KANSAS GEOLOGICAL SURVEY
OPEN-FILE REPORT 2001-22

Information and Education Assessment Report
to the Kansas Water Office

by

Rex Buchanan
John Davis

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INFORMATION AND EDUCATION ASSESSMENT REPORT TO THE KANSAS WATER OFFICE

Rex Buchanan and John Davis, Kansas Geological Survey

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Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that, in general, a higher proportion of correct answers was given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed

survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water. The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Roper Starch survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the ICRI at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

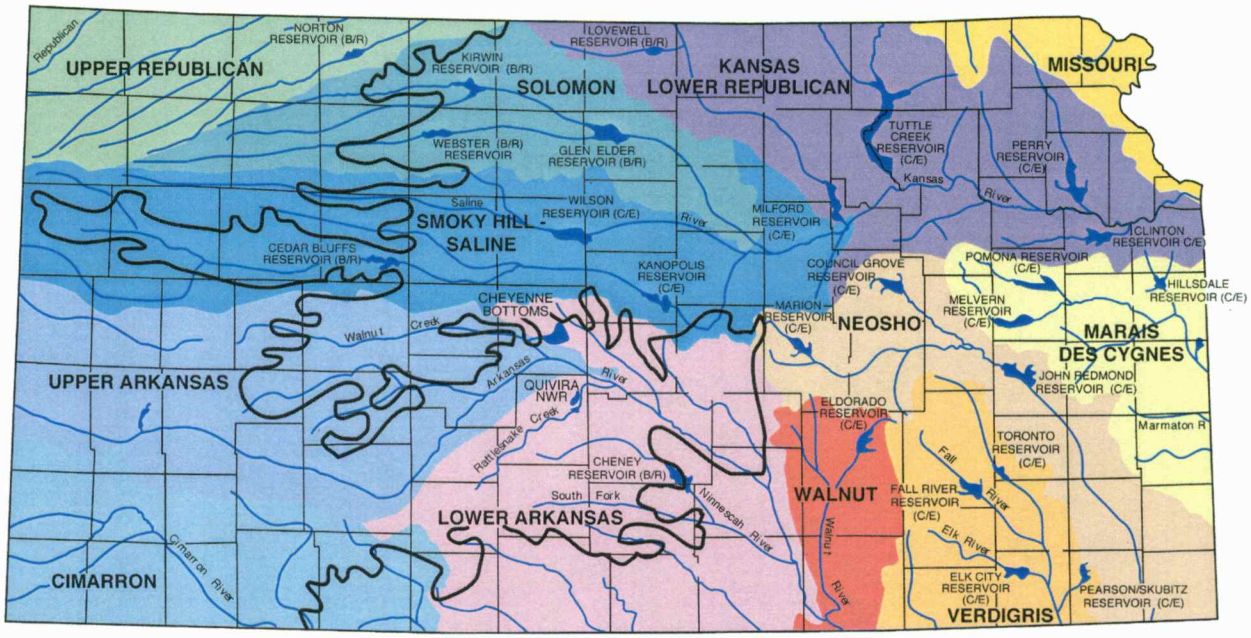
The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does

not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.



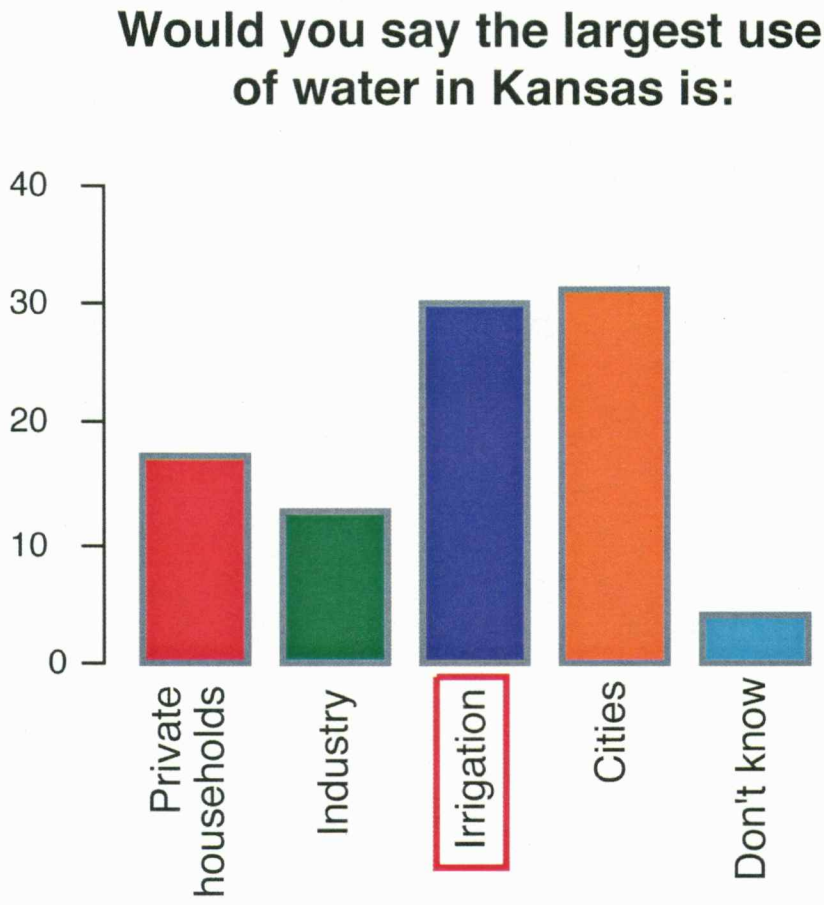
Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9 percent of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

In the following paragraphs, statewide proportions have been corrected for the bias introduced from sampling by drainage basin. No corrections have been made for the bias caused by the over-representation of women among the respondents, nor have any corrections been made for the bias resulting from the over-representation of rural as compared to urban respondents. However, correcting for basin population may also partially correct the urban/rural bias, because the most densely populated basins have the largest urban populations. Responses within individual basins are unbiased and do not require any adjustment.

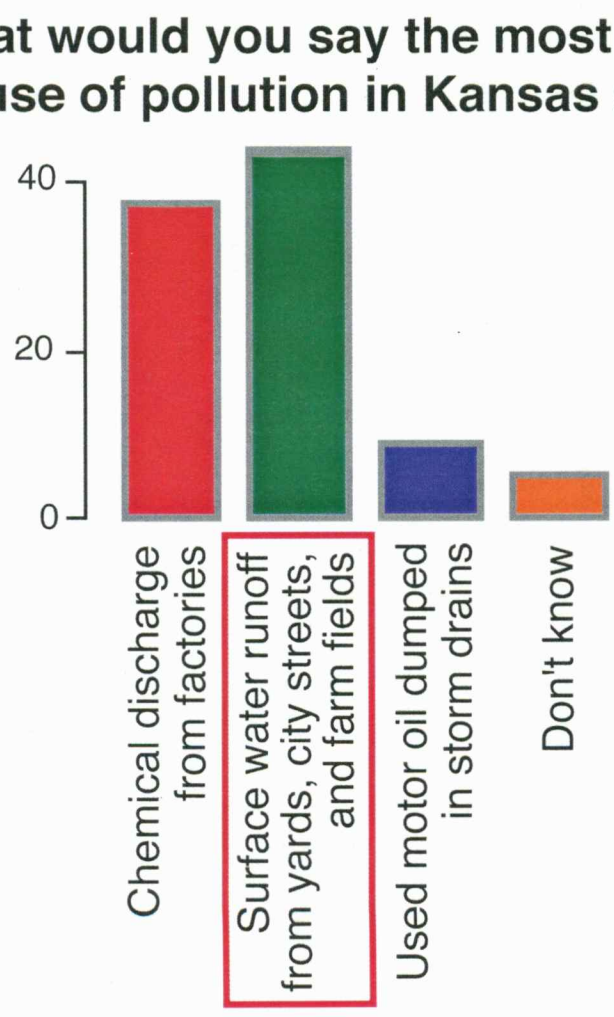
Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Thirty percent of the respondents correctly identified irrigation. Slightly more respondents, 32.5 percent, wrongly identified cities as the largest water user. Responses from the Upper Republican, Cimarron, and Upper Arkansas basins were significantly different from responses from persons living in other drainage basins. The difference mainly reflects a higher proportion of correct responses. This is probably a reflection of the heavy reliance on, and knowledge about, irrigation in those basins.



