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Final Report

Perceptions of Agricultural Water Use: Comparing the
General Public and Decision Makers

Erica Odera, Mary Hannah Miller, and Dr. Alexa Lamm

For More Information

Contact the Center for Public Issues Education at piecenter@ifas.ufl.edu or 352-273-2598.

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About the Authors

Erica Odera – Research coordinator, UF/IFAS Center for Public Issues Education

Mary Hannah Miller – Research assistant, UF/IFAS Center for Public Issues Education

Alexa J. Lamm, Ph.D. – Associate director, UF/IFAS Center for Public Issues Education; Assistant professor, Department of Agricultural Education and Communication

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Executive Summary

Perceptions of Agricultural Water Use: Comparing the General Public and Decision Makers

July 2015

Introduction

The Florida Department of Agriculture and Consumer Services, Florida Farm Bureau and Florida Dairy Farmers were interested in understanding public perception of agricultural water use in the state of Florida. There was a general belief the public had a negative view of agricultural water use, both in terms of quantity used and engagement in practices that may impact water quality. However, research has never explored what the general public actually believes about agricultural water practices. It is also believed the public does not understand the concepts of water recharge, the amount of withdrawal from different industries when compared to public consumption and use, or have an understanding of best management practices.

In addition to understanding public perception of these issues, the organizations were also interested in determining how to approach communicating with the public to enhance public awareness of current agricultural water use and engagement in best management practices that protect water resources. There were also questions related to whether or not the source delivering the message alters an ability to educate about agricultural water use. Lastly, while decision makers at both the local and state level should naturally align with the public's views, there was also an interest in determining if decision makers feel the same way about agricultural water use as the general public.

Findings

The following results are key comparative findings between the general Florida public and Florida decision maker respondents:

- When provided a list of 12 major water users, including some related to public consumption as well as agricultural users, the general public and decision makers considered golf courses and vegetable production facilities to be the highest water users.
- Generally, the public indicated they thought agricultural production facilities used more water than did decision makers. However, decision makers thought home water use was higher than the general public.
- Overall the public does not have much confidence in the quality of water in the state of Florida.
- When compared, the public was less confident in the quality of their home tap water than decision makers, but more confident in the quality of Florida's natural water systems.
 - Only 42% of the general public was highly or extremely confident in the quality of tap water in their homes compared to 72% of decision makers.
 - Only 19% of decision makers were highly or extremely confident in the quality of Florida natural water systems compared to 37% of the general public.
- The general public had higher positive overall attitudes (+.98) when asked a series of questions about farmers protecting water in Florida than decision makers. The general public indicated an overall positive response, while decision makers were neutral.
- On a scale assessing overall trust in farmers' practices regarding water, the general public displayed higher levels of trust than decision makers.
 - Only 54% of decision makers agreed or strongly agreed farmers will be concerned about water resources when they make important decisions about farming, compared to 88% of the general public.

- Only 36% of decision makers agreed or strongly agreed sound principles seem to guide farmers' behavior when it comes to water use, compared to 78% of the general public.
- Only 36% of decision makers agreed or strongly agreed farmers could be relied upon to keep their promises when it comes to water use.
- Despite these results, only 43% of decision makers believe it is important to watch farmers closely so they do not take advantage of water resources; a lower number than the general public.
- Overall, the general public believes agriculture helps the natural environment.
 - 74% agreed or strongly agreed farming protects our natural environment.
 - 73% agreed or strongly agreed agricultural lands allow water to return to and recharge groundwater resources.
 - Only 37% agreed or strongly agreed farming causes water runoff.
 - Only 32% agreed or strongly agreed farming causes soil erosion.
- When asked if they would pay more for food purchases if it meant reducing pressure on natural resources.
 - Decision makers (72%) and the general public (73%) agreed or strongly agreed they would pay more for the food they purchase if it meant farmers should use less pesticides.
 - Decision makers (62%) and the general public (63%) agreed or strongly agreed they would pay more for the food they purchase if it meant farmers saved as much water as possible.
 - Decision makers (65%) and the general public (62%) agreed or strongly agreed they would pay more for the food they purchase if it meant farmers used as little fertilizer as absolutely necessary.
- More decision makers were aware of best management practices (40%) than the general public (19%), but decision makers had lower levels of agreement that farmers in Florida practiced best management practices. Both groups indicated they agreed it is important that farmers practice best management practices.
- Decision makers were more familiar with water-related legislative actions or plans than the general public.
- In terms of learning about farmers' use of water, the general public was most likely to use local water management districts as a resource.
- When examining mode of learning preference, the general public preferred to use the Internet (45%), television (39%), or newspaper (34%) to learn more about water issues.
- When given a list of topics they would like to learn more about, the general public indicated they were most interested in learning about fertilizer and pesticide management (39%), while decision makers were most interested in learning about community actions concerning water issues (23%).
- Demographically, decision makers have been residents of Florida longer than the general public, are more highly educated, and represent a different political affiliation.
 - 66% of decision makers had lived in Florida for more than 30 years, compared to 28% of the general public.
 - 42% of decision makers hold a graduate or professional degree, compared to 12% of the general public.
 - 47% of decision makers are affiliated with the Republican Party, compared to 21% of the general public.

Recommendations

The following are key recommendations for creating messages, communicating with, and educating the general public and decision makers about agricultural water use in Florida.

For the general public:

- The general public had more concerns than decision makers about the quality of their tap water. Messages discussing agricultural water use should discuss how the agricultural sector and local water management districts ensure the safety and cleanliness of water for the home, especially for populations near active agricultural production areas who may have concerns about pollution from pesticides, fertilizers, and animal waste. The majority of respondents from both groups agreed or strongly agreed that these sources can pollute natural water sources so this may be an area in which to tailor messages to alleviate concerns.
- There is room to educate the public about all water-related legislative actions and plans. More awareness of laws and policies that protect water may help reduce concerns about agricultural production polluting water sources.
- The public indicated they would turn to water management districts over all other organizations when it came to learning more about agricultural production and water use. Perhaps use of water management districts, or representatives of those organizations, to help spread messages about water use related to agriculture in Florida could assist in educating the public about these issues.
- More education about the amount of water used among different groups would also be useful for the general public. Overall, the general public rated all agricultural groups as higher water users than decision makers. The largest gap occurred for livestock production. Consider tailoring messages to educate the public about actual water use statistics across agricultural groups, especially when compared to public consumption, the tourism industry and landscaping practices.
- The general public indicated they prefer using the Internet, television, and newspapers to receive information. Messages designed for the general public should be compatible with these three key sources.

For decision makers:

- Decision makers had less confidence in the quality of natural water systems in Florida than the general public. This concern can be understood as many decision makers are accountable to the public they serve, which uses these natural water systems. Messages targeting decision makers should take into account this concern, perhaps through describing ways in which agricultural water use BMPs help reduce pollution in natural water systems.
- Overall, decision makers had less confidence in trustworthiness of farmers to protect water in Florida than the general public. Messages could be created to try to bridge this gap by displaying stories of actual farmers and their efforts to practice BMPs and water conservation, as well as explicit descriptions of how BMPs are carried out in farms across Florida.
- There is room to educate decision makers about how agricultural production plays a part in the water recharge cycle. Targeting education for decision makers around this topic is recommended.
- Decision makers would like to learn about community actions concerning water issues and septic system management. These issues impact wider communities. Messages created for decision makers should take this into

account. Perhaps the agricultural industry can tell stories about how communities have come to understand and make educated decisions about their individual and collective water use, including their economic sectors, such as agriculture.

For both groups:

- Overall, both groups could be made more aware of BMPs and the way in which they help producers conserve water resources and reduce pollution. The idea of BMPs and their regulation is not well understood and, therefore, has little impact on trust.
- There was a difference in how individuals responded to question about agriculture's relationship to the natural environment, when presented with a negative frame scale, and whether the individual in the video about water was a farmer or a representative of the Nature Conservancy. Groups should consider using one of the two more "neutral" sources when delivering messages about agricultural water use to the general public, either UF/IFAS or a water management district staff member.
- Both groups liked visiting websites and watching TV or videos as ways to receive information. Messages could be explored targeting these channels.

Background

The Florida Department of Agriculture and Consumer Services, Florida Farm Bureau and Florida Dairy Farmers were interested in understanding public perception of agricultural water use in the state of Florida. There is a belief, from the agricultural industry at large, the public views agriculture as a negative water user, both in terms of quantity used and engaging in practices that negatively impact quality. It is also believed the public does not understand that while agriculture does withdraw water, it also serves to recharge water resources. In addition to understanding public perception, these groups are also interested in determining messages that may influence public awareness of current agricultural water use and engagement in best management practices that protect water resources. In addition, there is also an interest in determining if source credibility alters the agricultural industry's ability to educate about agricultural water use. While decision makers at both the local and state level should naturally align with the public's views, there was also an interest in determining if decision makers feel the same way about agricultural water use as the general public.

Methods

This study used an online survey design to answer the research questions. The population of interest was residents of the state of Florida age 18 or older and decision makers at the local level including county commissioners, county clerks and county managers. Since two populations were of interest, two strategies for data collection were employed.

The entire survey instrument was based on the 2012 RBC Canadian Water Attitudes Study (Patterson, 2012). The original instrument was adapted to fit a Floridian audience and researcher-developed questions specific to agricultural water use were added. An expert panel with expertise in water quality and quantity issues, agricultural water issues, and public opinion research reviewed the instrument for content, face validity, and survey design. The panel of experts included the Associate Director of the University of Florida/Institute of Food and Agricultural Sciences' Center for Public Issues Education for Agriculture and Natural Resources, the Associate Director of the Office of Agricultural Water Policy at the Florida Department of Agriculture and Consumer Services, the Director of Government and Community Affairs at the Florida Farm Bureau, the Chief Executive Officer of the Florida Dairy Farmers and an evaluation specialist with a background in survey design and construction.

Sampling occurred in two ways. First, to reach Florida residents, a non-probability opt-in sample was obtained from a public opinion survey research company. Non-probability samples are often used in public opinion research to make population estimates (Baker, et al., 2013). While non-probability samples require adjustments for nonrandom selection and nonresponse, previous literature has shown that non-probability samples have yielded results that are as good as or even better than probability-based samples (Abate, 1998; Twyman, 2008; Vavreck & Rivers, 2008).

The public opinion survey research company sent the sample a link to the developed survey to Florida residents representative of the state population based on the 2010 Census data and 525 responses were obtained. To compensate for potential exclusion, selection, and non-participation biases that tend to be limitations of using a non-probability sample, weighting procedures were implemented (Baker, et al., 2013). In this case, weighting was conducted using post-stratification methods (Kalton & Flores-Cervantes, 2003) to balance demographics ensuring the composition of the sample reflected the adult Florida population and to provide results intended to approximate the population of interest.

To reach decision makers in Florida, a list of email addresses for all county commissioners, county clerks, mayors and county managers ($N = 1,212$) was obtained. It is important to recognize there are some counties that do not have email addresses for this population and therefore were excluded from participation in the study. A link to the survey instrument was sent requesting their participation in the study. After the initial email and three reminders 194 responses were received, resulting in a response rate of 16%. Descriptive statistics were used to determine frequencies of responses, means and standard deviations. Independent t -tests and ANOVAs were employed to determine if there were statistical differences between groups.

Results

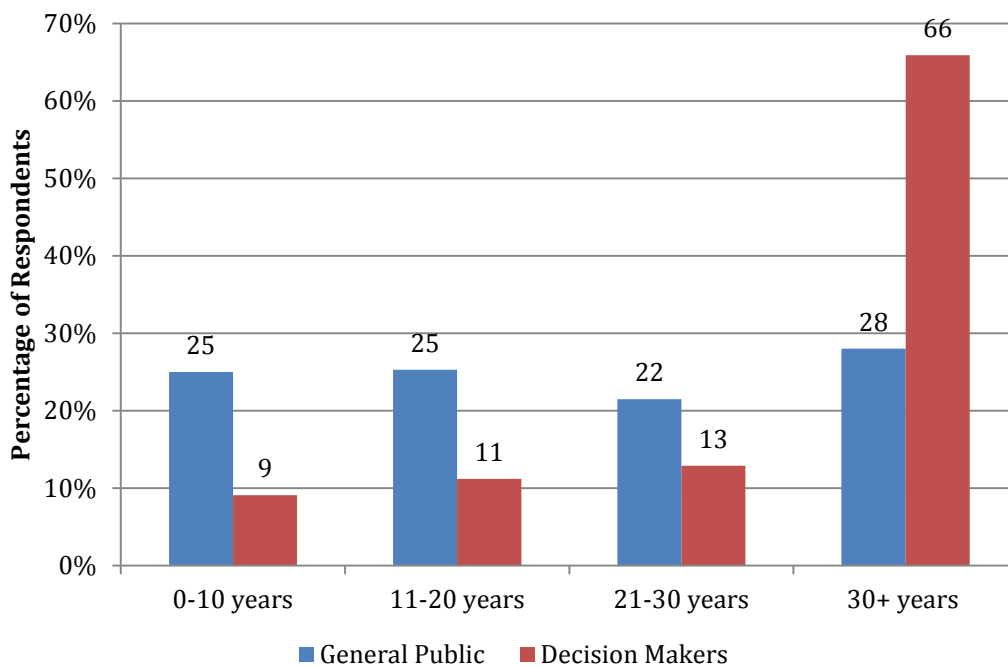
About the Respondents

Demographic questions were presented to respondents about how long they have lived in Florida, their place of residence including rural-urban continuum location, gender, age, race and ethnicity, educational attainment, and political affiliation and values. Respondents were also asked about their personal involvement in agriculture as well as the source where they or their community receive drinking water.

