perceived Reliance on Information Sources

Linear regression was used to identify factors affecting the gap in perceived reliance on information sources. The sample size for each model is 3,224, reflecting responses on four topics from each of the 806 participants. Model 1 (Table 3; $R^2 = .167$, $F(23,3200) = 27.836$, $p < .001$) examined factors influencing the gap in perceived reliance upon scientific information sources (scientists, health officials, and college or university science professors) relative to media sources (local news, national news, and social media). Of the factors included in the model, only scientific water knowledge and demographic factors (education, gender, age, and race) had a statistically significant effect. Belief case, water topic, and political identity were not statistically significant influencers.

Model 2 (Table 3; $R^2 = .086$, $F(23,3200) = 13.044$, $p < .001$) examined the same factors on the gap in perceived reliance upon scientific information sources (scientists, health officials, and college or university science professors) relative to interest group sources (business leaders, agricultural groups, and environmental groups). Statistically significant in this model were scientific water knowledge, Contrarian beliefs, political identity, and demographic factors (education and race).

Finally, Model 3 (Table 3; $R^2 = .214$, $F(23,3200) = 37.897$, $p < .001$) examined the gap in perceived reliance upon scientific information sources (scientists, health officials, and college or university science professors) relative to all other sources listed in the survey (the media groups used in Model 1, the interest groups used in Model 2, as well as the military, elected officials, and religious leaders). Identified as statistically significant were scientific water knowledge, belief case (Rightly Directed and Contrarian), and demographic factors (education, gender, age, race, and ethnicity). Political identity did not have a statistically significant effect.

Overall, the regression results partially support our third hypothesis. While water science was a strong factor in all three models, the influence of belief case varied across the models. None of the belief cases had statistical significance in the first model, only Contrarian beliefs had statistical significance in the second model, and half of the belief cases had statistical significance in the third model. Political identity had significance only in the second model, which examined the gap between scientific institutions and interest groups.

Table 3

Linear regression analysis of the perceived gap in reliance on scientific sources relative to other information sources

Explanatory Variable	Model 1: Science-media gap (n=3,224)		Model 2: Science-interest group gap (n=3,224)		Model 3: Science-other gap (n=3,224)	
	β	SE	β	SE	β	SE
Constant	.433***	.121	.270**	.100	-.358***	.081
Topic						
Fertilizer	Reference					
Septic	.032	.056	.047	.046	-.019	.037
Climate change	-.024	.056	-.014	.046	.026	.037
Future water availability	-.002	.057	-.020	.047	-.051	.038
Scientific water knowledge (OSWK)	.380***	.027	.219***	.022	.285***	.018
Belief case						
Rightly Directed	.097	.060	.017	.049	-.242***	.040
Contrarian	-.099	.077	-.156*	.063	-.266***	.051
Unsupported	.146	.076	.104	.062	-.017	.050
Misdirected	.060	.071	.063	.058	-.101*	.047
Uncommitted	-.030	.103	-.039	.085	-.122	.069
Abstainer	Reference					
Political identity (conservativism)	.000	.005	-.015***	.004	.007	.003
Education						
Less than high school	Reference					
High school or GED	.077	.113	.063	.093	-.045	.076

Some college	.392***	.113	.249**	.093	.018	.076
Associate's degree	.223	.122	.179	.100	-.132	.081
Bachelor's degree	.317**	.114	.206*	.094	-.030	.076
Some graduate school	.264	.156	.609***	.128	.058	.104
Completed graduate school	.098	.118	.168	.097	-.183*	.079
Gender						
Female	Reference					
Male	-.145***	.043	.009	.035	-.132***	.028
Age						
18 to 34	Reference					
35 to 55	.074	.052	-.060	.043	-.030	.035
56 and over	.361***	.056	.070	.046	.224***	.037
Race						
White	Reference					
Black	-.252***	.054	-.143***	.045	-.137***	.036
Other / Prefer not to say	-.081	.082	-.011	.067	.013	.054
Ethnicity						
Not Hispanic or Latin X	Reference					
Hispanic or Latin X	.063	.064	.007	.053	-.108*	.043
County size						
Metropolitan	Reference					
Non-metropolitan	-.011	.056	-.040	.046	-.034	.037

****p* < .001
***p* < .01
**p* < .05

Discussion

In this study, participants indicated that they were most open to influence on water topics when scientists were the source of information. This finding corresponds with poll results indicating that scientists are highly trusted relative to other information sources (Edelman, 2022; Li & Qian, 2022; Raine et al., 2019). Yet, despite this general result, 27.5% of water beliefs (Contrarian, Unsupported, Uncommitted) did not align with participants' perceptions of what water scientists believe. In the analyses that followed, the study sought to better understand the factors contributing to participants' perceived reliance on scientific information sources relative to other sources of water information.