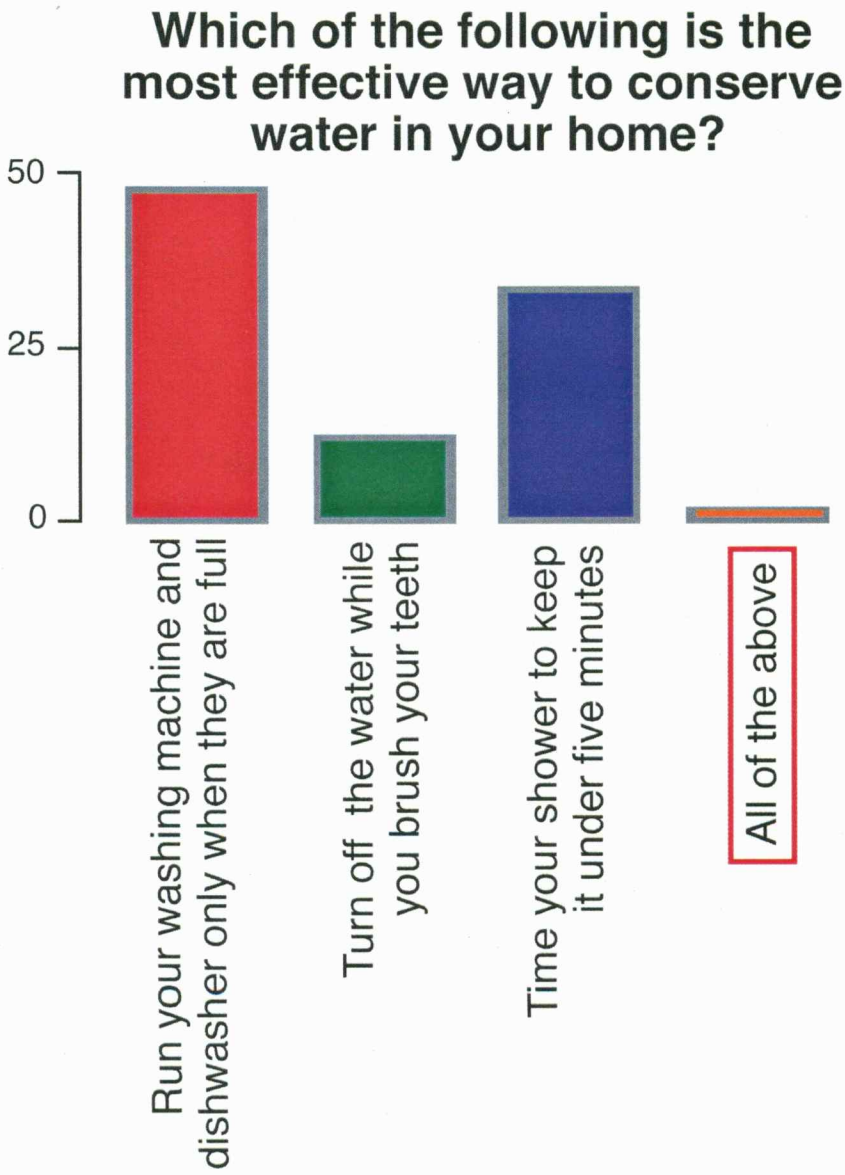
Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 47.8 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In Kansas, 38.9 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey). Responses from the Walnut basin had a significantly lower correct response rate than other basins. The Cimarron and Upper Arkansas basins also had significantly lower correct response rates, but were less pronouncedly different than the Walnut basin.



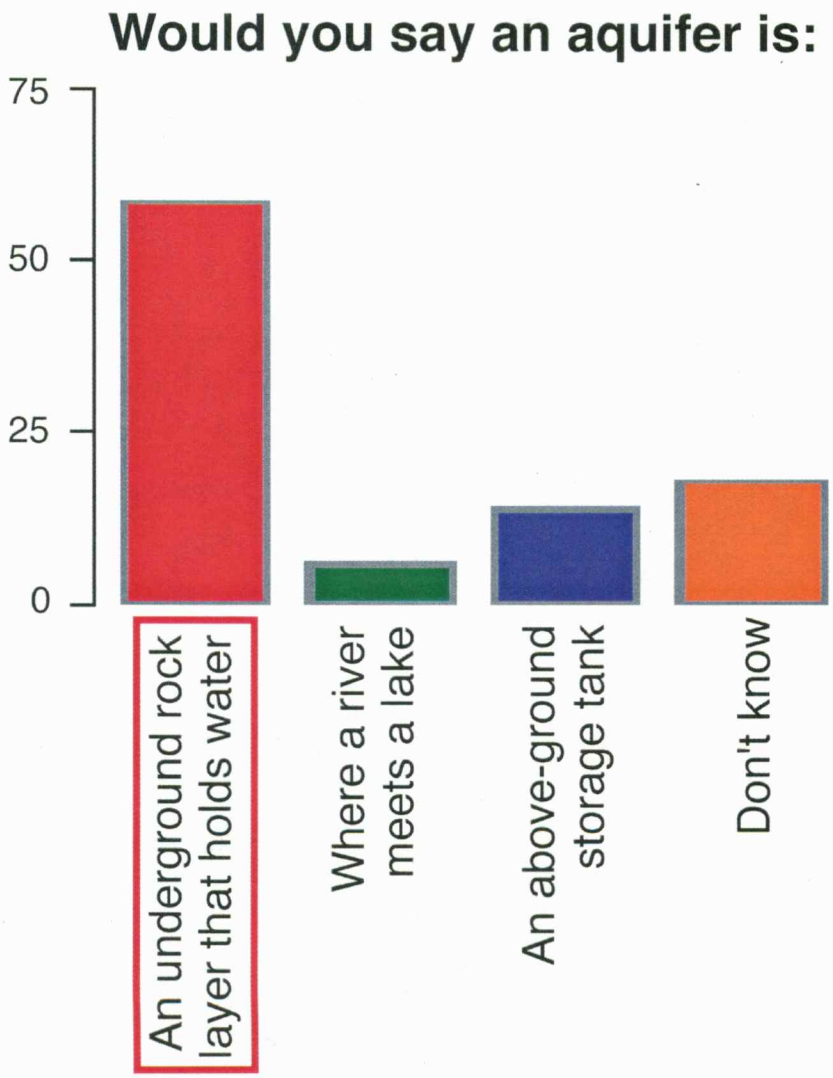
Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses. There were no significant differences in responses between basins.



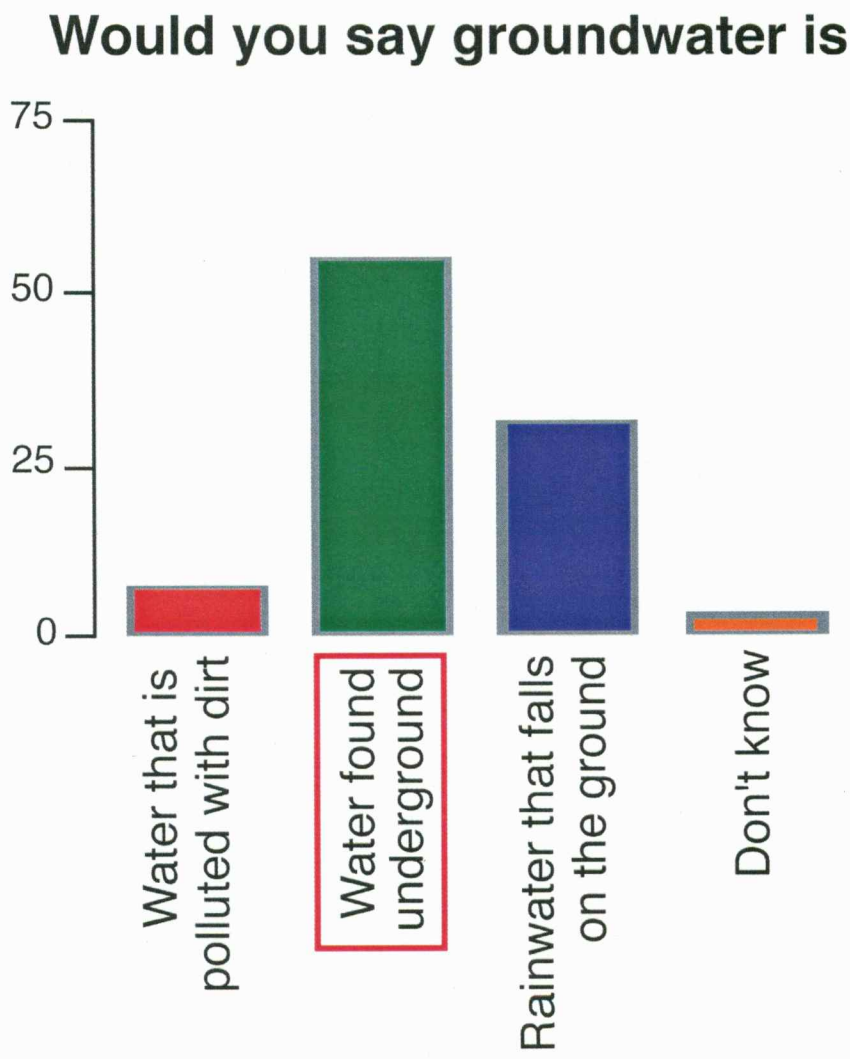
Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. The correct definition (answer a) was identified by 60.4 percent. Eighteen percent of the respondents, however, said that they did not know the correct answer. There was a significant gradient in responses from the Upper Republican, Smoky Hill-Saline, and Cimarron basins (with a high proportion of correct responses) to the Verdigris, Neosho, and Missouri basins (where the proportion of correct answers was lower), with other basins intermediate in response. This is probably a reflection of the greater reliance on, and knowledge of, groundwater in western Kansas drainage basins, as compared to those in the east.