Residence

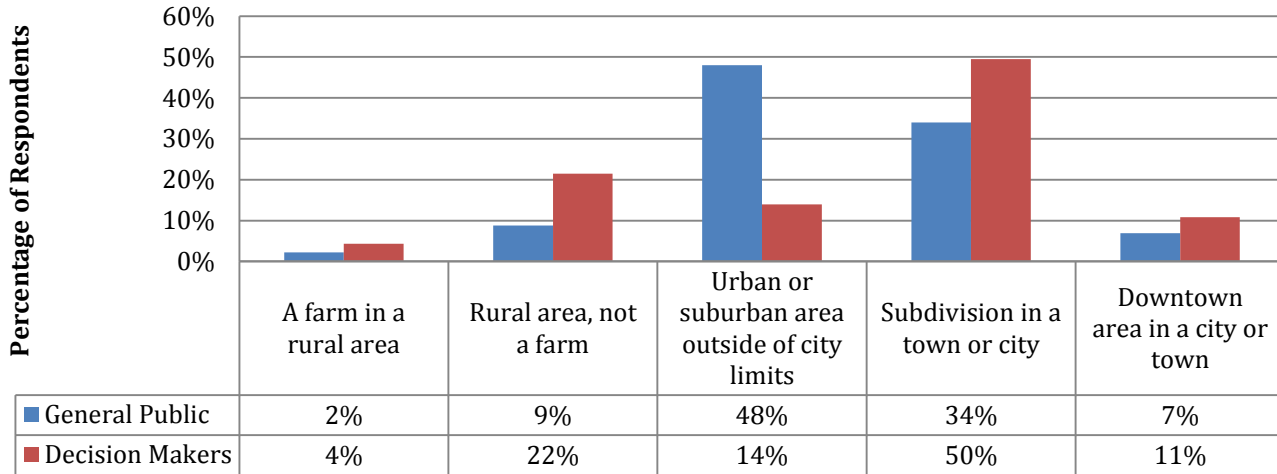
Respondents were asked how long they have lived in Florida and the residential area in which they live. More decision makers have lived in Florida for 30 or more years than the general public. Sixty-six percent of decision makers had lived in Florida for 30 or more years compared to 28% of the general public (Figure 1).

Figure 1: Years lived in Florida



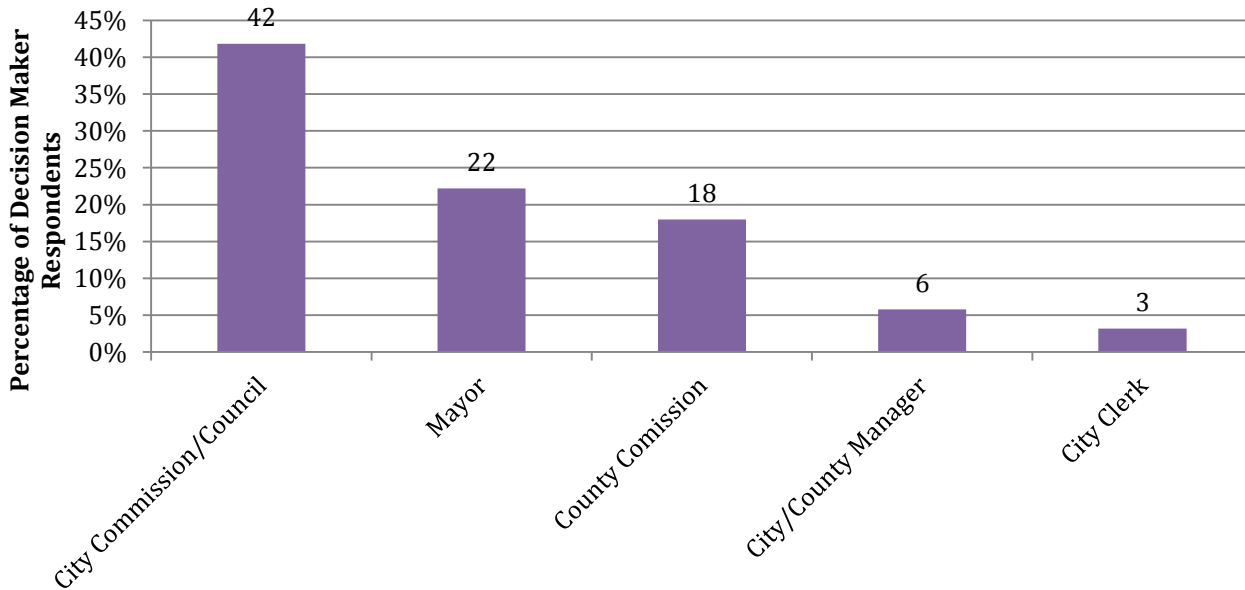
More respondents from the general public indicated they lived in an urban or suburban area outside of the city limits than decision makers, while more decision makers lived in a subdivision than the general public (Figure 2). Forty-eight percent of the general public lived in an urban or suburban area outside of the city limits, compared to 14% of decision makers, while 50% of decision makers live in a subdivision in a town or city compared to 34% of the general public. Decision makers were also more likely to live in a rural area (22%) than the general public (9%).

Figure 2: Residential area



Decision maker respondents were asked to indicate the type of public position they held. The most common position was city commission/council member (Figure 3). Twenty-two percent were mayors; 18% were county commissioners.

Figure 3: Type of public position held by decision makers



Note: 9% of respondents indicated “other.”

Demographics

Decision makers were more likely to be male, white, and older than the general public respondents (Table 1). The general public were more likely to live in large metropolitan areas (61.3%), compared to decision makers (41.3%).

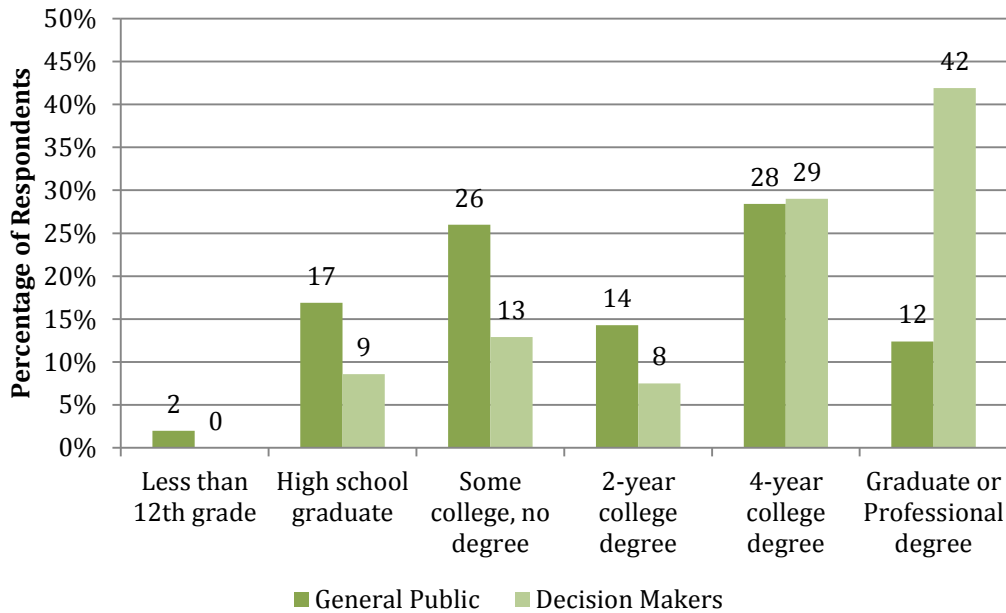
Table 1: Demographic characteristics of respondents

Demographic Category	General Public	Decision Makers
Gender		
Male	48.9	71.0
Female	51.1	29.0
Race and Ethnicity		
Hispanic	22.5	5.4
Native American	0	3.2
Asian	2.6	0
African American	16.4	5.4
White	76.9	89.2
Age		
19 and younger	1.7	0
20-29 years	16.5	0.6
30-39 years	15.8	5.6
40-49 years	18.3	19.0
50-59 years	17.4	29.1
60-69 years	14.3	30.2
70-79 years	9.6	14.0
80 and older	6.3	1.7
Rural Urban Continuum		
Metro- Counties in metro areas of 1 million population or more	63.1	41.3
Metro- Counties in metro areas of 250,000 to 1 million population	25.7	24.6
Metro- Counties in metro areas of fewer than 250,000 population	24.8	10.6
Nonmetro- Urban population of 20,000 or more, adjacent to a metro area	3.5	11.7
Nonmetro- Urban population of 2,500 to 19,999, adjacent to a metro area	2.9	9.5
Nonmetro- Completely rural or less than 2,500 urban population, adjacent to a metro area	0	2.2

Educational Attainment

Decision makers had higher educational attainment than the general public. Forty-two percent of decision makers held a graduate or professional degree, compared to 12% of the general public (Figure 4).

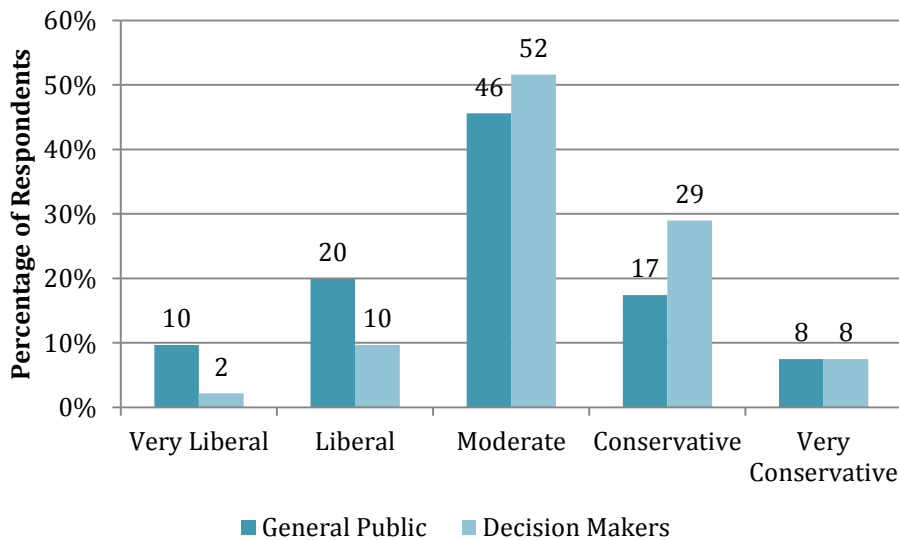
Figure 4: Education



Political Affiliation and Values

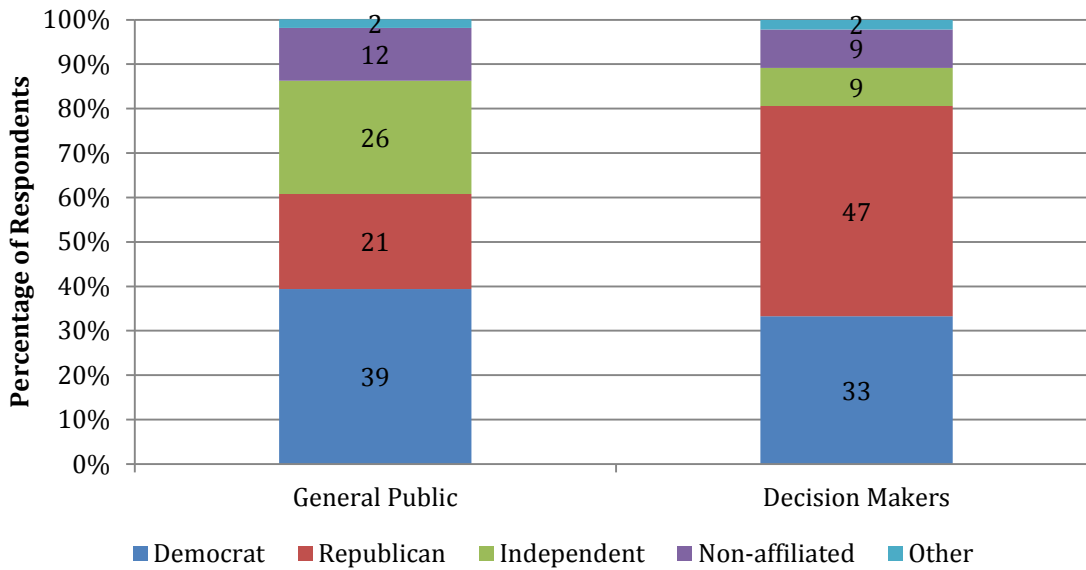
Decision makers indicated they were more politically conservative than the general public. Thirty-seven percent of the decision makers considered themselves to be conservative or very conservative, compared to 25% of the general public (Figure 5).

Figure 5: Political values



Decision makers were also more likely to be Republican (47%) than the general public (21%). More of the general public considered themselves Independent (26%) than decision makers (9%). Results can be seen in Figure 6.

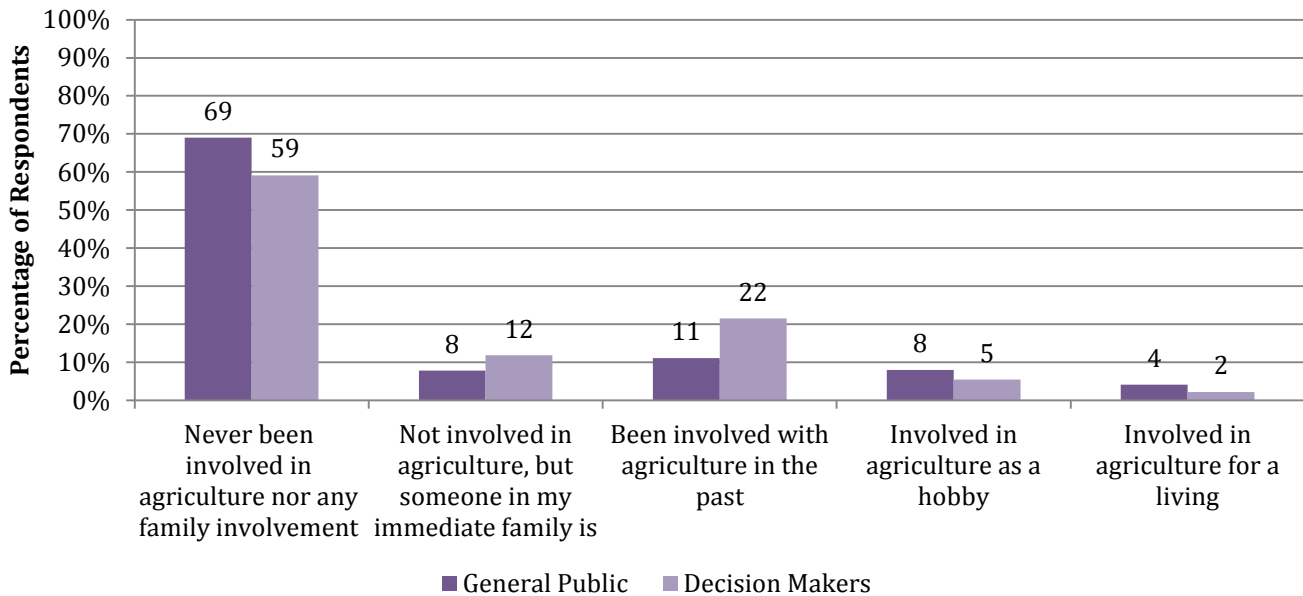
Figure 6: Political affiliation



Involvement in Agriculture

Both sets of respondents were asked to indicate their level of involvement in agriculture (Figure 7). The majority of respondents had never been involved in agriculture and had no family members involved in agriculture (60% of the general public and 59% of decision makers). More decision makers had been involved in agriculture in the past (22%) than the general public (11%).