Regression analyses found water science knowledge was a consistently strong influencer of the gap in reliance on scientific institutions relative to other information sources. This result is particularly notable given criticisms of the knowledge deficit model (Ecker et al., 2022). In addition to knowledge, education was significant to varying degrees across regression models. In contrast, political identity was statistically significant in only one of the models. Political identity, as measured here, is comprised of positional alignment with political party policies and liberal-conservative ideology. Political identity is, therefore, a reflection of one's values (Douglas & Wildavsky, 1982; Kahan & Braman, 2006) and could have functioned as a decision heuristic. That this was not observed suggests that perceived reliance on scientists depended more on what the person knew about water science than potentially competing psychological motivators.

One possible explanation for the relative strength of knowledge and the weakness of political identity could be the study's context. In the Floridan Aquifer region, water topics can be highly controversial and political among highly invested stakeholder groups (Hundemer & Monroe, 2020; Koebele & Crow, 2023; Stoa, 2014), but among typical citizens, awareness of water challenges and policy is low (Hubbard, 2020; Hundemer et al., 2021; Lamm et al., 2015; NEETF, 1998, 1999; Robelia & Murphy, 2012). Therefore, those respondents who are prone to adopt beliefs and rely on information sources that support their political or social interests may have lacked sufficient awareness of political prerogative to inform heuristic-based decisions. If partisan heuristics were not substantially relied upon, knowledge may have had a stronger effect that it would on a topic with more public awareness and political investment.

The finding that higher knowledge yields more perceived reliance on scientists is both hopeful and challenging. It is hopeful because society's achievement of its resource goals depends on scientists. While other information sources, including the media and interest groups, can and should advise on what society's goals should be, scientists can assess the current situation and advise on the courses of action most likely to achieve those goals. On the other hand, the relationship between knowledge and perceived reliance on scientists is challenging because it creates a chicken and egg scenario – to increase the reliance on scientists you may need to increase the public's knowledge; yet, to increase knowledge the public needs to rely on the words of scientists.

The study also confirms the assertion by Kahan (2015a), that knowledge and belief should be measured and assessed separately. Each belief type was associated with a wide range of OWSK scores; thus, knowing a lot about water did not equate with believing it. In addition, belief type and OWSK scores separately influenced the relative perceived reliance on scientists in our regression models. While knowledge had a consistently positive effect on perceived reliance on scientists, the effect of belief case was less predictable. Notable in Model 3 (the gap between scientists and all other sources), Rightly Directed beliefs and Contrarian beliefs both had a relatively strong negative effect. In other words, a similar effect resulted from accurate, well-informed beliefs and from beliefs that contradicted the person's water knowledge. New studies are needed to understand this result.

Finally, and in alignment with earlier studies, demographics affected the perceived reliance on information sources. In addition to education, which was already discussed, male gender and Black race had a negative effect on the perceived reliance on scientists. Conversely, age of 56 and above had a positive effect on perceived reliance on scientists.

This study generates two main courses for future inquiry. One is the conditions under which knowledge is a strong factor affecting the sources relied upon for water information. Specifically, in what ways does the water context affect reliance on information sources? If the water topic is highly partisan, will information reliance be more affected by political identity and less affected by knowledge? There is also opportunity to directly examine the factors that contribute to each of the belief cases, and the effect that each belief case has on reliance on scientific sources. This study's six belief cases were derived from the combination of people's personal beliefs and their perceptions of scientists' beliefs. This is a new approach that could support more nuanced examinations of the relationships between knowledge and belief.