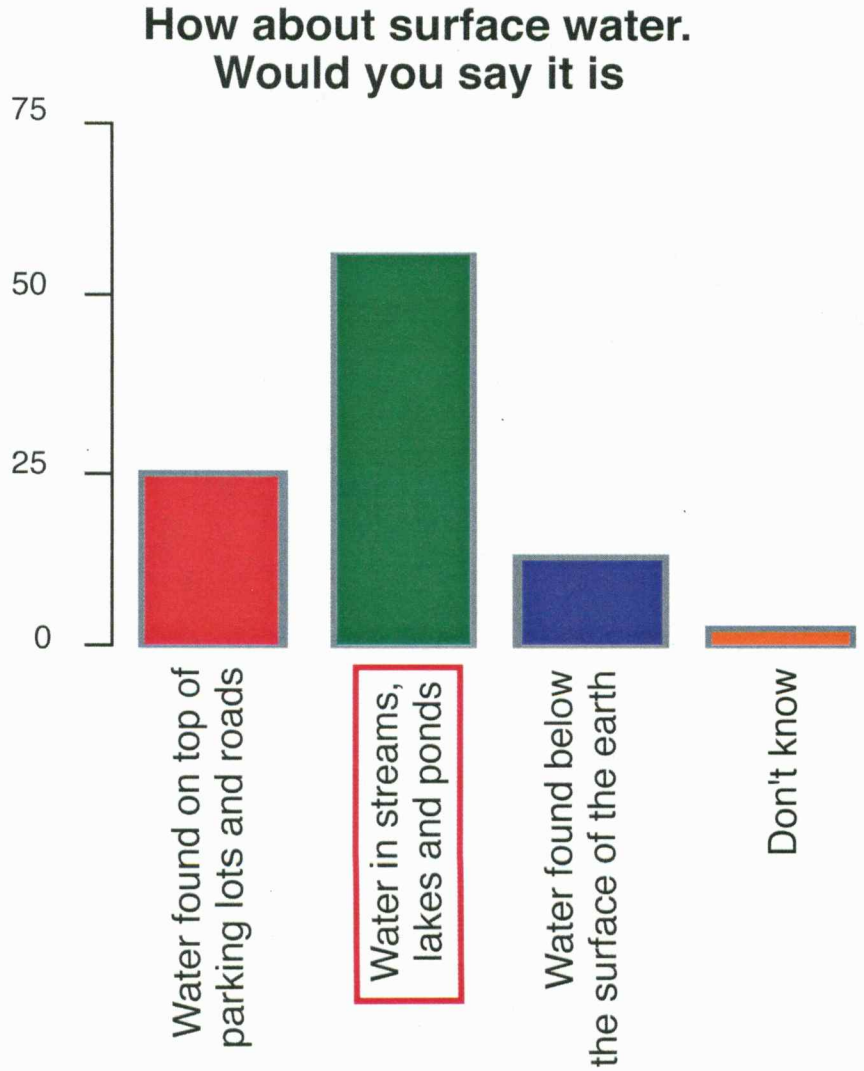
Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 58.9 percent of the respondents identified the correct definition (answer b), 32.5 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground." Significant differences were found between responses from the Marais des Cygnes, Neosho, and Missouri basins and the other basins. A high proportion of respondents from those three basins selected the rainwater definition rather than the correct choice. This is probably a reflection of the greater reliance on surface water in those basins, and a relative lack of knowledge about groundwater.



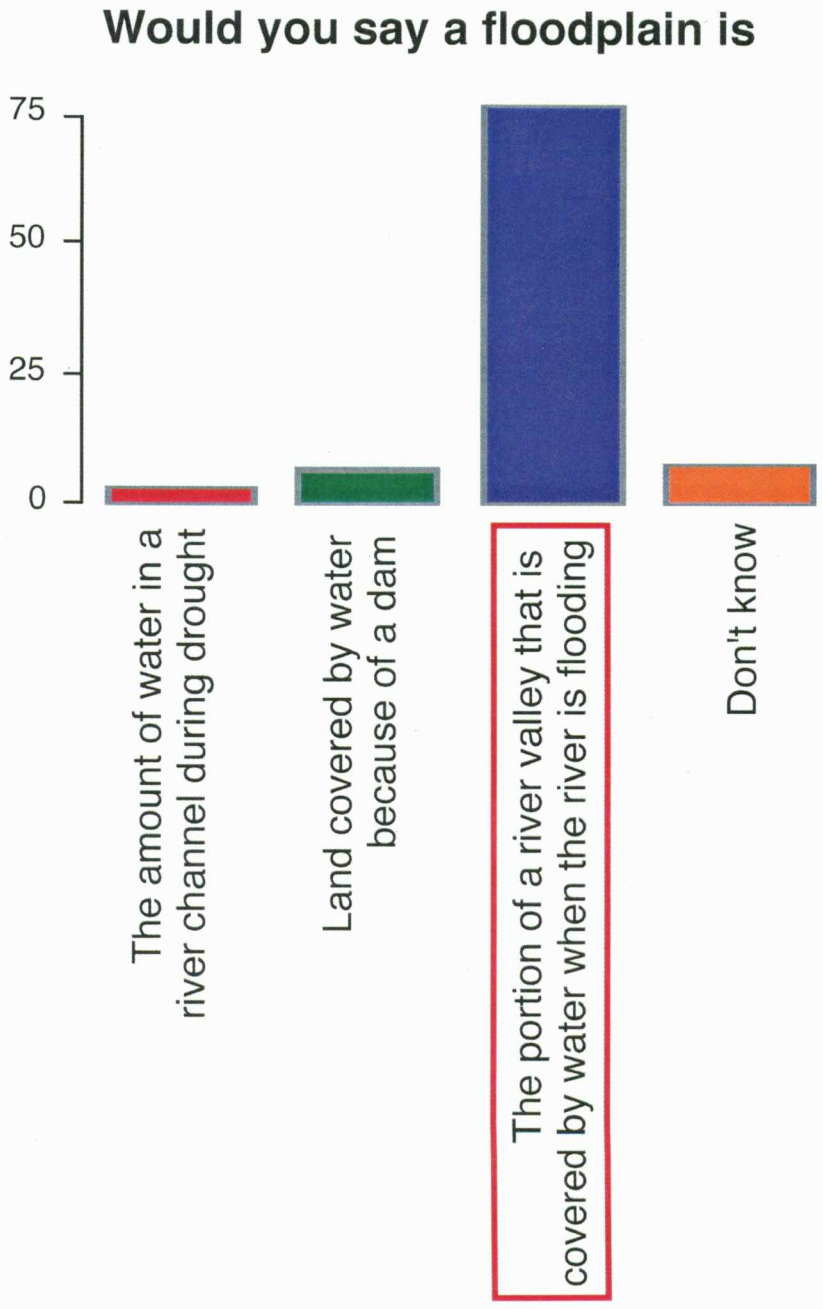
Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 58.2 percent of the respondents identified the correct definition (answer b). More than a quarter (26.5 percent) of the respondents, however, identified surface water as "water found on top of parking lots and roads." There was a weak but statistically significant gradient in responses from the Upper Arkansas basin, which had a high proportion of correct responses and low proportion of "don't know" responses, as compared to the Marais des Cygnes and Missouri basins, which had a high proportion of the "parking lots and roads" definition. In other words, even two basins that are relatively reliant on surface water are less familiar with the correct definition than one of the western basins, which is heavily reliant on groundwater.



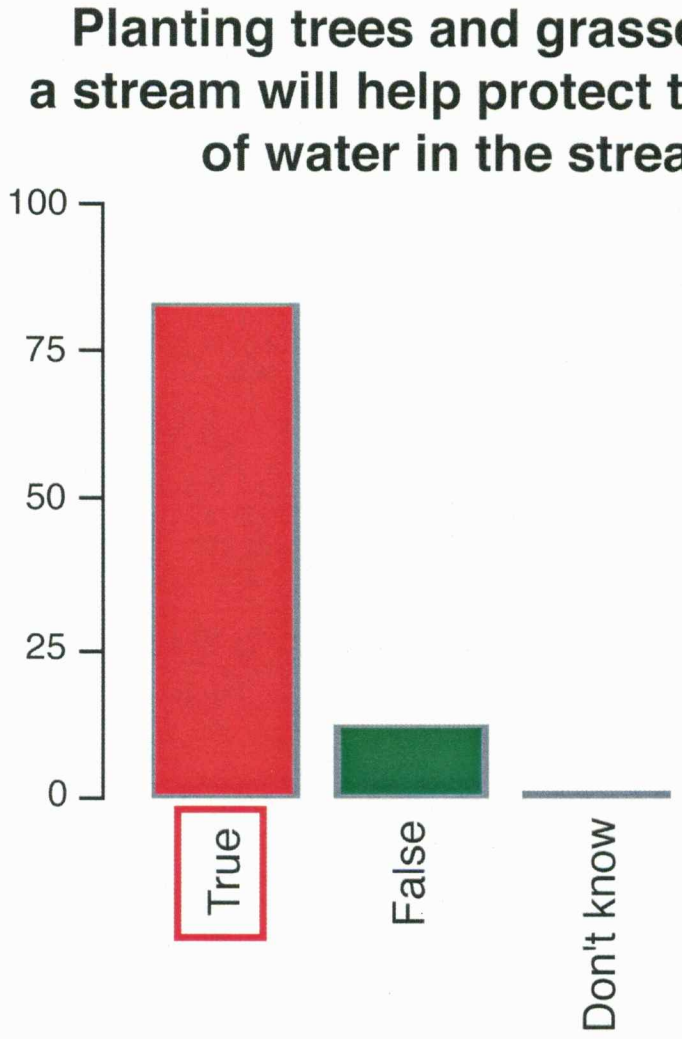
Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of all respondents (82.6 percent) identified the correct definition (answer c). The only significant difference is from the Upper Arkansas basin, where 24 percent of the respondents chose "don't know."