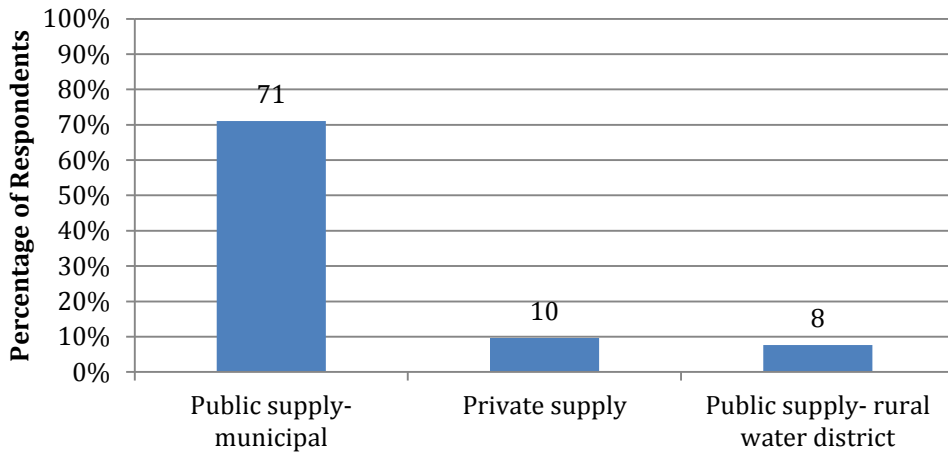
Figure 7: Involvement in agriculture



Water Source

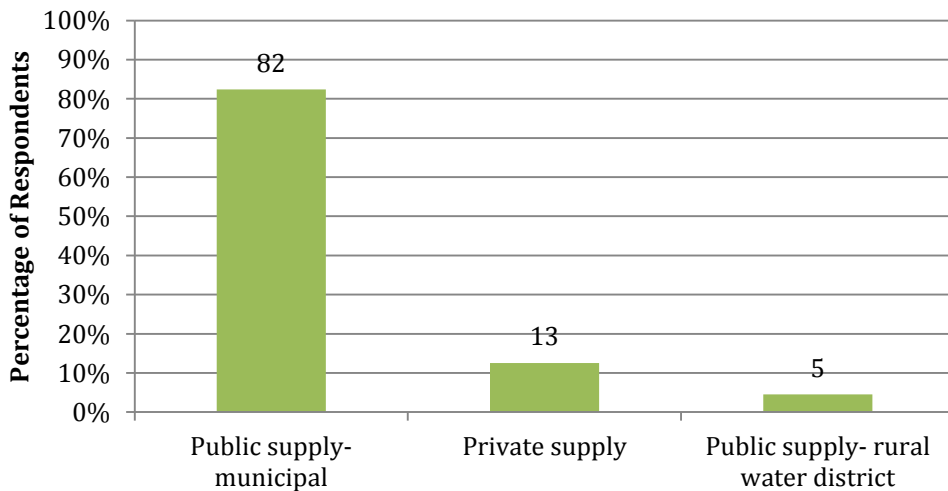
The survey conducted with the general public asked respondents to indicate the source of their home water supply. Seventy-one percent indicated they received their home water supply from a municipal public supply source (Figure 8). Respondents to the survey conducted with decision makers were asked to indicate the source of their community’s water supply. Eight-two percent of decision makers indicated their community received water from a municipal public supply source (Figure 9).

Figure 8: Home water supply source- General public



Note: 12% of respondents from the general public were unsure

Figure 9: Community water supply source- Decision makers



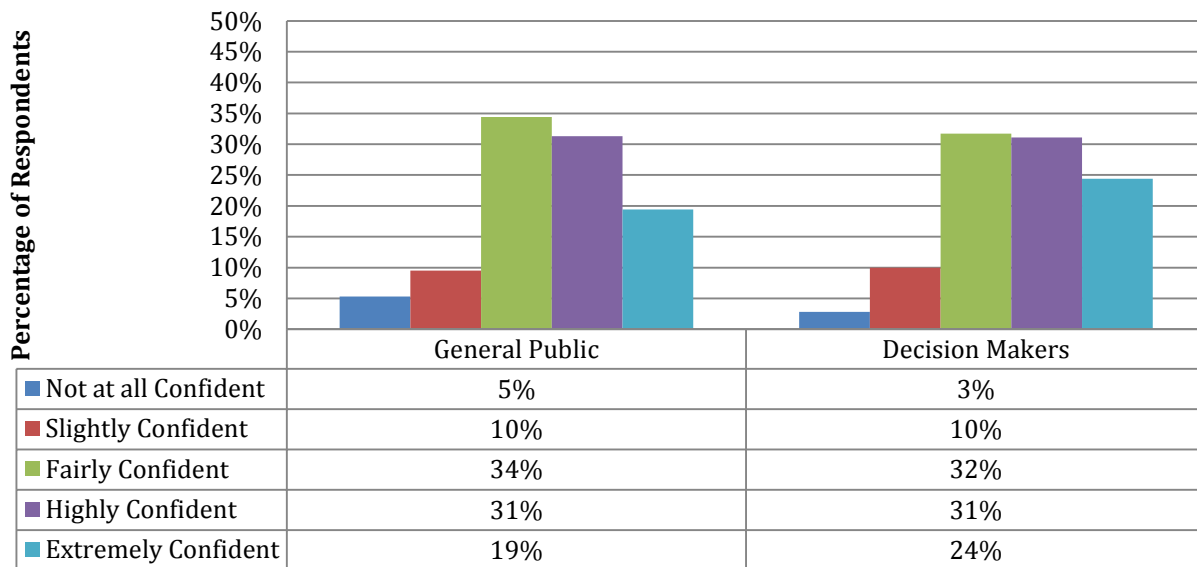
Note: 1% of decision maker respondents were unsure

Confidence in Water Resources

Respondents were asked about their confidence in water resources. They had to indicate their level of confidence on a five-point scale with 1 = *Not at all confident*, 2 = *Slightly Confident*, 3 = *Fairly Confident*, 4 = *Highly Confident*, and 5 = *Extremely Confident*.

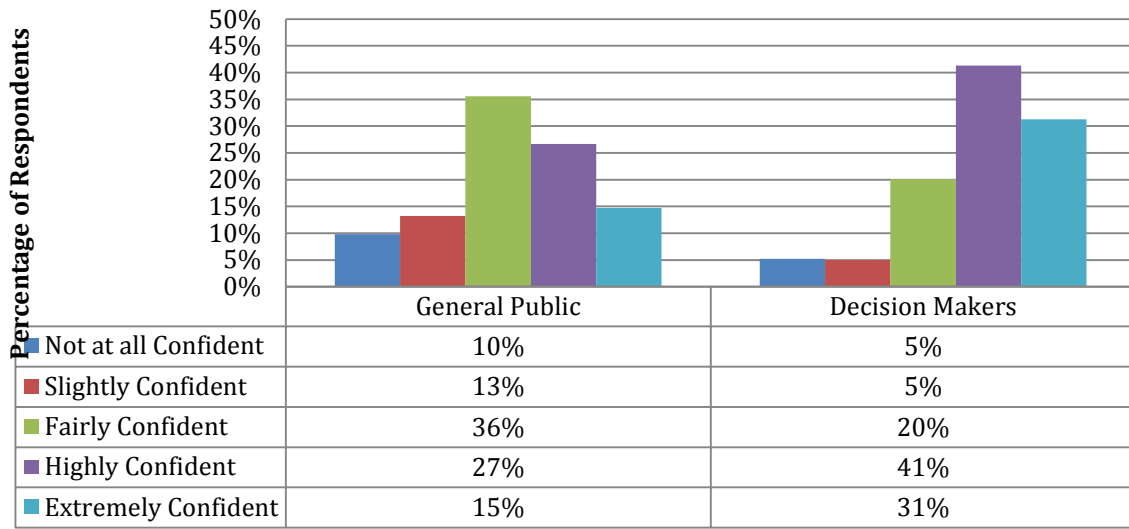
First, respondents were asked to indicate how confident they were that their community would have sufficient water resources in the next ten years. Decision makers and the general public answered similarly, with about half of respondents from both groups who indicated they felt highly or extremely confident in the sufficiency of future water resources in their community (Figure 10).

Figure 10: Confidence in sufficient future water resources



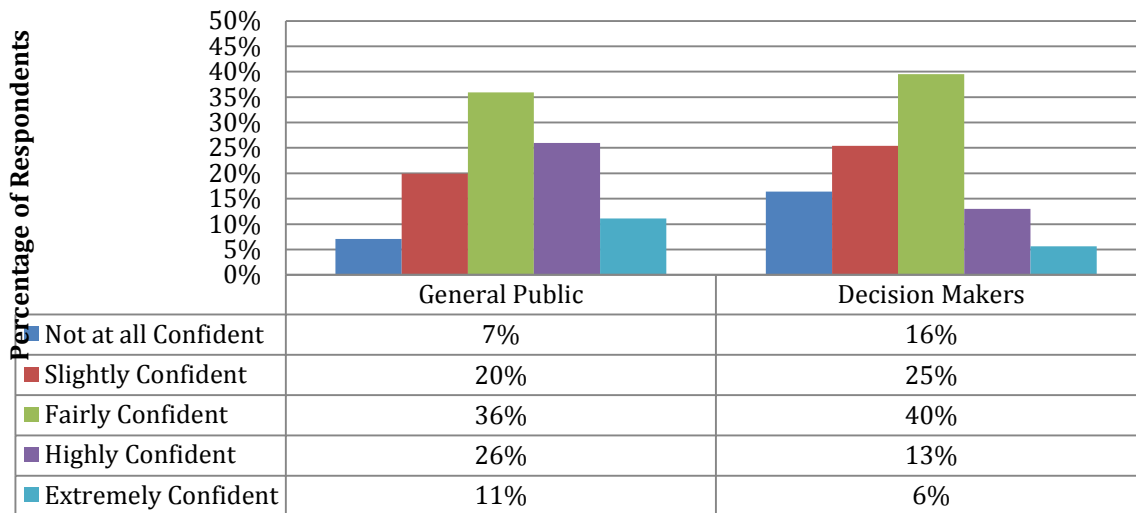
Respondents were asked how confident they were in the quality of their home tap water. Decision makers were more likely to indicate they were highly or extremely confident (72%) in the quality of their home tap water than the general public (42%). Results are displayed in Figure 11.

Figure 11: Confidence in quality of home tap water



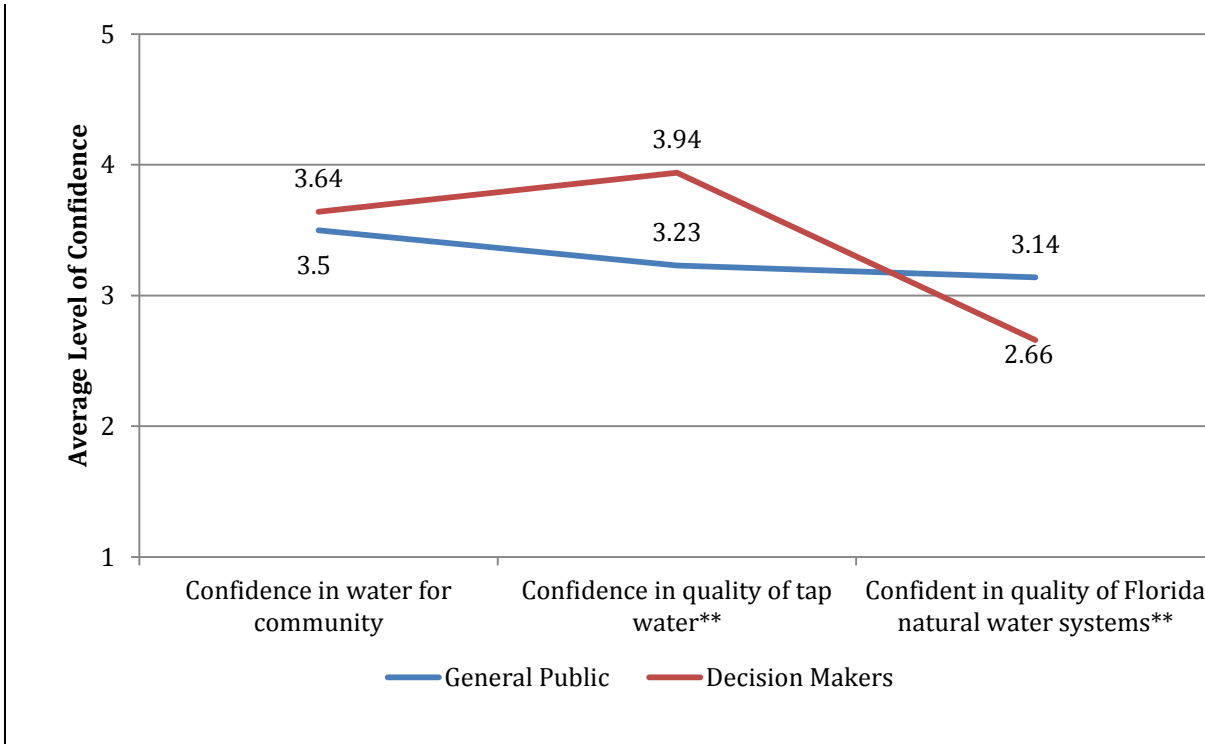
Next, respondents were asked, “how confident are you in the quality of Florida’s natural water systems such as lakes, streams, rivers, wetlands, estuaries, bays, etc.?” Thirty-seven percent of the general public were highly or extremely confident in the quality of Florida natural water systems, compared to 19% of decision makers (Figure 12).