Several limitations should be considered when utilizing the results of this study. The first and most significant limitation is the study's reliance on self-report data. We do not *know* that participants are more reliant on scientists than the media for water beliefs, we only know that participants *tell us* they would rely more on scientists than the media. People often intentionally and unintentionally misrepresent themselves (Kormos & Gifford, 2014) and this study does not account for those misrepresentation. Second, in cases where participants indicated that their beliefs would be influenced by a particular information source, we do not know the extent of that affect (and likely neither do the participants). They could completely change their beliefs in response to new information, or they could simply add the information to their bank of evidence without giving it substantial weight. Third, there is variation within each source type. For instance, a participant's consideration of "environmental groups" may include Greenpeace or Ducks Unlimited or both. Which environmental group (or which scientist, or which elected official, and so on) is the messenger can have a substantial impact on influence.

Disclosure Statement

The author reports there are no competing interests to declare.

Data Availability

The raw data used for analysis supporting the conclusions herein can be accessed through the Harvard Dataverse (Hundemer, 2021).

References

Berndt, M. P. (1996). *Ground-water quality assessment of the Georgia-Florida Coastal Plain study unit; analysis of available information on nutrients, 1972-92*. U.S. Geological Survey. http://pubs.er.usgs.gov/publication/wri954039

Blom, R. (2021). Believing false political headlines and discrediting truthful political headlines: The interaction between news source trust and news content expectancy. *Journalism, 22*(3), 821–837. https://doi.org/10.1177/1464884918765316

Brewer, P. R., & Ley, B. L. (2013). Whose science do you believe? Explaining trust in sources of scientific information about the environment. *Science Communication, 35*(1), 115–137. https://doi.org/10.1177/1075547012441691

Campbell, T. H., & Kay, A. C. (2014). Solution aversion: On the relation between ideology and motivated disbelief. *Journal of Personality and Social Psychology, 107*(5), 809–824. https://doi.org/10.1037/a0037963

Cohen, G. L. (2003). Party over policy: The dominating impact of group influence on political beliefs. *Journal of Personality and Social Psychology, 85*(5), 808–822. https://doi.org/10.1037/0022-3514.85.5.808

Cooper, N. A., & Monroe, M. C. (2021). *Water quality in the Floridan aquifer region*. AskIFAS. https://doi.org/doi.org/10.32473/edis-FR440-2021

Dahlstrom, M. F., & Ho, S. S. (2018). Exploring the ethics of using narratives to communicate in science policy contexts. In S. Priest, J. Goodwin, & M. F. Dahlstrom (Eds.), *Ethics and Practice in Science Communication* (pp. 95–115). University of Chicago Press.

Day, M. V., Fiske, S. T., Downing, E. L., & Trail, T. E. (2014). Shifting liberal and conservative attitudes using moral foundations theory. *Personality and Social Psychology Bulletin*, *40*(12), 1559–1573. https://doi.org/10.1177/0146167214551152

Declaration of Water Resource Caution Areas, 40A-2.801, 40A-2.801. (2014). https://www.flrules.org/gateway/ruleNo.asp?id=40A-2.801

Dewey, J. (1916). *Democracy and Education: An Introduction to the Philosophy of Education*. The Free Press.

Dickerson, C. A., Thibodeau, R., Aronson, E., & Miller, D. (1992). Using cognitive dissonance to encourage water conservation. *Journal of Applied Social Psychology*, *22*(11), 841–854. https://doi.org/10.1111/j.1559-1816.1992.tb00928.x

Douglas, M., & Wildavsky, A. (1982). *Risk and culture: An essay on the selection of technical and environmental dangers*. University of California Press.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace College.

Ecker, U. K. H., Lewandowsky, S., Cook, J., Schmid, P., Fazio, L. K., Brashier, N., Kendeou, P., Vraga, E. K., & Amazeen, M. A. (2022). The psychological drivers of misinformation belief and its resistance to correction. *Nature Reviews Psychology*, *1*, 13–29. https://doi.org/10.1038/s44159-021-00006-y

Edelman. (2022). *2022 Edelman trust barometer*. https://www.edelman.com/trust/2022-trust-barometer

Environmental Protection Agency. (2016a). *Adapting to climate change: Southeast*. https://www.epa.gov/sites/default/files/2016-07/documents/southeast_fact_sheet.pdf

Environmental Protection Agency. (2016b). *What climate change means for Florida*. https://www.epa.gov/sites/default/files/2016-08/documents/climate-change-fl.pdf

Esposo, S. R., Hornsey, M. J., & Spoor, J. R. (2013). Shooting the messenger: Outsiders critical of your group are rejected regardless of argument quality. *British Journal of Social Psychology*, *52*(2), 386–395. https://doi.org/10.1111/bjso.12024

Festinger, L. (1962). Cognitive dissonance. *Scientific American*, *207*(4), 93–106.