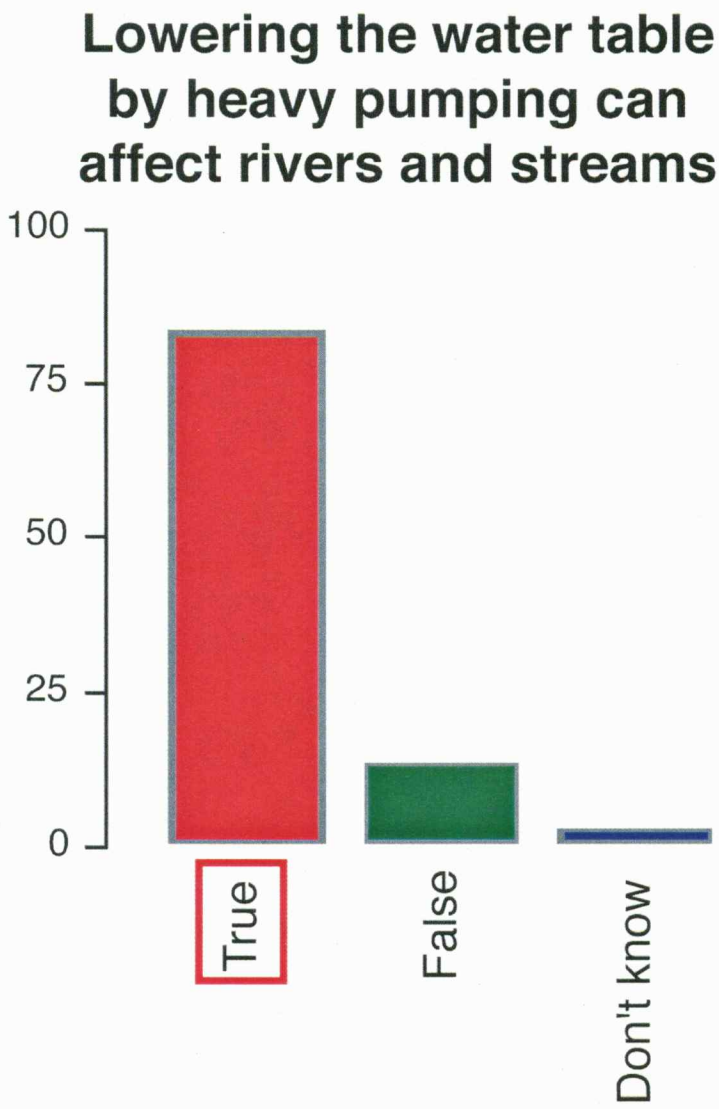
Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 84.8 percent of the respondents, made the correct response (which is True). There were no significant differences between basins. This could be interpreted to mean that the general population has some understanding of the role of vegetation in protecting water quality, or it may result from the self-evident wording of the question.



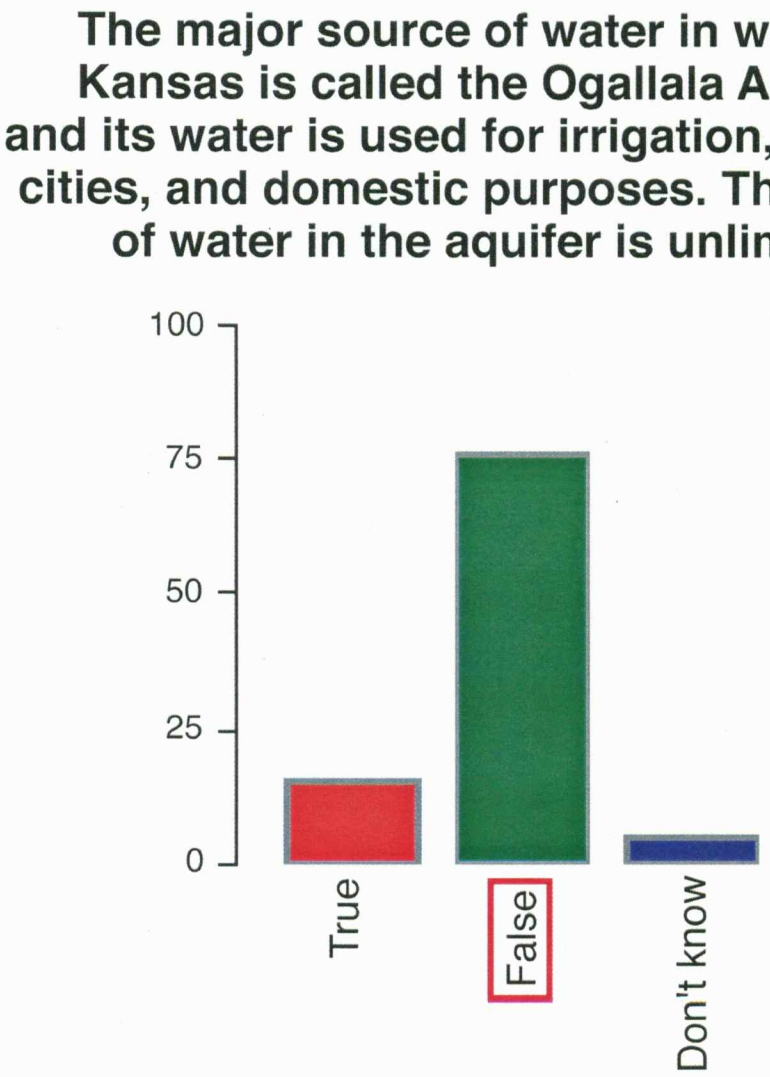
Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (84.6 percent) selected the correct response (which is True). There were no significant differences in responses between basins. This could be interpreted to mean that the general population has a good understanding of the connection between groundwater and streamflow.



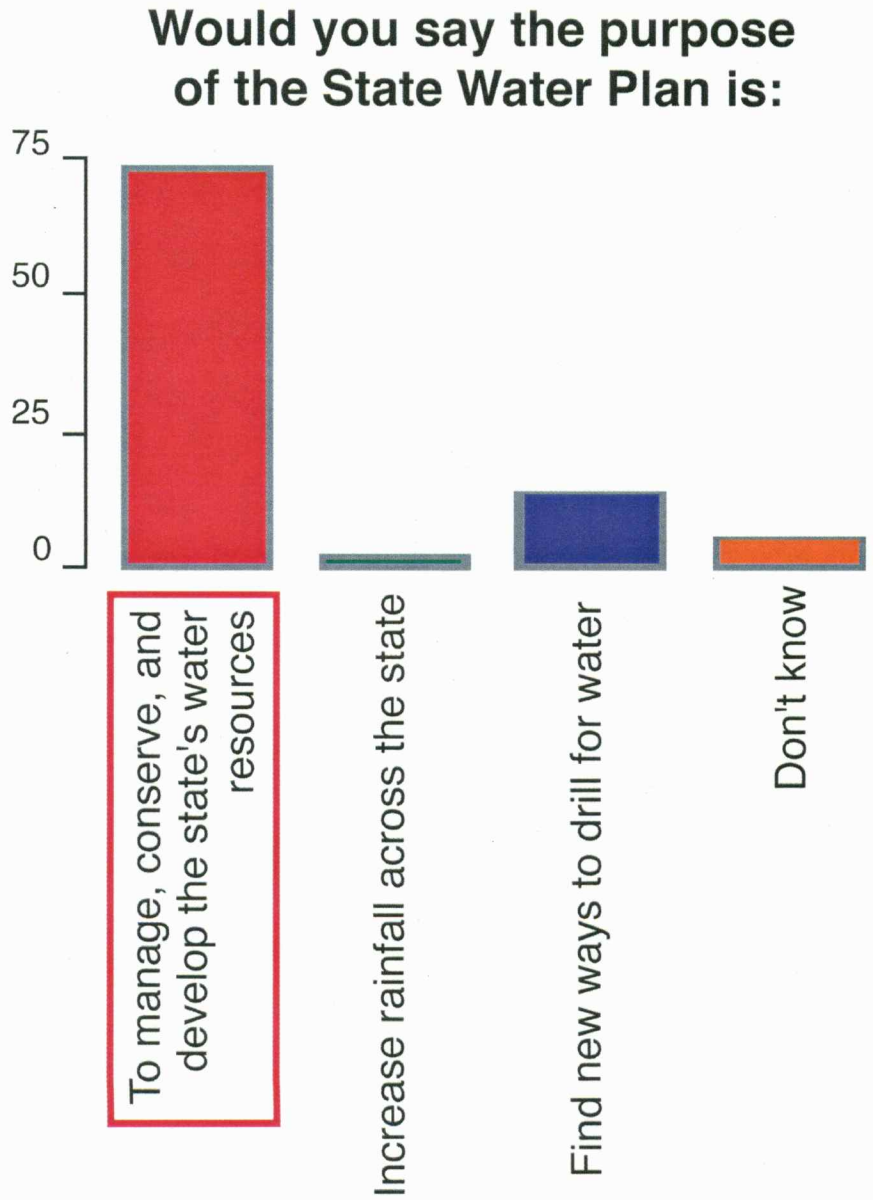
Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (81.8 percent) correctly answered that the aquifer contained a limited amount of water. The only significant difference in response between basins was from the Upper Arkansas basin, where a high proportion of respondents (36.5 percent) said that the question was true, that the supply of water in the aquifer was unlimited.



Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (76.9 percent) correctly identified the purpose of the plan (answer a). Responses from the Upper Arkansas and the Verdigris basins were significantly lower in proportion of correct responses and higher in the "don't know" and "rainmaking" responses.