Figure 12: Confidence in quality of Florida natural water systems



An independent *t*-test was conducted to assess differences in the average response for each of the three confidence items to determine if any statistically significant differences were present between the two groups. Statistical differences were found. Decision makers were more confident, on average, in the quality of their tap water when compared to the general public. On the other hand, the general public was more confident in the quality of Florida’s natural water systems than decision makers. Figure 13 visually displays these results.

Figure 13: Comparison of water confidence levels amongst General Public and Decision Makers

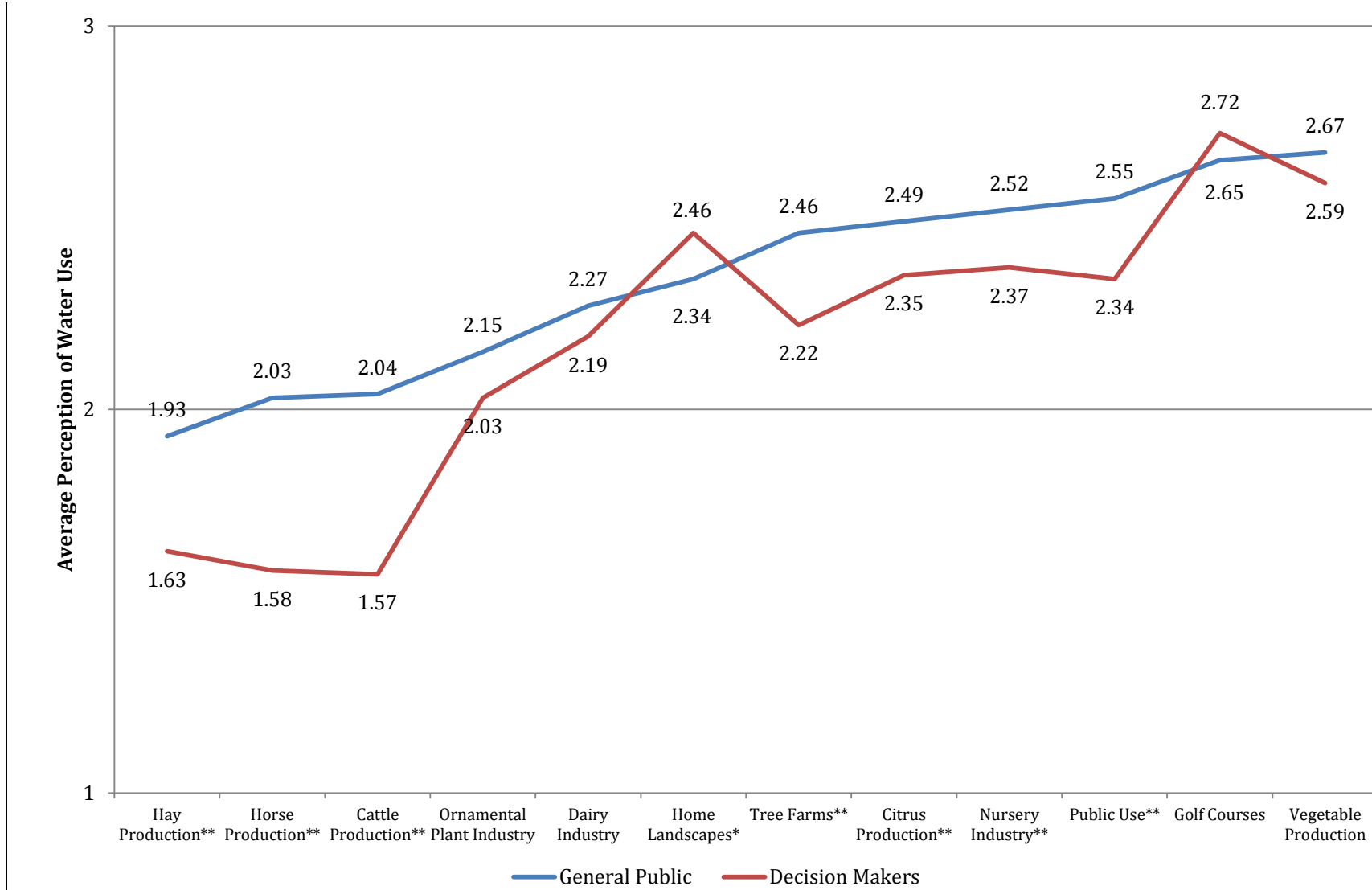


Note: ** = Statistically significant differences at the $p \leq .01$ level

Perceptions of Agricultural Water Use

One section in the survey asked respondents to indicate their perception of water use among different groups. These groups consisted of agricultural production groups, the public, home use, and golf courses. Results are displayed in Figure 14 and were calculated with a three-point scale with 1 = uses a small amount of water, 2 = uses a moderate level of water, and 3 = uses a lot of water. Respondents were given a photo of each group and then asked to drag the photo into a box with their chosen corresponding water use level. Decision makers indicated they thought hay, horses, and cattle used less water than the general public, and these results were statistically significant at the .01 level when an independent *t*-test was conducted. While these were statistically significant, both groups fell within the “uses a lot of water” range in their answers. Decision makers also considered home use to be higher than the general public, while they considered citrus, plants, and public use to be lower than the general public. Overall, respondents to both surveys considered golf and vegetable production to be the highest water users.

Figure 14: Perceptions of agricultural water use

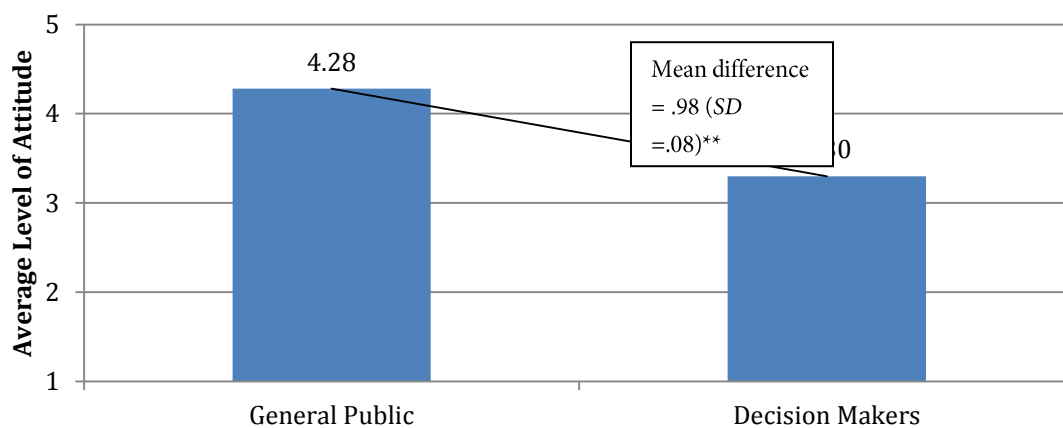


Note: ** = Statistically significant differences at the $p \leq .01$ level

Attitude towards Agricultural Water Use

Respondents were asked to indicate their attitude towards agricultural water use in Florida. This question was conducted in a semantic differential format, with two opposing words displayed from left to right. Respondents were given the sentence: “When it comes to protecting water in Florida, farmers are....” Respondents then chose where on a five-point scale between two words their attitude most closely aligned. The word pairings were *good/bad*, *positive/negative*, *careful/careless*, *thoughtful/thoughtfulness*, *cautious/reckless*, *innovative/old-fashioned*. A score of one indicated a negative attitude, while a five indicated a positive attitude. All six word pairings were averaged to create an overall attitude score. The general public scored an average of 4.28 while decision makers scored an average of 3.30 indicating the general public feels farmers protect water resources in Florida while decision makers are more neutral about the issue. This difference was statistically significant at the .01 level when an independent *t*-test was conducted. Results can be seen in Figure 15.

Figure 15: Attitude towards agricultural water use



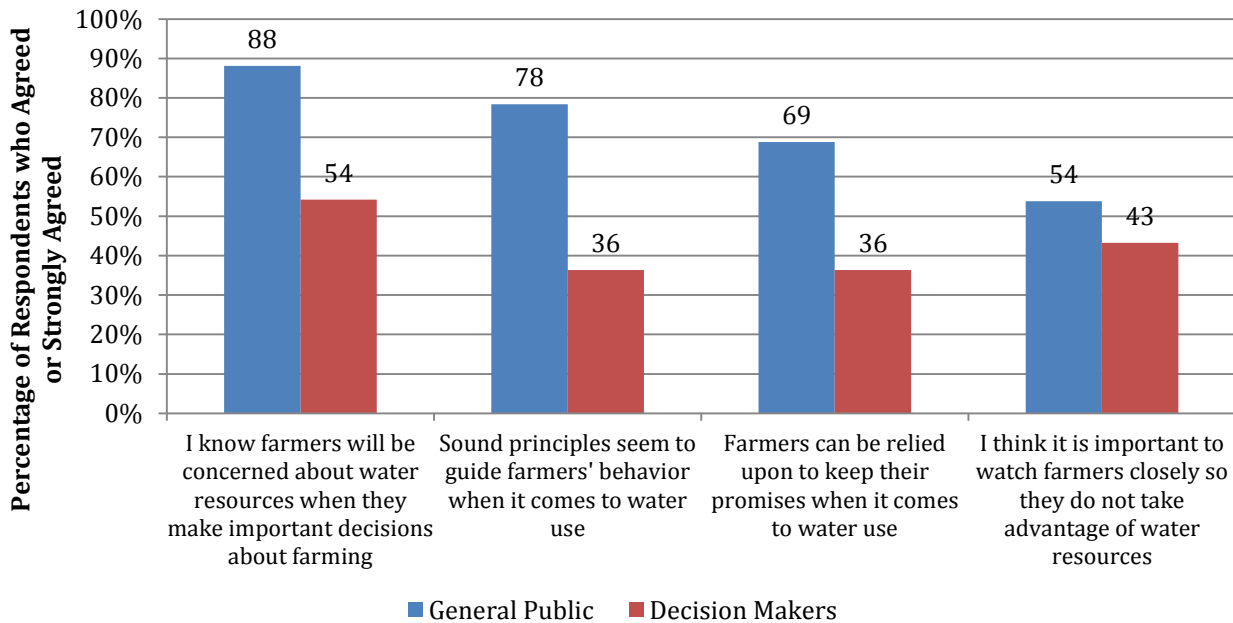
Note: ** = Statistically significant differences at the $p \leq .01$ level

Respondents were then asked to indicate their level of agreement to a variety of questions about farmers and their farming practices. Key concepts examined included: trust in water use and protection, use of resources, their relationship with the natural environment, and impacts on open space and wildlife. All questions were asked using a 5-point Likert-type agreement scale with 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, 5 = *Strongly Agree*. In Figures 16-20 the agree and strongly agree categories were combined to visually display differences in general agreement among decision makers and the general public. Table 2 displays the average response for each item among both the decision makers and general public.

Trust in Water Use and Protection

Respondents were asked about their trust in farmers' practices. In general, less than half of the decision makers did not trust farmers when it came to water use. However, only 43% agreed or strongly agreed it was important to watch them closely so they do not take advantage of water resources. Overall, the general public was more likely to indicate they agreed or strongly agreed farmers are concerned about water resources, are guided by sound principles about water use and can be relied upon to keep their promises about water use. The largest difference among the two groups occurred for the item “sound principles seem to guide farmers’ behavior when it comes to water use.” Thirty-six percent of decision makers agreed or strongly agreed with this statement compared to 78% of the general public (Figure 16). All items were statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers.

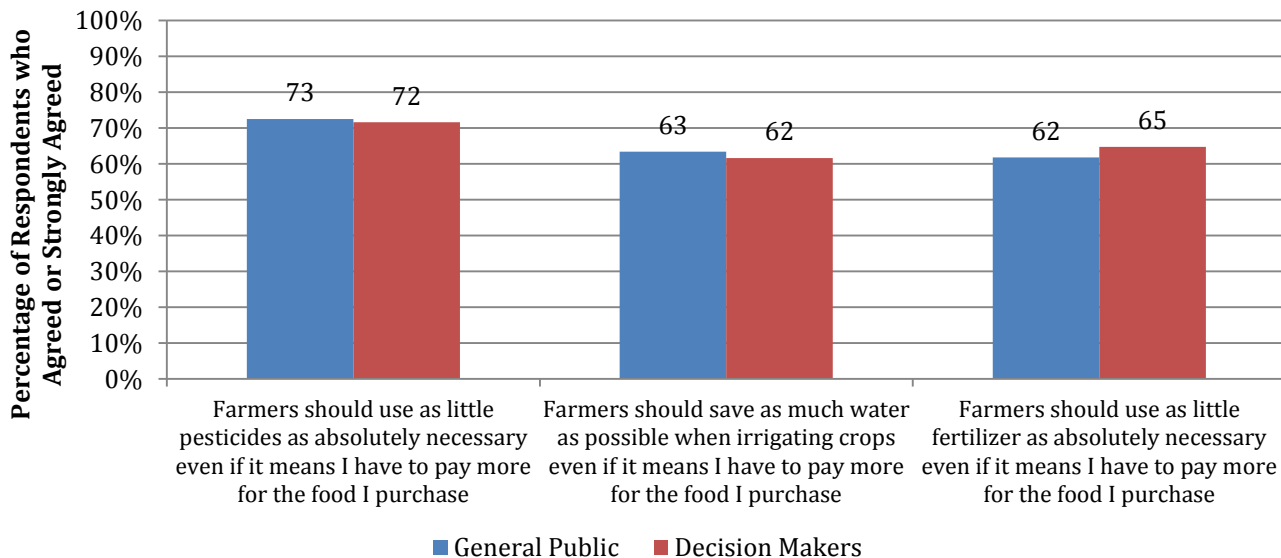
Figure 16: Trust in water use and protection



Use of Resources

Decision makers and the general public answered similarly to questions about farmers' use of resources. The majority of respondents from both groups agreed or strongly agreed farmers should use as little pesticides, fertilizer, and water as possible when producing their crops or products even if it means they have to pay more for the food they purchase. Results can be seen in Figure 17. All items were statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers.