Fielding, K. S., & Hornsey, M. J. (2016). A Social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.00121

Fischer, F. (2000). *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. Duke University Press. https://doi.org/10.2307/j.ctv11smwd9

Gauchat, G. (2012). Politicization of science in the public sphere: A study of public trust in the United States, 1974 to 2010. *American Sociological Review*, *77*(2), 167–187. https://doi.org/10.1177/0003122412438225

Haidt, J. (2012). *The Righteous Mind: Why Good People Are Divided by Politics and Religion*. Random House, Inc.

Hamilton, L. (2014). *Do You Trust Scientists About the Environment?* Carsey Institute. https://doi.org/10.34051/p/2020.214

Hornsey, M. J. (2008). Social identity theory and self-categorization theory: A historical review. *Social and Personality Psychology Compass*, *2*(1), 204–222. https://doi.org/10.1111/j.1751-9004.2007.00066.x

Hubbard, M. L. (2020). The role of knowledge in water resource management: An assessment of the Oregon general public. *The Social Science Journal*, 1–18. https://doi.org/10.1080/03623319.2020.1782635

Huddy, L. (2001). From social to political identity: A critical examination of social identity theory. *Political Psychology*, *22*(1), 127–156. https://doi.org/10.1111/0162-895X.00230

Huddy, L., & Bankert, A. (2017). Political partisanship as a social identity. *Oxford Research Encyclopedia of Politics*. https://doi.org/10.1093/acrefore/9780190228637.013.250

Huddy, L., Davies, C., & Sandor, J. (2020). Measuring the direction and strength of partisan identity. In H. Oscarsson and S. Holmberg (Eds.), *Research Handbook on Political Partisanship* (pp. 103–122). Edward Elgar Publishing.

Hundemer, S., 2021. Replication data for: The water science communication problem. Harvard Dataverse 1. https://doi.org/10.7910/DVN/U3DMHO

Hundemer, S., & Monroe, M. C. (2020). A co-orientation analysis of producers' and environmentalists' mental models of water issues: Opportunities for improved communication and collaboration. *Environmental Communication*, *15*(3), 1–19. https://doi.org/10.1080/17524032.2020.1828128

Hundemer, S., & Monroe, M. C. (2021). *Water availability in Southwest Georgia and Northeast Florida*. AskIFAS. https://doi.org/doi.org/10.32473/edis-FR438-2021

Hundemer, S., Monroe, M. C., & Kaplan, D. (2021). The water science communication problem: Water knowledge and the acceptance or rejection of water science. *Journal of Hydrology*, *406*, 1–16. https://doi.org/10.1016/j.jhydrol.2021.127230

Hundemer, S., Treise, D., & Monroe, M. (2022). A scarcity of biospheric values in local and regional reporting of water issues: Media coverage in the Floridan Aquifer region. *Journal of Applied Communications*, *106*(2). https://doi.org/10.4148/1051-0834.2424

Kahan, D. M. (2015a). Climate-science communication and the measurement problem. *Political Psychology*, *36*(S1), 1–43. https://doi.org/10.1111/pops.12244

Kahan, D. M. (2015b). *The politically motivated reasoning paradigm*. In Emerging Trends in the Social and Behavioral Sciences (pp. 1–16). John Wiley & Sons, Inc.

Kahan, D. M. (2017). On the sources of ordinary science knowledge and extraordinary science ignorance. In K. H. Jamieson, D. M. Kahan, & D. A. Scheufele (Eds.), *Oxford Handbook of the Science of Science Communication* (pp. 35–50). Oxford University Press.

Kahan, D. M., & Braman, D. (2006). Cultural cognition and public policy. *Yale Law & Policy Review, Public Law Working Paper No. 87*, *24*, 147–170.

Kahneman, D. (2011). *Thinking, Fast and Slow*. Farrar, Straus and Giroux.