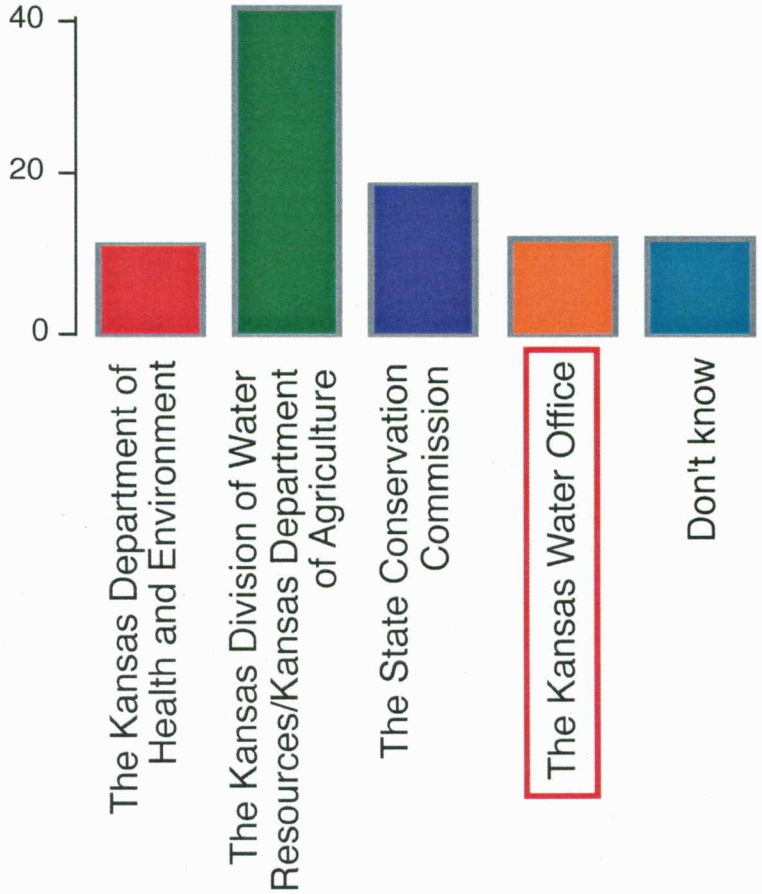


Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water-resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 12.6 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 11.2 percent of respondents said "don't know," 11.9 percent said the Kansas Department of Health and Environment, and 21.0 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 43.2 percent of responses. There were marginally significant differences in responses, with a higher proportion of respondents from the Walnut and Lower Arkansas basins selecting the Kansas Department of Health and Environment, contrasted with responses in the Upper Arkansas basin, which included a higher proportion of the correct choice. There was a significant difference between urban and rural responses, with rural respondents favoring the Division of Water Resources.

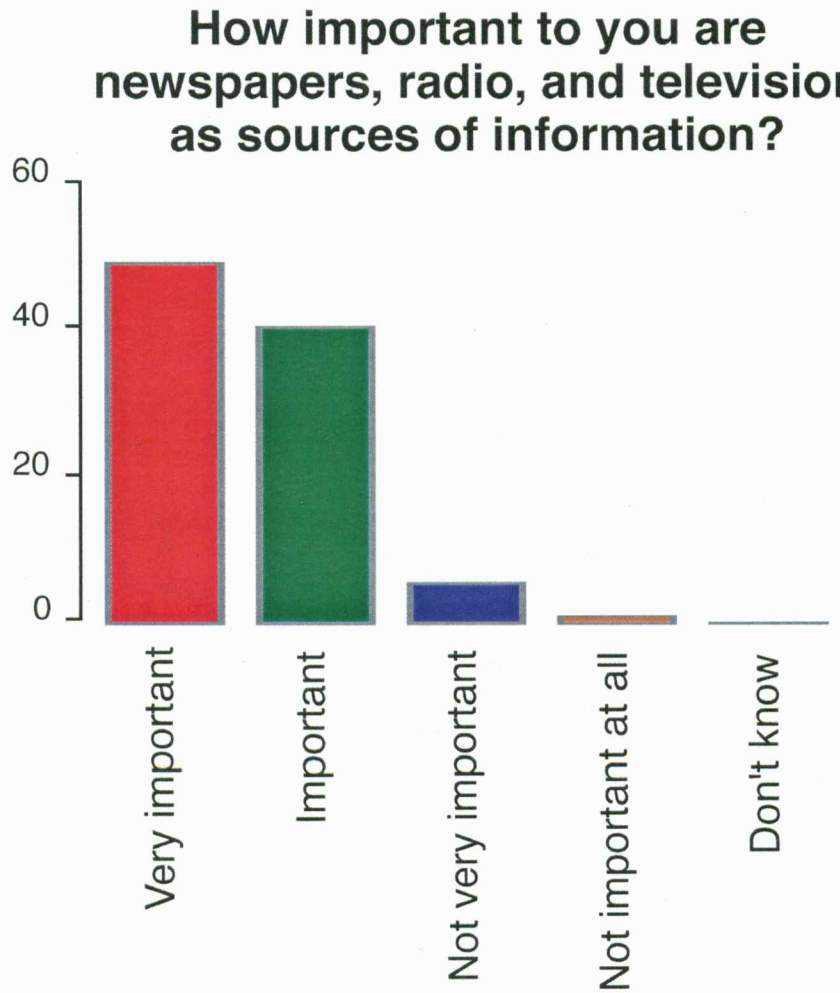
The responses to Question 12 would seem to clearly indicate that Kansans lack an understanding of the role of the Kansas Water Office, and might be taken further to indicate that they have difficulty in distinguishing between the roles of various water agencies in the state. Answers to Question 11 might indicate that Kansans know and understand the Kansas Water Plan, though it might also indicate an ability of respondents to guess the correct answer from the nature of the choices presented to them, even without much knowledge or background about water. Anecdotal responses from callers who conducted the poll indicated that some respondents expressed a general lack of knowledge about the topic (Becky Nordyke, Wichita State University, personal communication). Responses to this question would seem to indicate that the Division of Water Resources of the Kansas Department of Agriculture has substantial name recognition, in the context of water issues in the state. However, it does seem clear that Kansans do not understand the various roles of water agencies in the state. Kromm and White have written that "those in farm and farm related occupations have a significantly greater knowledge of the state water law . . ." (Kromm and White, 1981, p. 43), based on their studies of knowledge and perception about water. Results of the present study would seem to indicate, however, that the rural population is not significantly better informed than city dwellers, at least on the question of responsibility for planning and coordinating water policy.

Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is:

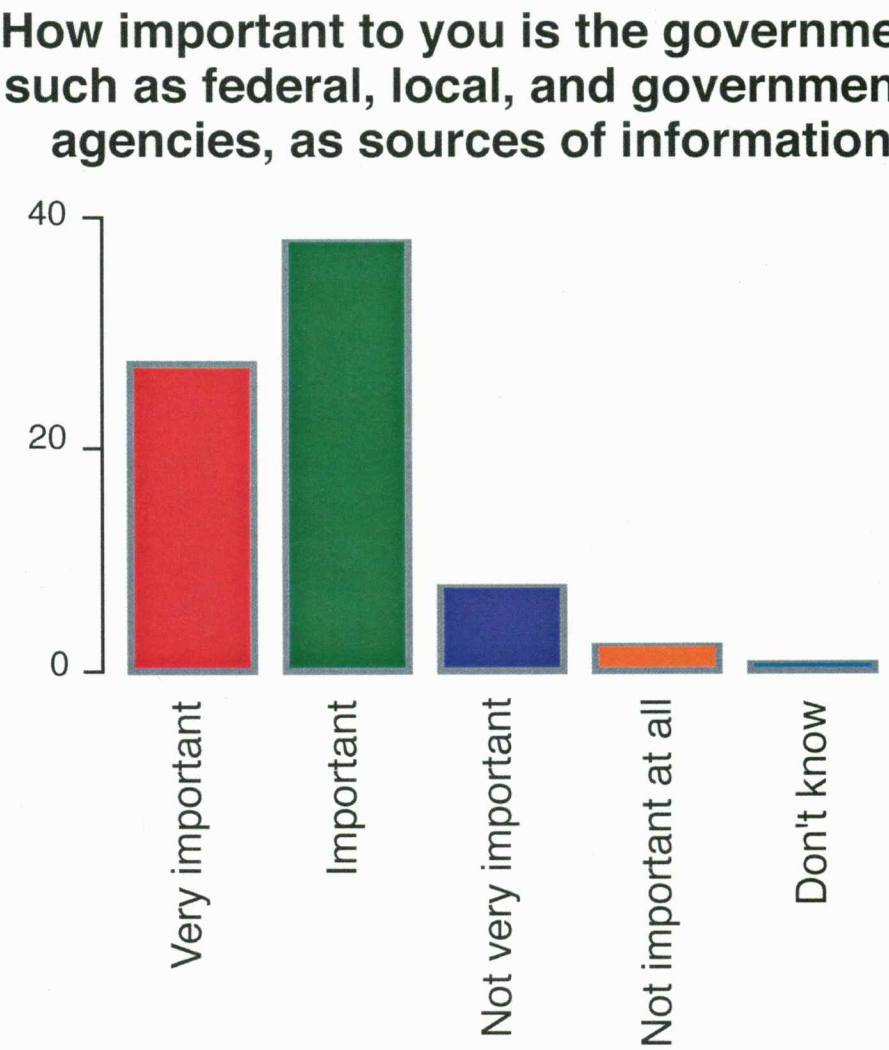


Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

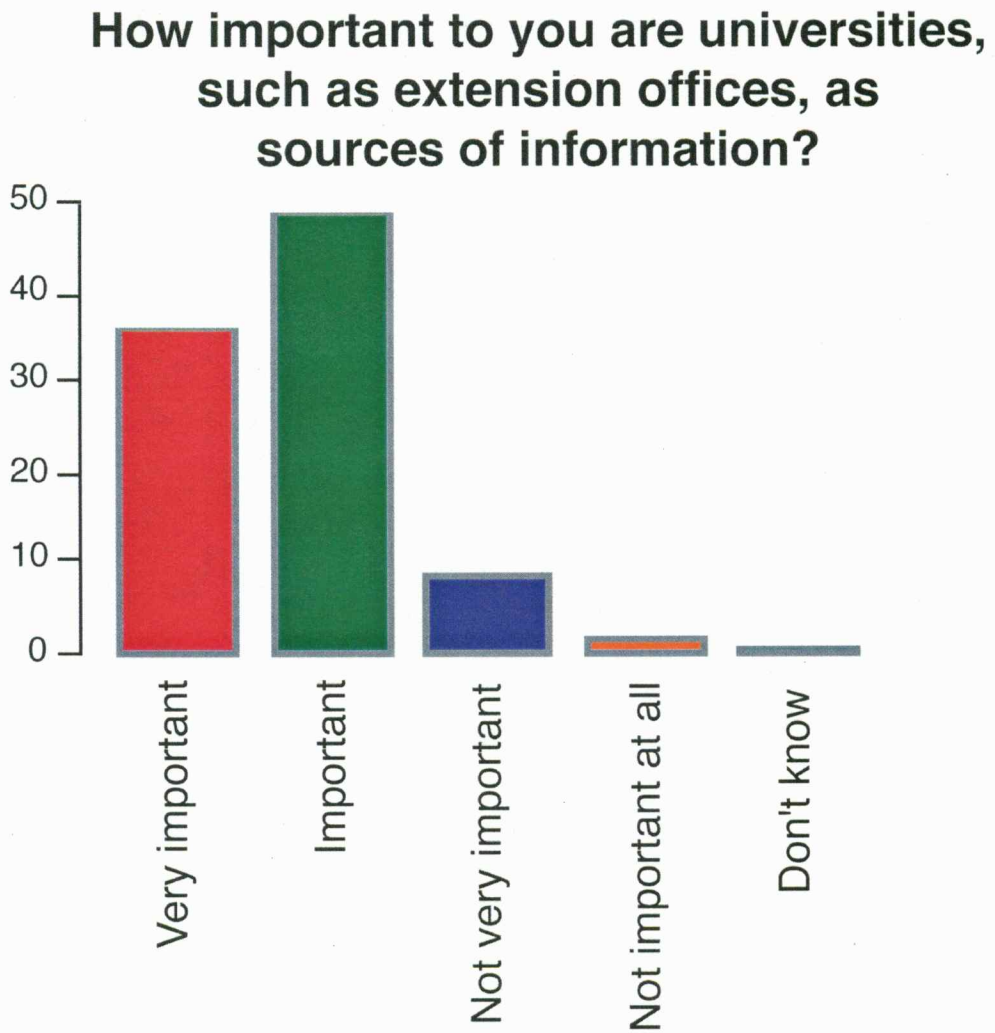
Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 50.2 percent rated the media as very important and 41.6 percent rated them as important. Thus, more than 90 percent of respondents rated the media as important or very important sources of information. There were significant differences between basins, with a high proportion of Walnut basin respondents selecting "very important" and the Solomon basin, where a significant proportion selected "not very important."



When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 32.9 percent rated agencies as very important sources while 50.9 percent rated them as important sources of information. Thus, 83.8 percent of respondents rated governmental agencies a very important or important source of information. There were no significant differences in responses between basins.

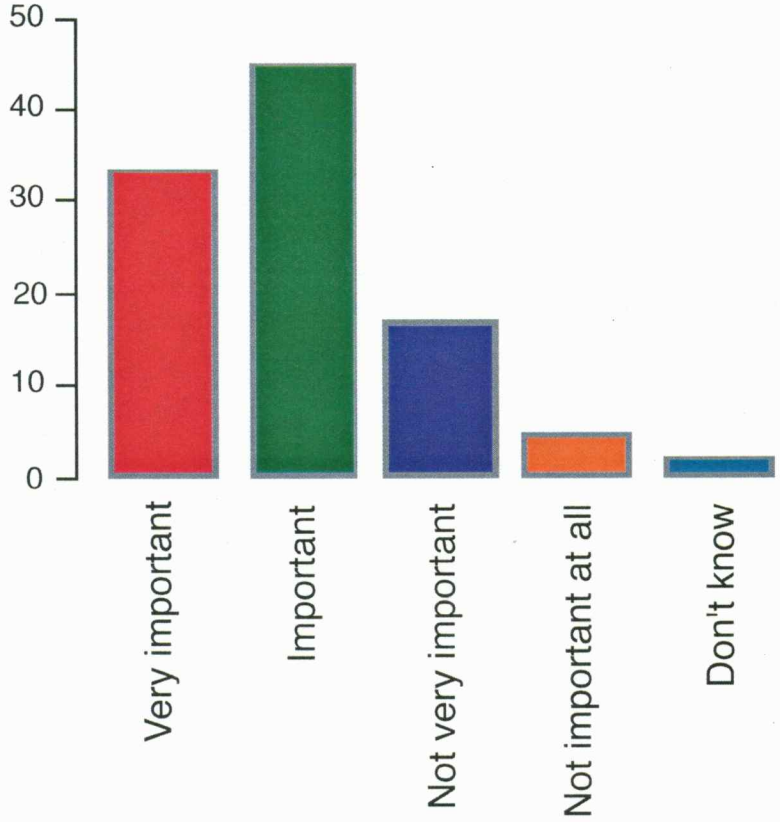


When asked to rate the importance of universities and their extension offices, 34.8 percent of respondents rated them as "very important" and 51.5 rated them as "important." Thus, 86.3 percent of respondents rated universities and extension offices as very important or important sources of information. These sources, then, are rated very slightly higher than governmental agencies, but below the media as sources of information. There were no significant differences in responses between basins.

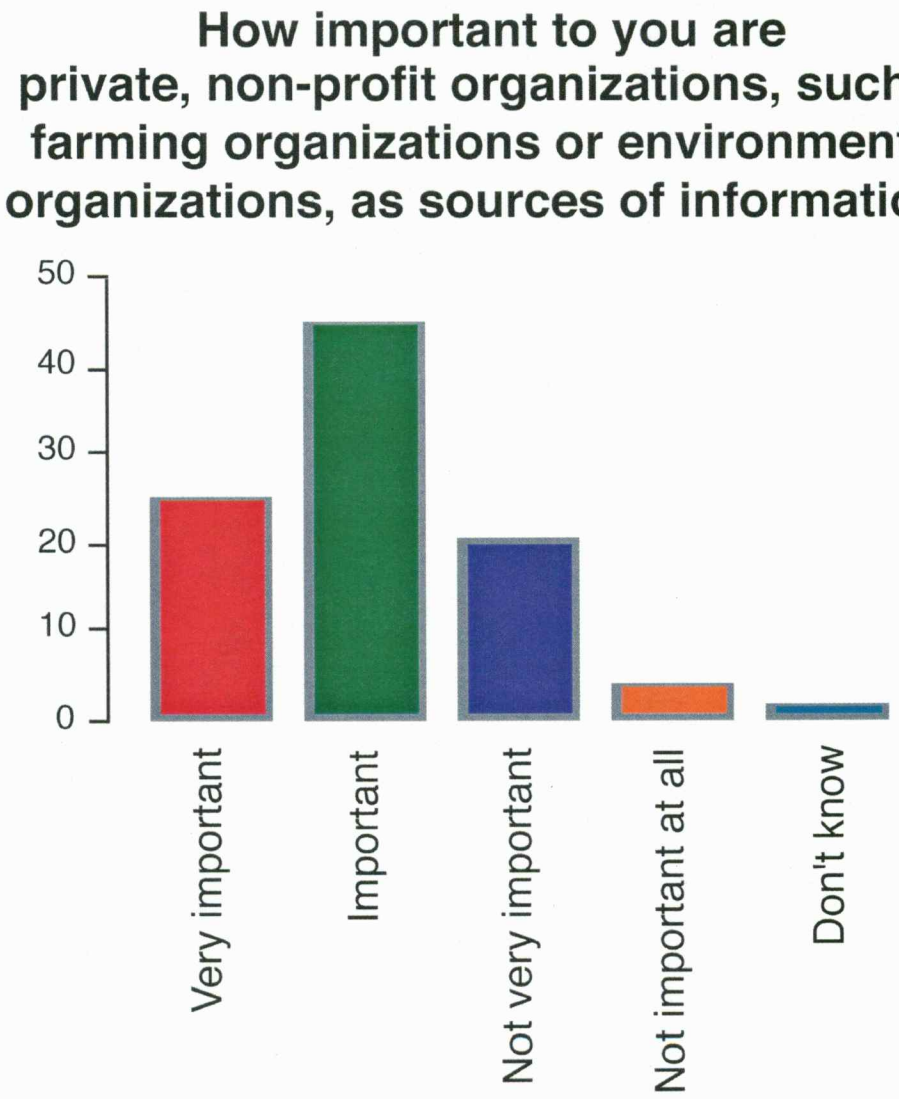


When asked to rate public water suppliers, such as water companies, as sources of information, 33.5 percent of respondents rated them as "very important," 44.1 percent rated them as "important," and 16.2 percent rated them as not very important. In total 77.6 percent of respondents rated water suppliers as very important or important sources of information, placing them below the media, universities and extension offices, and governmental agencies. There were no significant differences between basins.