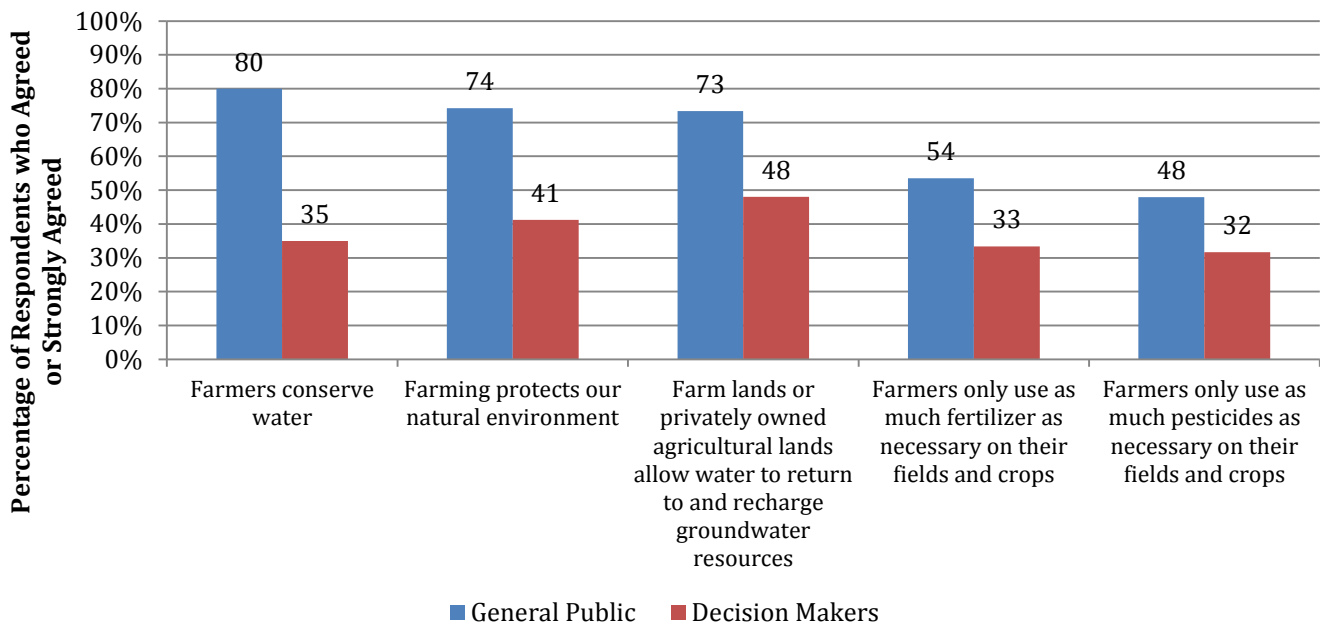
Figure 17: Use of resources



Relationship with the Natural Environment

Respondents were asked about their perceptions regarding agriculture’s relationship with the natural environment from a positive perspective. Overall, less than half of the decision makers agreed or strongly agreed with the statements indicating that in general decision makers do not perceive agriculture as valuable to the natural environment. More respondents from the general public agreed or strongly agreed to all statements than decision makers. The largest difference occurred for the item “farmers conserve water.” Only 35% of decision makers agreed or strongly agreed to this statement compared to 80% of the general public (Figure 18). All items were statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers.

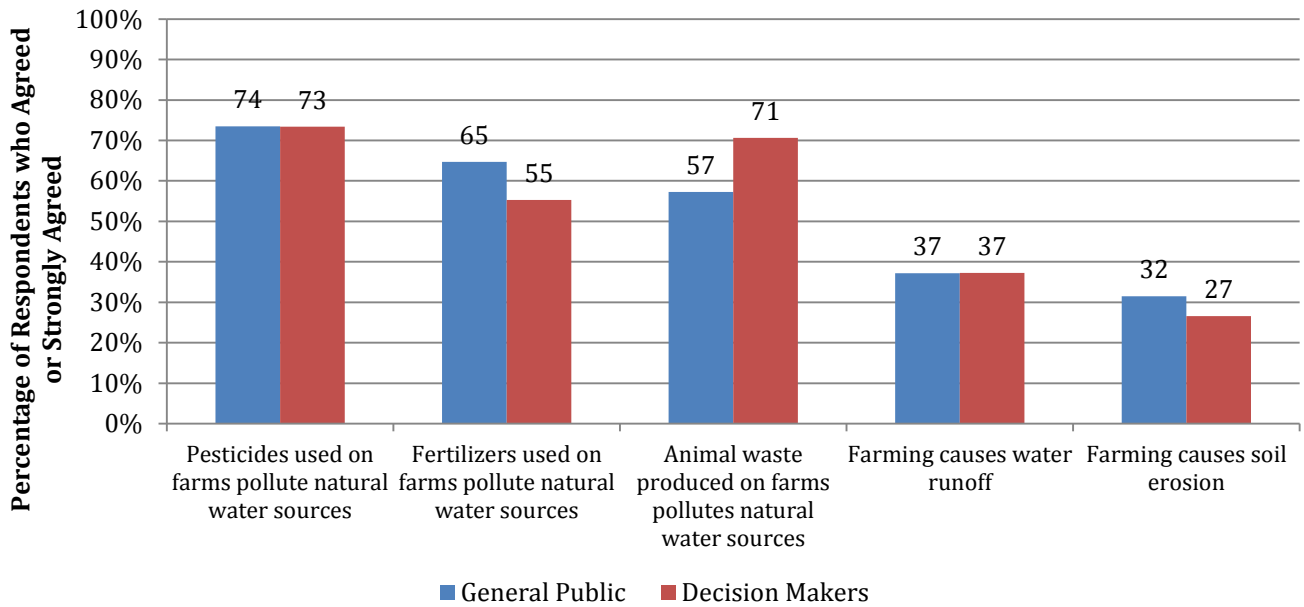
Figure 18: Relationship with the Natural Environment – Positive Frame



Respondents were also asked a series of questions about agriculture’s relationship with the natural environment that was framed negatively. While decision makers were less likely to indicate they agreed or strongly agreed with the positive statements than the general public, they were also less likely to indicate they agreed or strongly agreed with the negative statements than the general public.

Overall, less than half of the respondents from both groups agreed or strongly agreed farming causes soil erosion or water runoff. However, more than half of the respondents from both groups agreed or strongly agreed pesticides and fertilizers used on farms pollute natural water sources. Decision makers were more likely to agree or strongly agree that animal waste can pollute natural water sources than the general public (Figure 19). All items were statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers except for the item “pesticides used on farms pollute natural water sources,” which was not statistically significant.

Figure 19: Relationship with the Natural Environment – Negative Frame



Impact on Open Space and Wildlife

Lastly, a series of questions were asked about agriculture and its relationship to preserving open space and wildlife. Overall, respondents from both groups believed agriculture preserves open space and acts as a buffer to urban areas (Figure 20). However, they were less likely to agree or strongly agree farms are a valuable resource when it comes to protecting wildlife, and more specifically endangered species.

When comparing the two groups, the largest difference occurred for the item “farms are a way to protect wildlife.” Fifty-nine percent of the general public agreed or strongly agreed with this statement compared to 39% of decision makers. While decision makers were less likely to agree or strongly agree farms help preserve open space or protect wildlife and habitats, they were more likely to agree or strongly agree that farms provide a buffer to urban areas (77%) than the general public (65%). All items were statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers.

Figure 20: Impact on Open Space and Wildlife

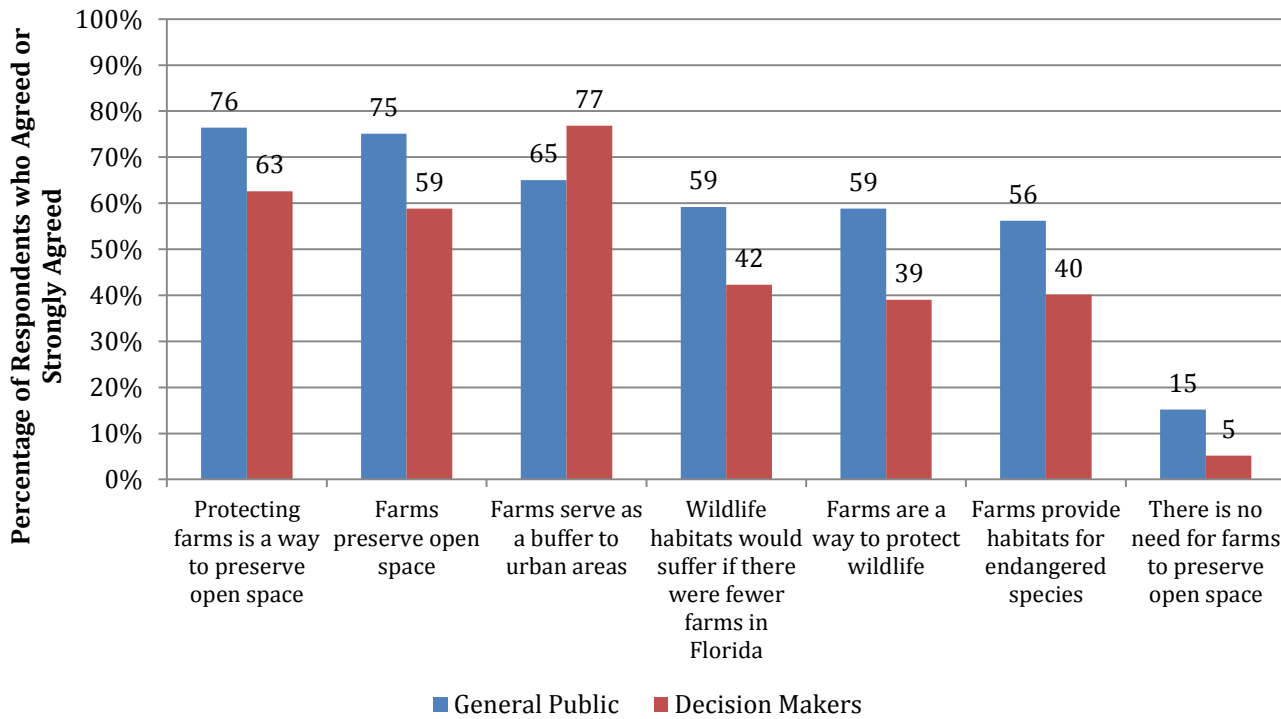


Table 2 displays the overall average response to each of the items presented in Figures 16-20. The items were split into five different conceptual areas and summed and averaged into five different scales. The five different scales are shown in bold and all demonstrated strong internal reliability of $\alpha = .73$ or higher. The scales were compared among decision makers and the general public using an independent samples *t*-test.

Regarding *trust in water use and protection*, the general public had an average of 3.69 while decision makers had an average of 3.20. This indicates that while decision makers held a neither agree nor disagree position, the general public held a position of agreement to the overall statements. Regarding *use of resources*, both the general public and decision makers had average responses corresponding with an attitude of agreement to the statements. Regarding *relationship with the natural environment using positive frame questions*, decision makers held a neither agree nor disagree position (3.37), while the general public held a position of agreement (3.80). For the overall average of questions regarding the *relationship with the natural environment using negative frame questions*, the general public held a neither agree nor disagree position (3.50), while decision makers held an agree position (3.56). Regarding the *impact on open space and wildlife*, both groups held an agreement position.

Two scales had statistically significant differences between the two groups at the .01 level. These two scales were items regarding trust in farmers and items regarding how farming practices help the environment. In both cases the general public indicated a higher level of agreement to the items than decision makers. The means and standard deviations for both the overall scales and the individual items are displayed in Table 2.

Table 2: Index Results and Comparisons between Groups

	General Public <i>M</i>	General Public <i>SD</i>	Decision Makers <i>M</i>	Decision Makers <i>SD</i>
Trust in Water Use and Protection** ($\alpha=.73$)	3.69	.66	3.20	.74
I know farmers will be concerned about water resources when they make important decisions about farming	4.30	.81	3.60	.95
Farmers can be relied upon to keep their promises when it comes to water use	3.88	.87	3.26	.93
Sound principles seem to guide farmers' behavior when it comes to water use	4.04	.84	3.33	.82
I think it is important to watch farmers closely so they do not take advantage of water resources (RC)	3.48	1.12	3.38	1.07
Use of Resources ($\alpha=.85$)	3.82	.89	3.75	.95
Farmers should save as much water as possible when irrigating crops even if it means I have to pay more for the food I purchase	3.77	1.04	3.65	1.01
Farmers should use as little fertilizer as absolutely necessary even if it means I have to pay more for the food I purchase	3.72	1.03	3.72	1.09
Farmers should use as little pesticides as absolutely necessary even if it means I have to pay more for the food I purchase	3.97	1.02	3.88	1.07
Relationship with the Natural Environment - Positive Frame** ($\alpha=.84$)	3.80	.67	3.37	.71
Farmers conserve water	4.06	.78	3.29	.79
Farming protects our natural environment	3.99	.87	3.33	.92
Farm lands or privately owned agricultural lands allow water to return to and recharge groundwater resources (such as aquifers where we get our drinking water)	3.96	.81	3.61	.83
Farmers only use as much fertilizer as necessary on their fields and crops	3.54	.95	3.33	.90
Farmers only use as much pesticides as necessary on their fields and crops	3.46	.96	3.28	.95
Relationship with the Natural Environment – Negative Frame ($\alpha=.85$)	3.50	.76	3.56	.75
Farming causes soil erosion	3.02	1.00	3.11	.84
Farming causes water runoff	3.18	1.02	3.33	.92
Fertilizers used on farms pollute natural water sources	3.76	.94	3.73	.89
Pesticides used on farms pollute natural water sources	3.95	.86	3.85	.93
Animal waste produced on farms pollutes natural water sources	3.61	1.02	3.75	.95
Impact on Open Space and Wildlife ($\alpha=.81$)	3.75	.64	3.71	.58
Farms preserve open space	3.94	.80	3.85	.79
There is no need for farms to preserve open space (RC)	2.43	1.05	2.16	.79

Farms serve as a buffer to urban areas	3.80	.84	3.96	.76
Protecting farms is a way to preserve open space	4.03	.82	3.89	.73
Farms are a way to protect wildlife	3.70	1.00	3.51	.85
Wildlife habitats would suffer if there were fewer farms in Florida	3.65	1.04	3.53	.88
Farms provide habitats for endangered species	3.59	1.05	3.55	.86

Note: ** = Statistically significant differences at the $p \leq .01$ level; (RC) = item recoded for use in the overall index

Video and Messaging Source Credibility Experiment

An experimental design was incorporated into the survey presented to the general public to determine if the source of information influenced perception and attitude towards agricultural water use. The respondents to the general public survey were randomly assigned one of four videos to watch that described how farmers use best management practices to reduce agricultural water use and how the public uses more water than farmers, on average. The videos can be viewed on the PIE Center YouTube channel at

- <https://www.youtube.com/watch?v=OTLkyAemxEM>
- <https://www.youtube.com/watch?v=5BIHTwk-ln4>
- <https://www.youtube.com/watch?v=ba3XV0AtyuM>
- <https://www.youtube.com/watch?v=-ku5-mLEFel>

The four videos were identical except for the source treatment. When the speaker was on screen a different title was presented. In addition, a logo and web address was presented at the conclusion of the video that aligned with the title presented when the speaker was on screen. These four sources were:

- 1) Environmental Scientist from the Nature Conservancy,
- 2) Farmer from CostaFarms,
- 3) Regulator from the Florida Water Management District, and
- 4) Water Scientist from UF/IFAS.