Kennedy, B., Tyson, A., & Funk, C. (2022). Americans' trust in scientists, other groups declines. *Pew Research Center*. https://www.pewresearch.org/science/2022/02/15/americans-trust-in-scientists-other-groups-declines/

Kidwell, B., Farmer, A., & Hardesty, D. M. (2013). Getting liberals and conservatives to go green: Political ideology and congruent appeals. *Journal of Consumer Research*, *40*(2), 350–367. https://doi.org/10.1086/670610

Knobloch-Westerwick, S., & Meng, J. (2009). Looking the other way: Selective exposure to attitude-consistent and counterattitudinal political information. *Communication Research*, *36*(3), 426–448. https://doi.org/10.1177/0093650209333030

Koebele, E. A., & Crow, D. A. (2023). Mitigating conflict with collaboration: Reaching negotiated agreement amidst belief divergence in environmental governance. *Policy Studies Journal*, *51*(2), 439–458. https://doi.org/10.1111/psj.12496

Kormos, C., & Gifford, R. (2014). The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology*, *40*, 359–371. https://doi.org/10.1016/j.jenvp.2014.09.003

Krumpal, I. (2011). Determinants of social desirability bias in sensitive surveys: A literature review. *Quality and Quantity*, *47*(4).

Lamm, K. W., Lamm, A. J., & Carter, H. S. (2015). Bridging water issue knowledge gaps between the general public and opinion leaders. *Journal of Agricultural Education*, *56*(3), 146–161. https://doi.org/10.5032/jae.2015.03146

Lede, E., Meleady, R., & Seger, C. R. (2019). Optimizing the influence of social norms interventions: Applying social identity insights to motivate residential water conservation. *Journal of Environmental Psychology*, *62*, 105–114. https://doi.org/10.1016/j.jenvp.2019.02.011

Li, N., & Qian, Y. (2022). Polarization of public trust in scientists between 1978 and 2018: Insights from a cross-decade comparison using interpretable machine learning. *Politics and the Life Sciences*, *41*(1), 45–54. https://doi.org/10.1017/pls.2021.18

Liedke, J., & Gottfried, J. (2022). U.S. adults under 30 now trust information from social media almost as much as from national news outlets. *Pew Research Center*. https://www.pewresearch.org/fact-tank/2022/10/27/u-s-adults-under-30-now-trust-information-from-social-media-almost-as-much-as-from-national-news-outlets/

Malka, A., Krosnick, J. A., & Langer, G. (2009). The association of knowledge with concern about global warming: Trusted information sources shape public thinking. *Risk Analysis*, *29*(5), 633–647. https://doi.org/10.1111/j.1539-6924.2009.01220.x

Marella, R. L., & Berndt, M. P. (2005). *Water withdrawals and trends from the Floridan aquifer system in the southeastern United States, 1950-2000.* United States Geological Survey. http://pubs.er.usgs.gov/publication/cir1278

Mase, A. S., Babin, N. L., Prokopy, L. S., & Genskow, K. D. (2015). Trust in sources of soil and water quality information: Implications for environmental outreach and education. *JAWRA Journal of the American Water Resources Association*, *51*(6), 1656–1666. https://doi.org/10.1111/1752-1688.12349

Metzger, M. J., Flanagin, A. J., & Medders, R. B. (2010). Social and heuristic approaches to credibility evaluation online. *Journal of Communication*, *60*(3), 413–439. https://doi.org/10.1111/j.1460-2466.2010.01488.x

Miller, J. D. (1983). Scientific literacy: A conceptual and empirical review. *Daedalus*, *112*(2), 29–48.

Missimer, T., Danser, P., Amy, G., & Pankratz, T. (2014). Water crisis: The metropolitan Atlanta, Georgia, regional water supply conflict. *Water Policy*, *16*(4), 669–689. https://doi.org/10.2166/wp.2014.131

Mitchell, A. (2014, October 21). Political polarization & media habits. *Pew Research Center's Journalism Project*. https://www.pewresearch.org/journalism/2014/10/21/political-polarization-media-habits/

Mitchell, A., Gottfried, J., Barthel, M., & Shearer, E. (2016). *The modern news consumer*. Pew Research Center. https://www.pewresearch.org/journalism/2016/07/07/the-modern-news-consumer/

NEETF. (1998). *The national report card on environmental knowledge, attitudes and behaviors*. National Environmental Education & Training Foundation and Roper Starch Worldwide. http://www.neefusa.org/resources/publications.htm

NEETF. (1999). *The national report card on environmental readiness for the 21st century*. The National Environmental Education & Training Foundation (NEETF) and Roper Starch Worldwide.