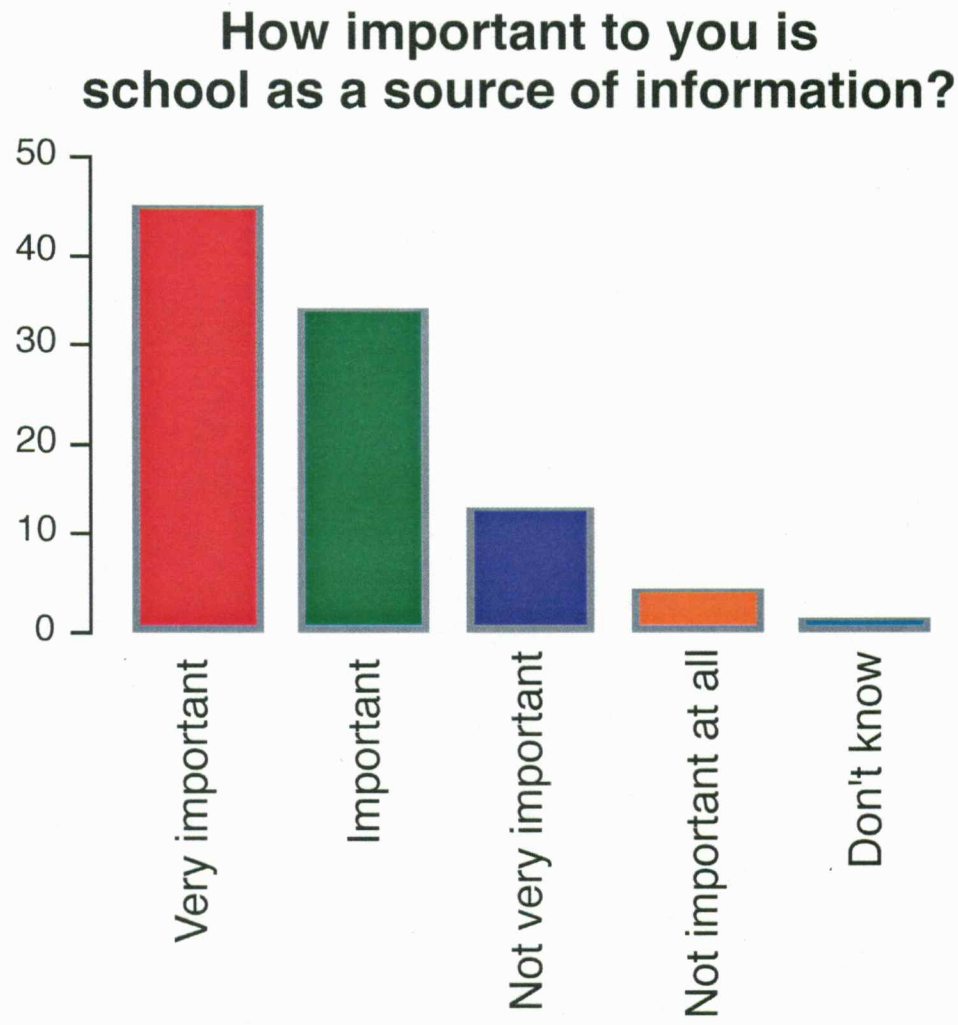
How important to you are public water suppliers, such as water companies, as sources of information?



When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 25.8 percent of respondents said they were "very important" sources of information and 49.3 percent said they were "important" sources of information. Thus, 75.1 percent of respondents rated private organizations as "very important" or "important." There were no significant differences in responses between basins. There was a significant difference between rural and urban respondents, with a higher proportion of urban dwellers not responding "don't know" and rural respondents selecting "not very important" and "not important at all."



Finally, respondents were asked to rate schools as a source of information. In response, 42.5 percent said schools were a very important source of information, and 38.2 said they were an important source of information, for a total of 80.7 percent of respondents who thought that schools were a "very important" or "important" source of information. There was no significant difference in responses between basins. There was a significant difference between rural and urban respondents, with a higher proportion of urban dwellers selecting "very important" and rural residents selecting "not very important at all." Thus schools appear to be an important source of information about water, particularly among urban dwellers.



Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, schools, public water suppliers, and non-profit organizations, although the differences in importance of these are not statistically significant for the state as a whole. These results differ somewhat from responses obtained by Kaw Valley Heritage Alliance's study of sources of information in northeastern Kansas, which rated the Kansas State University Agricultural Extension Service, state universities, Kansas Department of Agriculture, Natural Resources Conservation Service, and Kansas Department of Health and Environment most highly as sources of information, and rated the Environmental Protection Agency, newspapers, and environmental organizations somewhat lower (Burress and Harris, p. 54). However, that survey asked respondents to rate the credibility of information sources (as opposed to asking them how they wanted to receive information). It was also restricted to water-quality information, rather than water in general, and asked respondents to rank sources.

These results also differ somewhat from those obtained by Kromm and White (1990), who found that irrigators in High Plains counties considered the following to be important sources of information (ranked in order of preference): Soil Conservation Service (now the Natural Resources Conservation Service), University research stations, local groundwater or resource districts, private agricultural consulting firms, university extension service, friends, and neighbors, federal and county agents, well drillers, and others (Kromm and White, 1990, p. 9). However, their study focused only on irrigators and in High Plains counties. The results of the current study would seem to indicate that, for the general public, mass media is the preferred method of receiving information; however, remember that this survey did not force respondents to rank sources in relative order of importance.

Discussion

Of the eleven questions that asked for factual responses (and not preferences of sources of information), more than 50 percent of the respondents answered seven or more questions correctly. The number of correct responses was influenced by education. That is, respondents with a high school diploma or some college scored better on the test than those with only some high school. Those with a college degree or some graduate work answered more questions correctly than those with less education.

In very general terms, these results provide a baseline knowledge concerning Kansans' level of knowledge concerning some water terms and concepts. On question 1, concerning water use, less than a third of the Kansas population understands that irrigation is the primary use of water in the state. On question 2, concerning common

cause of stream pollution, Kansans score significantly better than the general population of the U.S. in identifying runoff as the correct answer, though less than half of the state's population knew the correct answer to this question.

The results seem to indicate that Kansans' knowledge of water terminology is good. More than half of the respondents correctly identified the definition of an aquifer, the definition of groundwater, the definition of surface water, and the definition of a floodplain. On the other hand, a substantial portion of the population said it did not know what an aquifer was, more than 25 percent of the respondents defined groundwater as "rainwater that falls on the ground," and more than 25 percent of the respondents thought that surface water was found "on top of parking lots and roads."

Three true-false questions were designed to test Kansans' understanding of water concepts. More than 75 percent of the respondents answered correctly that vegetation could protect water quality in streams, that lowering the water table could affect streamflow, and that the amount of water in the Ogallala aquifer was not infinite. If these results are an accurate reflection of understanding, it would appear that Kansans have a good comprehension of these water-related concepts, although it is also possible that some correct responses were, to an extent, self-evident from the wording of the questions.

It would also appear, however, that Kansans have a poor comprehension of the role of state agencies in water issues in the state. They clearly do not understand the role of the Kansas Water Office, and their identification of the Water Office's role with other agencies probably indicates that they do not have a clear understanding of the role of other water agencies in the state. While it might be encouraging that a substantial number of respondents (75 percent) correctly identified the purpose of the State Water Plan, the high response may reflect the unlikely nature of the alternative answers to the question and not represent any real knowledge or understanding of the State Water Plan.

Finally, in terms of sources of information, it is possible to assume that Kansans gather water-related information from a variety of sources, and no single source of information stands out. However, the correlation of correct answers with educational level suggests that schools are one effective avenue for increasing knowledge (it also may be argued that more highly educated respondents have greater information on a variety of topics, and that the correlation between education and knowledge about water is not a causation).

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

APPENDIX

Interdisciplinary Communication Research Institute

KANSAS WATER OFFICE SURVEY OF THE 12 RIVER BASINS

(Final draft February 13, 2001)

Hello, my name is _____. I am calling from the survey lab at Wichita State University. We are not selling anything. We are doing a survey about water usage in the state of Kansas. Would you have time to answer a few questions? It will only take about five or six minutes. [If *Yes, continue. If No, try to schedule a callback]* Thank you. Here's my first question:

Screening question: Are you over 18 years of age? Yes No

[If Yes, continue. If No, ask if there is an adult over 18 in the house. If there is, ask if you can speak with the adult. If not, thank the respondent and say that you have no further questions.]

First, a few general questions. They are multiple choice.

1) Would you say that the largest user of water in Kansas is:
a) private households
b) industry
c) irrigation or
d) cities
e) don't know

2) What would you say is the most common cause of pollution in Kansas streams?
a) chemical discharges from factories
b) surface water runoff from yards, city streets, and farm fields
c) used motor oil dumped in storm drains
d) don't know

3) Which of the following is the most effective way to conserve water in your home:

a) run your washing machine and dishwasher only when they are full

b) turn off the water while you brush your teeth

c) time your shower to keep it under five minutes

d) all of the above

e) don't know

And now some definitions. Ready?