The purpose of this video treatment was to assess whether the organization from which the message was received had an effect on respondents’ attitudes and perceptions. A series of ANOVAs were conducted to look at each of the four treatment groups and compare the variances of responses when it came to the five scales highlighted in Table 2. The only scale where significant differences were found based on which video the respondent watched was *Relationship with the natural environment – negative frame* ($F = 2.85; p = .04$). The group of respondents who received the nature conservancy video had the highest mean score (3.64) followed by the UF/IFAS video, Water Management, and Farmer video (Table 3). Overall, those who received the Nature Conservancy and UF/IFAS video had an attitude of agreement with the scale while those who received the Water Management and Farmer videos had an attitude of “neither agree nor disagree.”

A Bonferroni post-hoc test was conducted to explore the reasons for the ANOVA results and found there was a statistically significant difference in response between the respondents receiving the nature conservancy and farmer video treatments. Those who received the nature conservancy video had an overall higher average score on the *Relationship with the natural environment – negative frame* scale than those who received the farmer video. This indicated those who received the message from the nature conservancy expressed stronger negative perceptions of agricultural water use than those receiving the message directly from the farmer (Table 4).

Table 3: Video treatment group results for Relationship with the natural environment – negative frame scale

Group	N	Mean (SD)	SD
Nature Conservancy	136	3.64	.63
UF/IFAS	136	3.52	.74
Water Management	105	3.47	.79
Farmer	147	3.38	.85

Table 4: Bonferroni tests examining video treatment group results for Relationship with the natural environment – negative frame scale

Video Group (I)	Video Group (J)	Mean Difference (I-J)	Std. Error	p
UF/IFAS	Water Management	.04	.10	1.00
	Nature Conservancy	-.13	.09	.99
	Farmer	.13	.09	.87
Water Management	UF/IFAS	-.04	.10	1.00
	Nature Conservancy	-.17	.10	.49
	Farmer	.09	.10	1.00
Nature Conservancy	UF/IFAS	.13	.09	.99
	Water Management	.17	.10	.49
	Farmer	.26*	.09	.03*
Farmer	UF/IFAS	-.13	.09	.87
	Water Management	-.09	.10	1.00
	Nature Conservancy	-.26*	.09	.03*

Note: * = Statistically significant differences at the $p \leq .05$ level

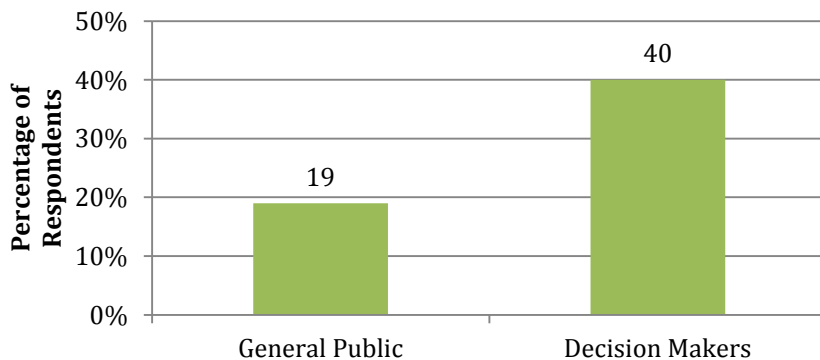
Best Management Practices

Respondents were asked a series of questions regarding best management practices (BMPs).

Awareness of Best Management Practices

Respondents were asked whether they were aware of any BMPs farmers in Florida implement to protect water. Nineteen percent of the general public respondents reported “yes” compared to 40% of decision makers (Figure 21). This was statistically significant at the .01 level when a Chi-square test was conducted to assess differences between the general public and decision makers.

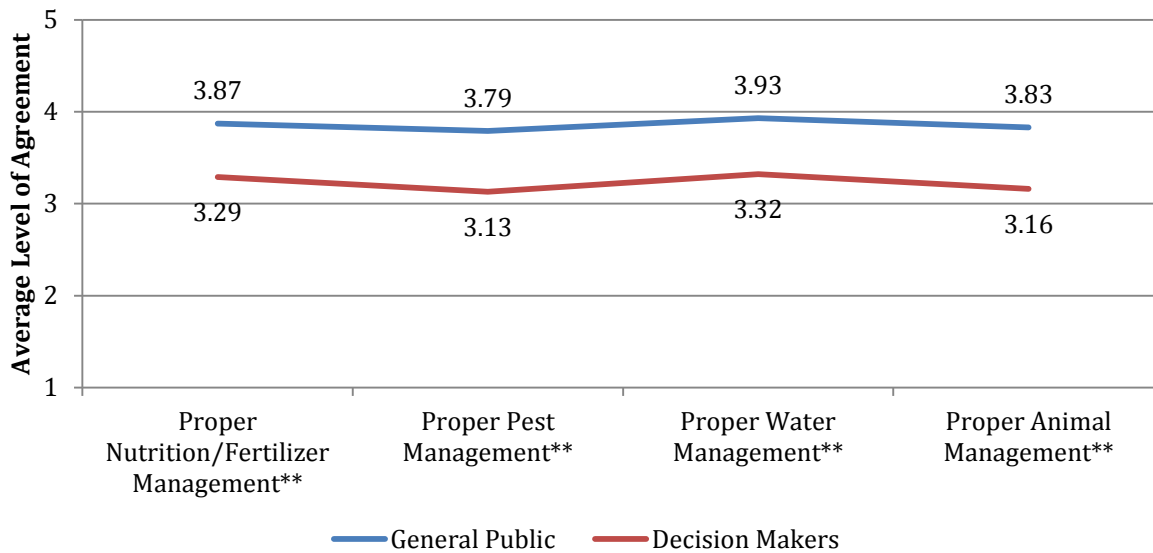
Figure 21: Awareness of Best Management Practices



Best Management Practices Use

Next, respondents were asked to indicate their level of agreement that farmers in Florida practice specific BMPs on a five-point Likert-type agreement scale with 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, and 5 = *Strongly Agree*. The general public agreed with all four statements while the decision makers were neutral indicating they neither agreed nor disagreed with all four statements (Figure 22). The differences between the two groups were statistically significant at the .01 level for all four statements.

Figure 22: Best Management Practices Use

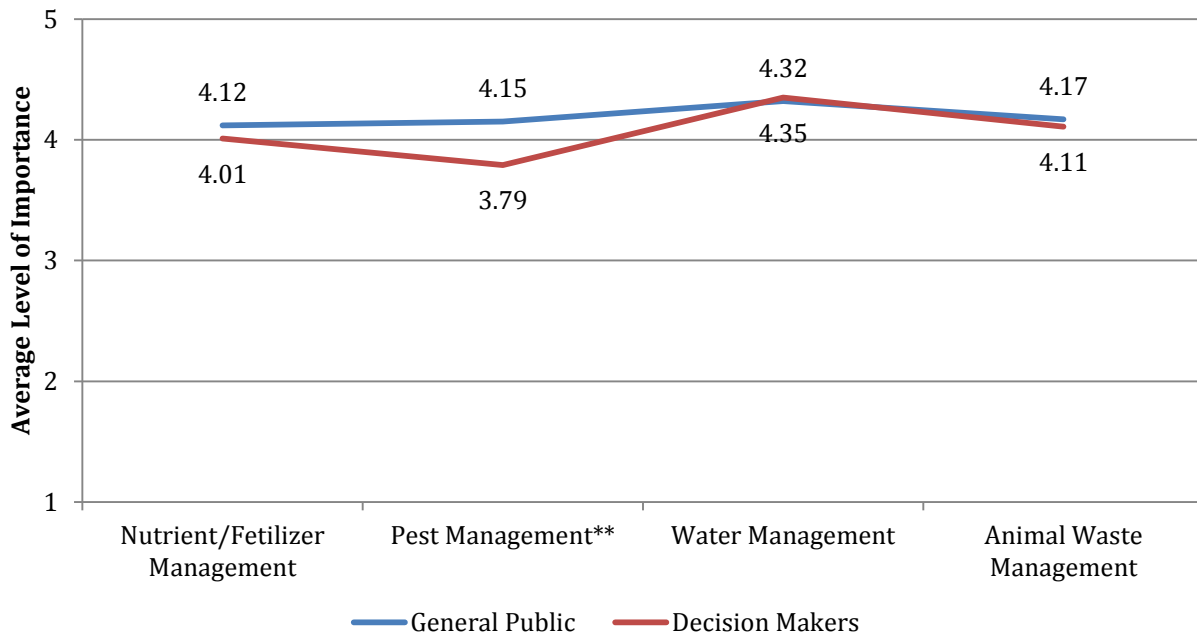


Note: ** = Statistically significant differences at the $p \leq .01$ level

Importance of Best Management Practices

Next, respondents were asked how important they considered it to be that farmers practice the four BMPs. Responses were 1 = *Not Important*, 2 = *Slightly Important*, 3 = *Important*, 4 = *Very Important*, and 5 = *Extremely Important*. Both the general public and decision makers responded similarly, with an average centering around “very important” for three items (nutrient/fertilizer management, water management, and animal waste management). Average responses differed amongst the two groups with respect to pest management (Figure 23). When tested for statistical significance, it was found decision makers considered this item less important than the general public.

Figure 23: Importance of Best Management Practices



Note: ** = Statistically significant differences at the $p \leq .01$ level

Table 5 displays the overall average scores for the four items comprising a single average that farmers practice proper BMPs as well as the four items comprising the single average score for the importance that farmers practice BMPs. There was a statistically significant difference at the .01 level between the general public and decision makers regarding agreement that farmers practice proper BMPs when an independent *t*-test was conducted. The general public indicated it was very important while decision makers indicated it was important.

When compared, responses to the individual items were also statistically different at the .01 level. Regarding the importance that farmers practice BMPs, there was a statistically significant difference between the overall average score between decision makers and the general public at the .05 level when an independent *t*-test was conducted. The general public had an average of 4.19 while decision makers had an average of 4.07; therefore, both groups indicated it was very important. The only individual item that had a statistically significant difference was the item “pest management.” While the results differed, in terms of real scale limits, both the general public and decision makers indicated this was a very important practice for farmers to engage in as well.

Table 5: Best Management Practice Index Results

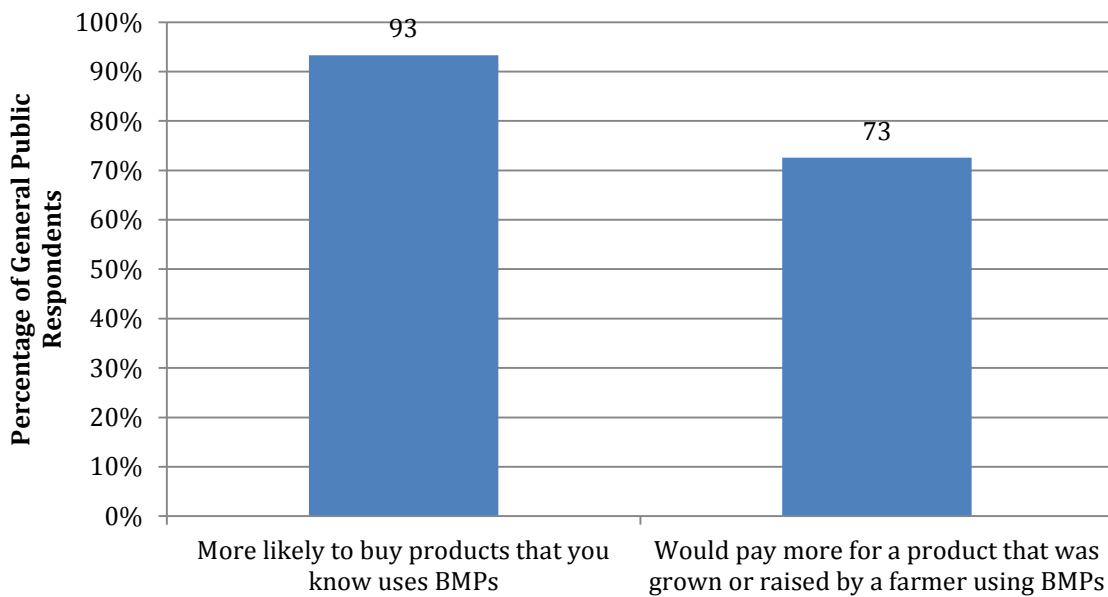
	General Public M (SD)	Decision Makers M (SD)
Agreement that Farmers Practice Proper BMPs**	3.86 (.69)	3.22 (.70)
Proper Nutrition/Fertilizer Management**	3.87 (.74)	3.29 (.73)
Proper Pest Management**	3.79 (.78)	3.13 (.74)
Proper Water Management**	3.93 (.77)	3.32 (.75)
Proper Animal Waste Management**	3.83 (.77)	3.16 (.82)
Importance that Farmers Practice BMPs*	4.19 (.71)	4.07 (.63)
Nutrient/Fertilizer Management	4.12 (.81)	4.01 (.74)
Pest Management**	4.15 (.83)	3.79 (.86)
Water Management	4.32 (.78)	4.35 (.65)
Animal Waste Management	4.17 (.85)	4.11 (.73)