O'Keefe, D. (2016). *Persuasion: Theory and research*. Sage.

Owens, S. (2000). 'Engaging the public': Information and deliberation in environmental policy. *Environment and Planning A: Economy and Space*, *32*(7), 1141–1148. https://doi.org/10.1068/a3330

Priest, S. H., Bonfadelli, H., & Rusanen, M. (2003). The "trust gap" hypothesis: Predicting support for biotechnology across national cultures as a function of trust in actors. *Risk Analysis*, *23*(4), 751–766. https://doi.org/10.1111/1539-6924.00353

Priest, S. (2013). Critical science literacy: What citizens and journalists need to know to make sense of science. *Bulletin of Science, Technology & Society, 33*(5–6), 138–145. https://doi.org/10.1177/0270467614529707

Priest, S. (2018). Communicating climate change and other evidence-based controversies: Challenges to ethics in practice. In S. Priest, J. Goodwin, & M. F. Dahlstrom (Eds.), *Ethics and Practice in Science Communication* (pp. 55–73). University of Chicago Press.

Raine, L., Keeter, S., & Perrin, A. (2019). *Americans' trust in government, each other, leaders*. Pew Research Center. https://www.people-press.org/2019/07/22/trust-and-distrust-in-america/

Robelia, B., & Murphy, T. (2012). What do people know about key environmental issues? A review of environmental knowledge surveys. *Environmental Education Research*, *18*(3), 299–321. https://doi.org/10.1080/13504622.2011.618288

Smith, M. U., & Siegel, H. (2004). Knowing, believing, and understanding: What goals for science education? *Science & Education, 13*(6), 553–582. https://doi.org/10.1023/B:SCED.0000042848.14208.bf

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Stoa, R. B. (2014). Florida water management districts and the Florida Water Resources Act: The challenges of basin-level management. *The Kentucky Journal of Equine, Agriculture, & Natural Resources Law*, *7*, 73–88.

Sturgis, P., & Allum, N. (2004). Science in society: Re-evaluating the deficit model of public attitudes. *Public Understanding of Science*, *13*(1), 55–74. https://doi.org/10.1177/0963662504042690

Sullivan, G., & Monroe, M. C. (2021). Water's journey through natural and human systems. AskIFAS. https://doi.org/doi.org/10.32473/edis-FR445-2021

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Review of Psychology*, *33*(1), 1–39. https://doi.org/10.1146/annurev.ps.33.020182.000245

Tajfel, H., & Turner, J. C. (1986). The social identity theory of intergroup behaviour. In S. Worchel & W. G. Austin (Eds.), *Psychology of Intergroup Relations* (pp. 7–24). Nelson-Hall.

Taylor, M., Lamm, A., & Lundy, L. (2017). Using cognitive dissonance to communicate with hypocrites about water conservation and climate change. *Journal of Applied Communications*, *101*(3). https://doi.org/10.4148/1051-0834.1843

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Blackwell.

Turner, J. C., & Oakes, P. J. (1986). The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence. *British Journal of Social Psychology*, *25*(3), 237–252. https://doi.org/10.1111/j.2044-8309.1986.tb00732.x

Valizadeh, N., Bagheri-Gavkosh, M., Bijani, M., & Hayati, D. (2022). Application of social identity models of collective action to facilitate participation in groundwater aquifer storage and recovery management. *Frontiers in Psychology, 13*. https://doi.org/10.3389/fpsyg.2022.996877

Wilkins, E. J., Miller, H. M., Tilak, E., & Schuster, R. M. (2018). Communicating information on nature-related topics: Preferred information channels and trust in sources. *PLOS ONE, 13*(12). https://doi.org/10.1371/journal.pone.0209013

Wolsko, C. (2017). Expanding the range of environmental values: Political orientation, moral foundations, and the common ingroup. *Journal of Environmental Psychology, 51*, 284–294. https://doi.org/10.1016/j.jenvp.2017.04.005

Wolsko, C., Ariceaga, H., & Seiden, J. (2016). Red, white, and blue enough to be green: Effects of moral framing on climate change attitudes and conservation behaviors. *Journal of Experimental Social Psychology*, *65,* 7–19. https://doi.org/10.1016/j.jesp.2016.02.005