Note: ** = Statistically significant differences at the $p \leq .01$ level; * = Statistically significant differences at the $p \leq .05$ level

Willingness to pay for BMP products

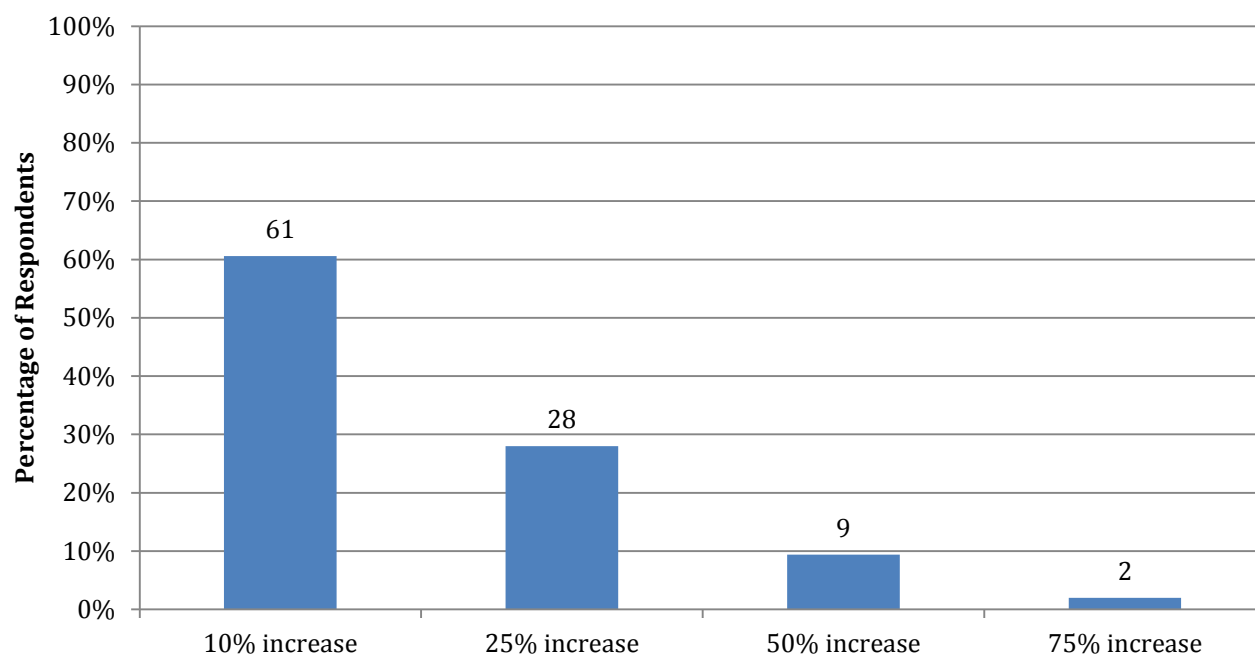
Respondents to the survey for the general public were asked about their willingness to buy or pay more for products created by farmers that use BMPs. Ninety-three percent of the general public indicated they would be more likely to buy products from farmers they knew used BMPs while 73% would pay more for a product that was grown or raised by a farmer using BMPs. Results are displayed in Figure 24.

Figure 24: Buy or pay more for BMP products



Those respondents who indicated they would be willing to pay more for a product produced using BMPs ($n = 380$) were asked how much more they would be willing to pay. The question specifically asked how much more respondents would be willing to pay for fruit grown using BMPs compared to fruit not produced using BMPs. Specific prices were given and included a) 10% or \$2.75 instead of \$2.50 for a small container, b) 25% or \$3.13 instead of \$2.50 for a small container, c) 50% or \$3.75 instead of \$2.50 for a small container, or d) 75% or \$4.38 instead of \$2.50 for a small container. Sixty-one percent would be willing to pay 10% more but only 2% would be willing to pay 75% more (Figure 25).

Figure 25: Would pay more for BMP products



Knowledge about Water Issues

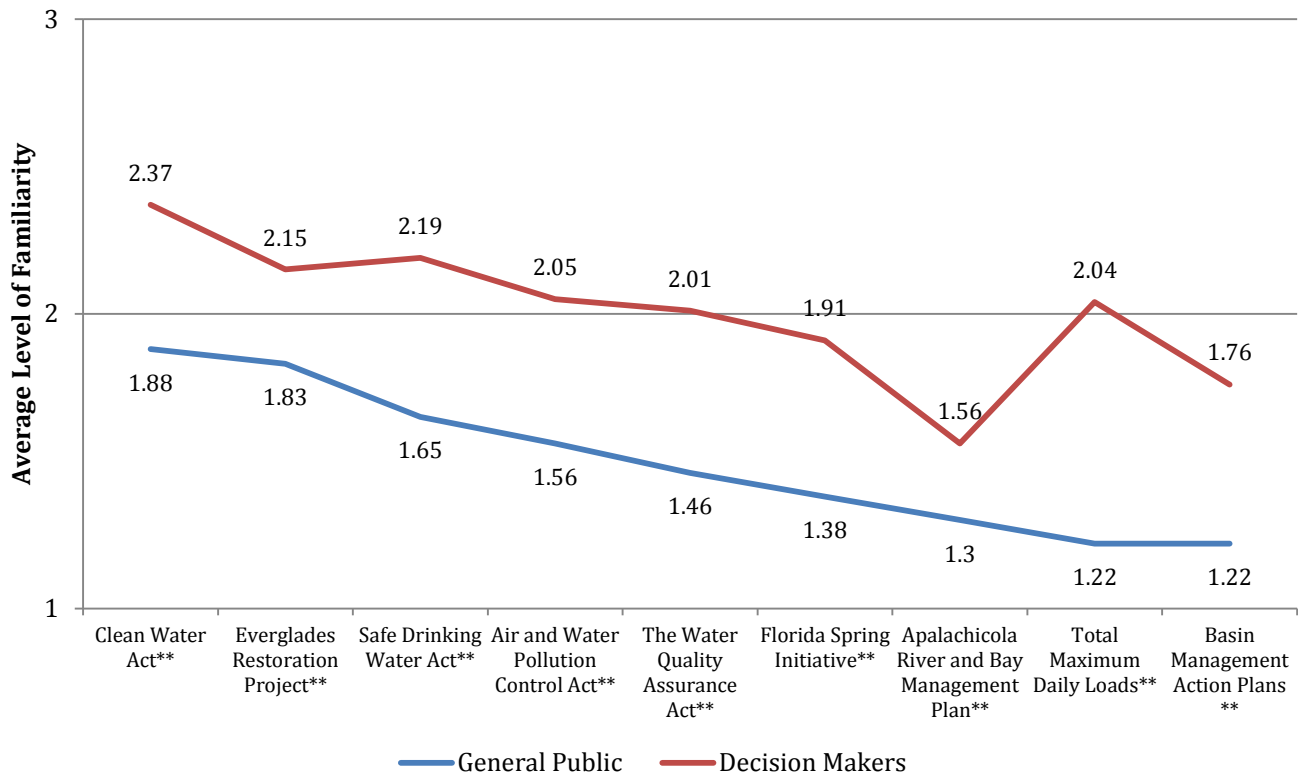
Respondents were asked about topics related to their knowledge of, and learning practices related to, water issues.

Familiarity with Water-Related Legislative Action or Plans

Respondents were asked their level of familiarity with water-related legislative actions or plans. Respondents were presented with a list of legislative action or plans related to water and asked to indicate whether they were 1 = *Not Familiar*, 2 = *Somewhat Familiar*, or 3 = *Very Familiar* with the listed item.

Both the general public and decision makers were most familiar with the Clean Water Act, the Everglades Restoration Project, and the Safe Drinking Water Act. The general public was not familiar with Total Maximum Daily Loads or Basin Management Action Plans. Decision makers reported being the least familiar with the Apalachicola River and Bay Management Plan. Overall, the general public considered themselves less familiar with all of the legislative actions or plans than decision makers. All differences between these two groups were statistically significant at the .01 level (Figure 26). Table 6 displays the averages for each item as well as an overall average score of the entire set of items. The overall average score indicated the general public is not familiar with water-related legislative action or plans in general while decision makers are somewhat familiar.

Figure 26: Familiarity with water-related legislative actions or plans



Note: ** = Statistically significant differences at the $p \leq .01$ level

Table 6: Familiarity with water-related legislative actions or plans

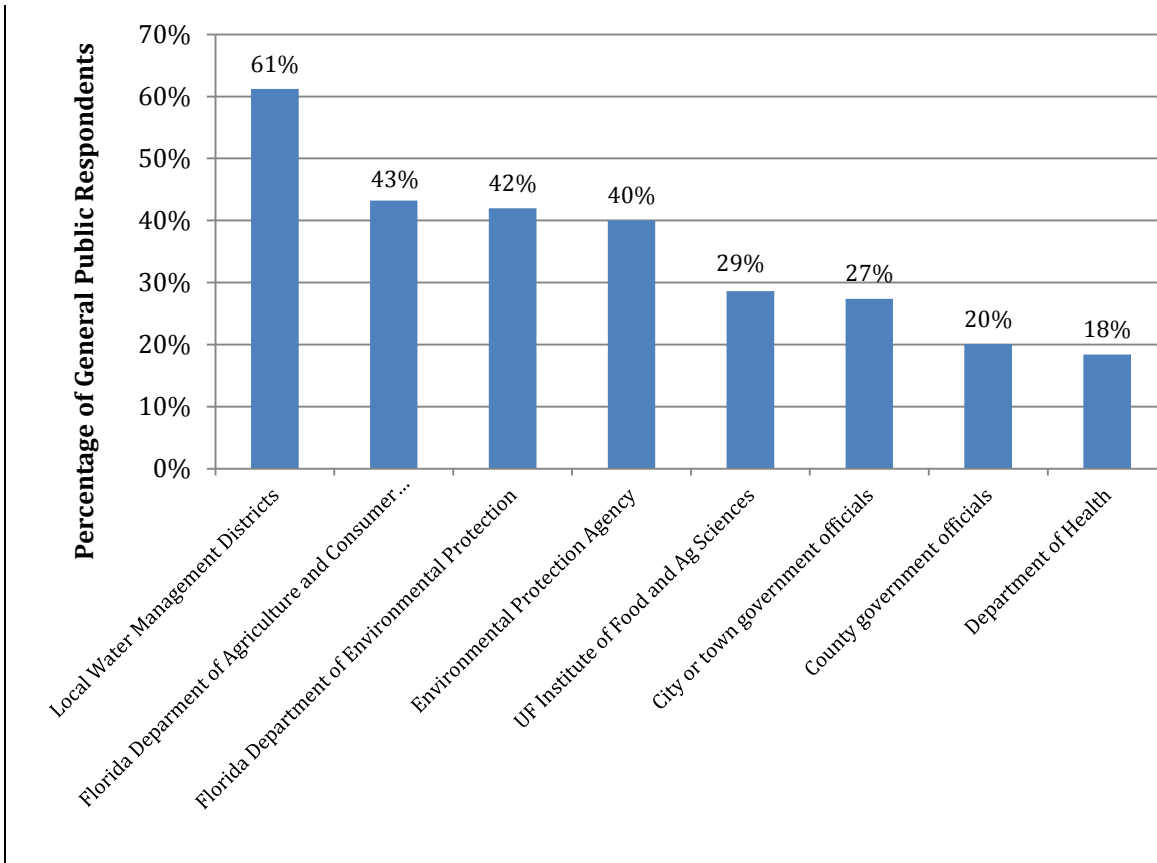
	General Public <i>M</i>	General Public <i>SD</i>	Decision Makers <i>M</i>	Decision Makers <i>SD</i>
Overall Familiarity with Water-Related Legislative Actions or Plans**	1.50	.47	2.00	.48
Everglades Restoration Project**	1.83	.65	2.15	.64
Apalachicola River and Bay Management Plan**	1.30	.59	1.56	.63
Florida Spring Initiative**	1.38	.65	1.91	.75
Clean Water Act**	1.88	.69	2.37	.58
Air and Water Pollution Control Act**	1.56	.69	2.05	.67
The Water Quality Assurance Act**	1.46	.63	2.01	.63
Safe Drinking Water Act**	1.65	.68	2.19	.64
Total Maximum Daily Loads**	1.22	.50	2.04	.78
Basin Management Action Plans**	1.22	.52	1.76	.74

Note: ** = Statistically significant differences at the $p \leq .01$ level

Organizations to Consult for More Water Information

Respondents to the survey for the general public were asked to indicate which organizations they would contact to learn more about water issues. They were presented with a list and allowed to select all that applied. The most frequent organization chosen was local water management districts, with 61% of the general public selecting this organization (Figure 27).

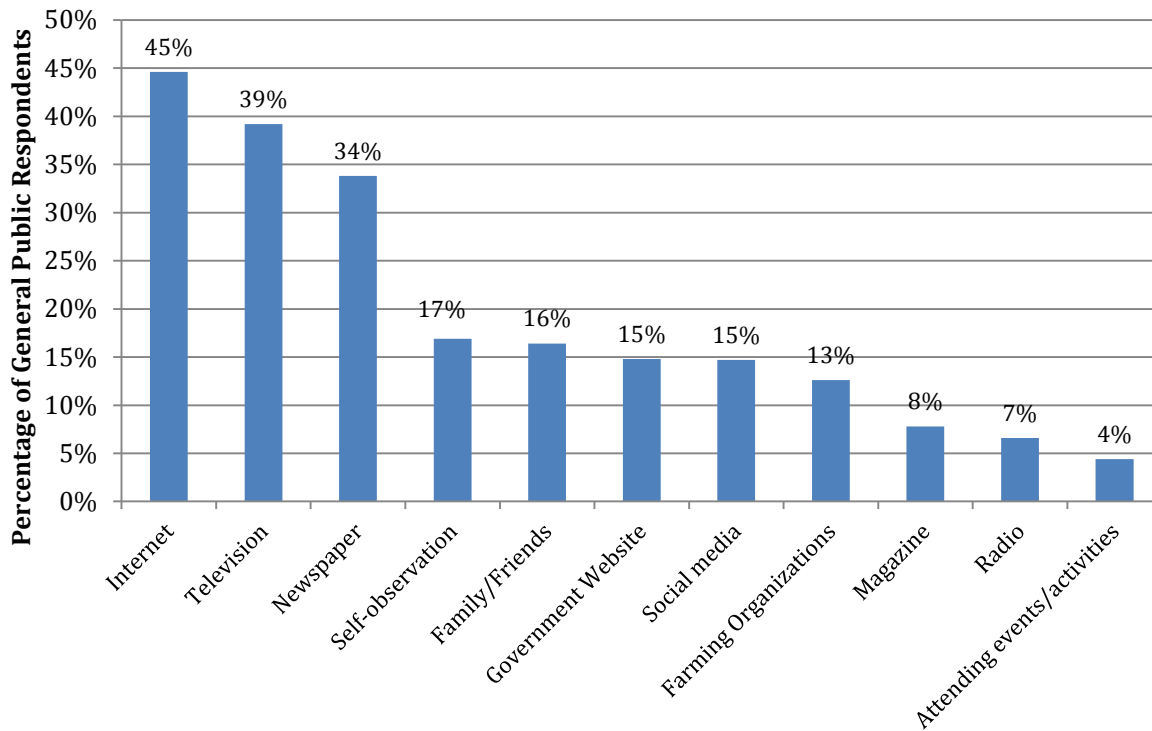
Figure 27: Organizations to learn more about water issues



Source of Information Consulted for Water Issues

Similarly, respondents to the general public survey were asked to indicate where they get their information about farmers' use of water in Florida. They were presented with a list and allowed to select all that applied. The internet, television, and newspapers were the three most common sources of information (Figure 28).

Figure 28: Sources for information about farmers' use of water- General Public



Interest in Water Topics

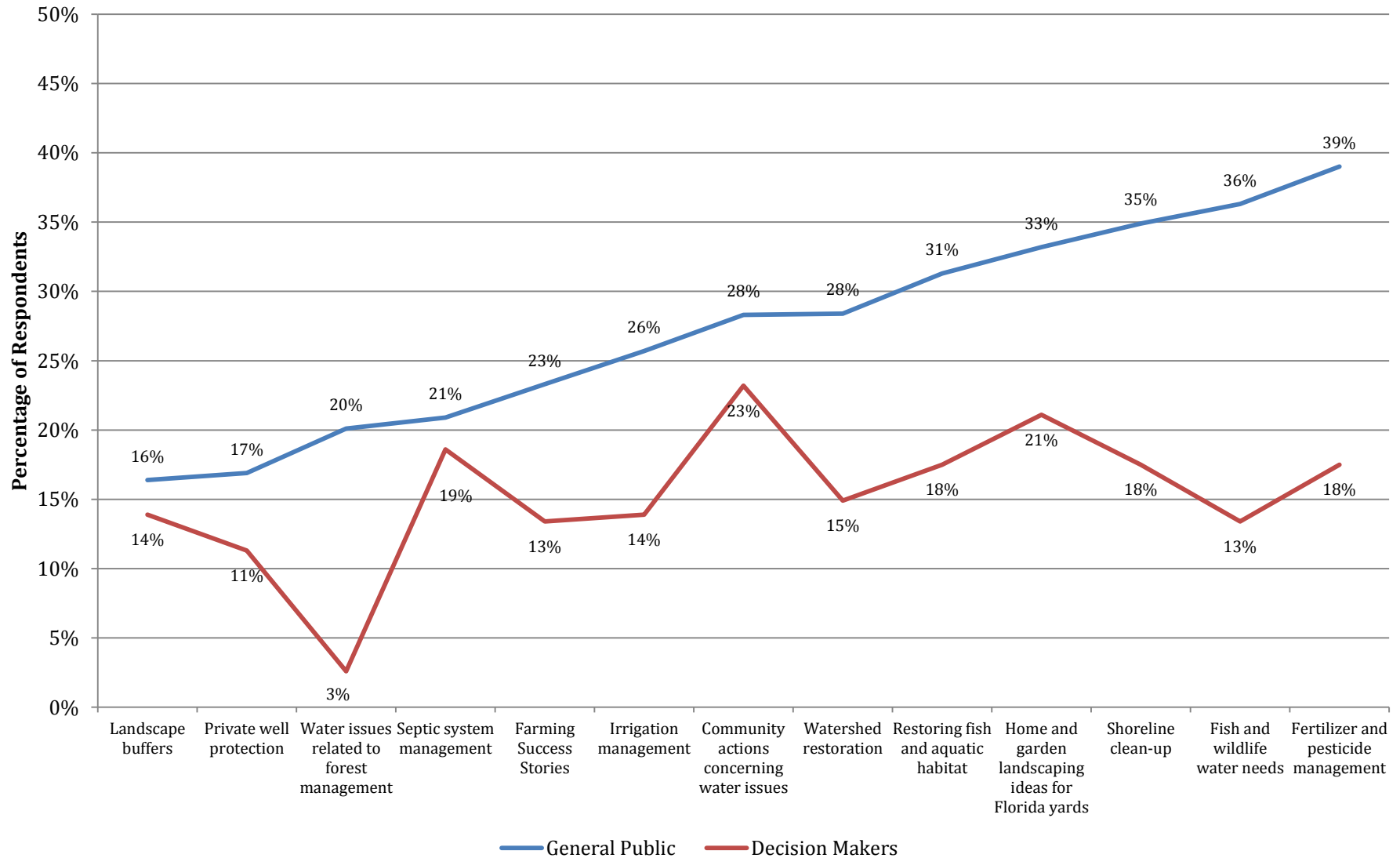
Respondents to both surveys were asked to indicate whether they were interested in a list of topics related to water issues and allowed to select all that applied.

The general public was most interested in learning about fertilizer and pesticide management, fish and wildlife water needs and shoreline clean up. They were least interested in learning about landscape buffers, private well protection, and water issues related to forest management.

Decision makers were most interested in community actions concerning water issues and home and garden landscaping ideas for Florida yards. They were least interested in water issues related to forest management, private well protection, and farming success stories.

Overall, the general public was more interested than decision makers in learning about all of the water-related topics presented. The largest difference between the two was fish and wildlife water needs. Thirty-six percent of the general public indicated they were interested in this topic compared to only 13% of decision makers (Figure 29).

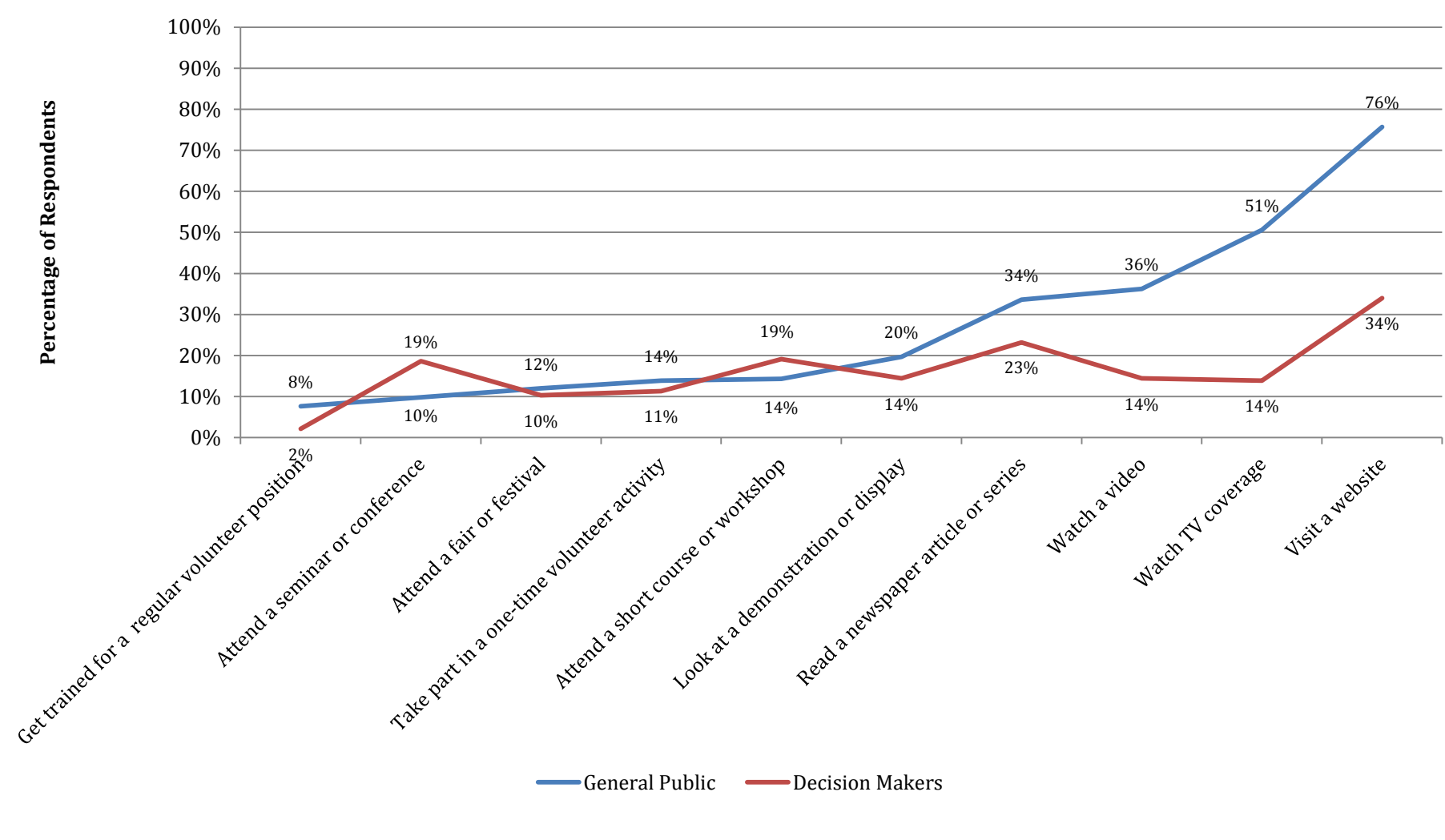
Figure 29: Interest in water-related topics



Preferred Way of Learning

Respondents were asked about their preferred methods for learning about water topics. They were presented with a list and allowed to choose all that applied (Figure 30). The general public would like to learn through visiting a website, watching TV coverage, or watching a video. Decision makers would like to learn through visiting a website, reading a newspaper article or series, attending a short course or workshop, or attending a seminar or conference.

Figure 30: Preferred way of learning



Recommendations

The following are key recommendations for creating messages, communicating with, and educating the general public and decision makers about agricultural water use in Florida.

For the general public:

- The general public had more concerns than decision makers about the quality of their tap water. Messages discussing agricultural water use should discuss how the agricultural sector and local water management districts ensure the safety and cleanliness of water for the home, especially for populations near active agricultural production areas who may have concerns about pollution from pesticides, fertilizers, and animal waste. The majority of respondents from both groups agreed or strongly agreed that these sources can pollute natural water sources so this may be an area in which to tailor messages to alleviate concerns.
- There is room to educate the public about all water-related legislative actions and plans. More awareness of laws and policies that protect water may help reduce concerns about agricultural production polluting water sources.
- The public indicated they would turn to water management districts over all other organizations when it came to learning more about agricultural production and water use. Perhaps use of water management districts, or representatives of those organizations, to help spread messages about water use related to agriculture in Florida could assist in educating the public about these issues.
- More education about the amount of water used among different groups would also be useful for the general public. Overall, the general public rated all agricultural groups as higher water users than decision makers. The largest gap occurred for livestock production. Consider tailoring messages to educate the public about actual water use statistics across agricultural groups, especially when compared to public consumption, the tourism industry and landscaping practices.
- The general public indicated they prefer using the Internet, television, and newspapers to receive information. Messages designed for the general public should be compatible with these three key sources.

For decision makers:

- Decision makers had less confidence in the quality of natural water systems in Florida than the general public. This concern can be understood as many decision makers are accountable to the public they serve which uses these natural water systems. Messages targeting decision makers should take into account this concern, perhaps through describing ways in which agricultural water use BMPs help reduce pollution in natural water systems.
- Overall, decision makers had less confidence in trustworthiness of farmers to protect water in Florida than the general public. Messages could be created to try to bridge this gap by displaying stories of actual farmers and their efforts to practice BMPs and water conservation, as well as explicit descriptions of how BMPs are carried out in farms across Florida.
- There is room to educate decision makers about how agricultural production plays a part in the water recharge cycle. Targeting education for decision makers around this topic is recommended.

- Decision makers would like to learn about community actions concerning water issues and septic system management. These issues impact wider communities. Messages created for decision makers should take this into account. Perhaps the agricultural industry can tell stories about how communities have come to understand and make educated decisions about their individual and collective water use, including their economic sectors, such as agriculture.

For both groups:

- Overall, both groups could be made more aware of BMPs and the way in which they help producers conserve water resources and reduce pollution. The idea of BMPs and their regulation is not well understood and therefore has little impact on trust.
- There was a difference in how individuals responded to question about agriculture's relationship to the natural environment, when presented with a negative frame scale, and whether the individual in the video about water was a farmer or a representative of the Nature Conservancy. Groups should consider using one of the two more "neutral" sources when delivering messages about agricultural water use to the general public, either UF/IFAS or a water management district staff member.
- Both groups liked visiting websites and watching TV or videos as ways to receive information. Messages could be explored targeting these channels.

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