4) Would you say an aquifer is:

a) an underground rock layer that holds water

b) where a river meets a lake

c) an above-ground storage tank

d) don't know

5) Would you say groundwater is:

a) water that is polluted with dirt

b) water found underground

c) rainwater that falls on the ground

d) don't know

6) How about surface water. Would you say it is:

a) water found on top of parking lots and roads

b) water in streams, lakes, and ponds

c) water found below the surface of the earth

d) don't know

7) Would you say a floodplain is:

a) the amount of water in a river channel during drought

b) land covered by water because of a dam

c) the portion of a river valley that is covered by water when the river is flooding

f) don't know

And now some true or false questions.

8) Planting trees and grasses along a stream will help protect the quality of water in the stream. True or False? (Don't know)

9) Lowering the water table by heavy pumping can affect rivers and streams. True or False. (Don't know)

10) The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited.
True or False? (Don't know)

I am now going to ask you a couple of questions about the State Water Plan

11) Would you say the purpose of the State Water Plan is:
a) to manage, conserve, and develop the state's water resources
b) increase rainfall across the state
c) find new ways to drill for water
d) don't know

12) And would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is:
a) the Kansas Department of Health and Environment
b) the Kansas Division of Water Resources/Kansas Department of Agriculture
c) the State Conservation Commission
d) the Kansas Water Office
e) don't know

I just have a quick question about where you like to get your information

13) How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important at All? *[If necessary, repeat the choices]*
a) newspapers, radio, and television
b) the government, such as federal, local, and governmental agencies
c) universities, such as extension offices
d) public water suppliers, such as water companies
e) private, non-profit organizations, such as farming organizations or environmental organizations
f) school

14. Would you describe the place where you live as more rural or urban?

15. Finally, which of the following best describes your educational level?
- High school
- High school diploma
- Some college
- A college degree
- Some graduate work
- A graduate degree

Thank you very much for taking part in this survey, which was done for the Kansas Water Office. If you would like more information about the Kansas Water Office you can call toll free 1888 KAN-WATER or you can go to their Web site, which is kwo.org.

CALLER: Please code for:
a) Area code and prefix (6 digits)
b) Male or Female
c) River basin

KANSAS-LOWER REPUBLICAN BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Roper Starch survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Kansas-Lower Republican basin, 106 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Thirty-three percent of the respondents correctly identified irrigation. About 25.5 percent wrongly identified cities as the largest water user, and another 24.5 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 53.8 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Kansas-Lower Republican basin, 36.8 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. The correct definition (answer a) was identified by 58.5 percent. More than 20 percent of the respondents, however, said that they did not know the correct answer.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 60.4 percent of the respondents identified the correct definition (answer b), 33.0 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 56.6 percent of the respondents identified the correct definition (answer b). More than a quarter (28.3 percent) of the respondents, however, identified surface water as "water found on top of parking lots and roads."

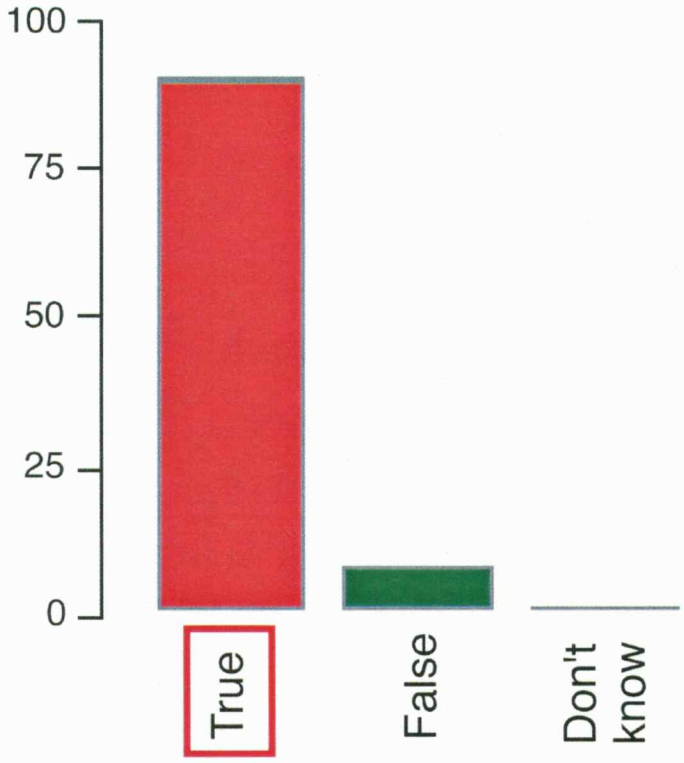
Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (85.9 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 90.6 percent of the respondents, made the correct response (which is True). In fact, respondents from the Kansas-Lower Republican basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.

Planting trees and grasses along a stream will help protect the quality of water in the stream?

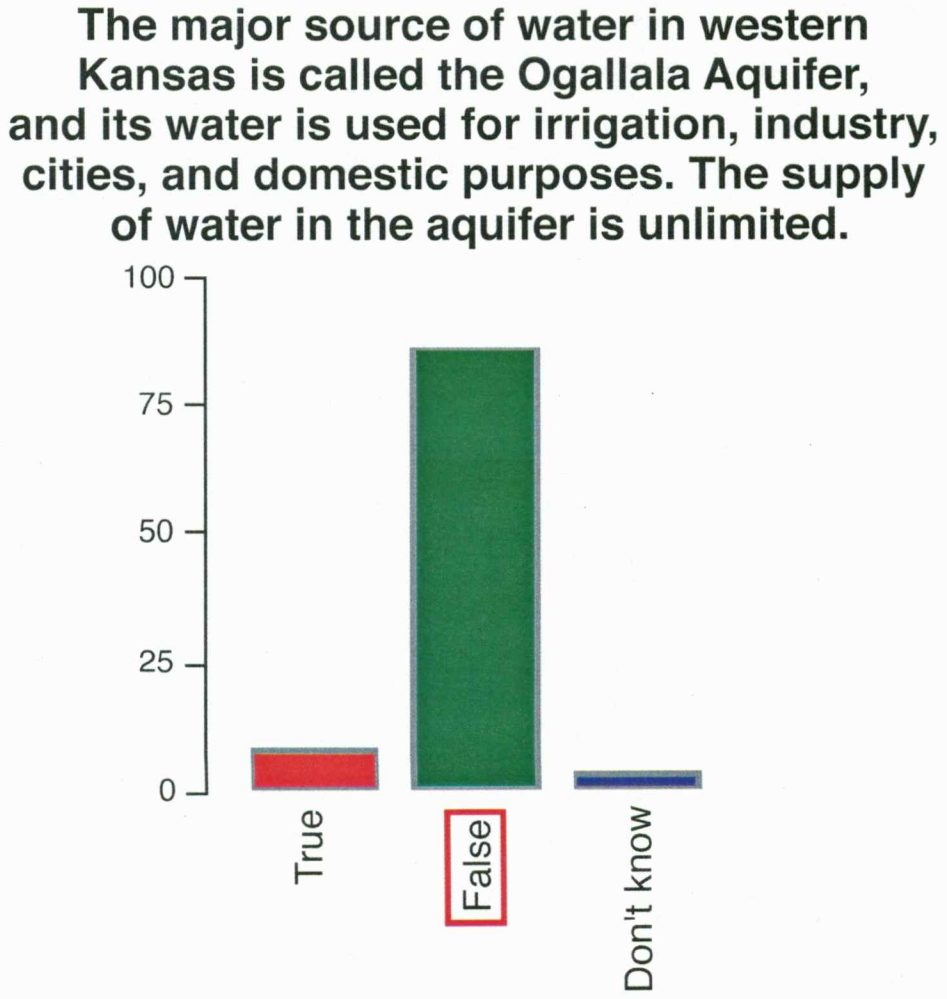


Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (86.8 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (87.7 percent) correctly answered that the aquifer contained a limited amount of water. In fact, respondents from the Kansas-Lower Republican basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.



Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (74.5 percent) correctly identified the purpose of the plan (answer a), although 17 percent said its purpose was to "find new ways to drill for water."

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water-resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 14.2 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 12.3 percent of respondents said "don't know," 9.4 percent said the Kansas Department of Health and Environment, and 18.9 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 45.3 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 50.9 percent rated the media as very important and 42.5 percent rated them as important. Thus, more than 90 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 31.1 percent rated agencies as very important sources while 50 percent rated them as important sources of information. Thus, 81.1

percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 34.9 percent of respondents rated them as "very important" and 48.1 rated them as "important." Thus, 83 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 38.7 percent of respondents rated them as "very important," 44.3 percent rated them as "important," and 12.3 percent rated them as not very important. In total 83 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 24.5 percent of respondents said they were "very important" sources of information and 52.8 percent said they were "important" sources of information. Thus, 77.3 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 39.6 percent said schools were a very important source of information, and 42.5 said they were an important source of information, for a total of 82.1 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, public water suppliers, schools, governmental agencies, and non-profit organizations.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

NEOSHO BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Neosho basin, 102 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 17.7 percent of the respondents correctly identified irrigation. Nearly 40 percent wrongly identified cities as the largest water user, and another 22.6 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

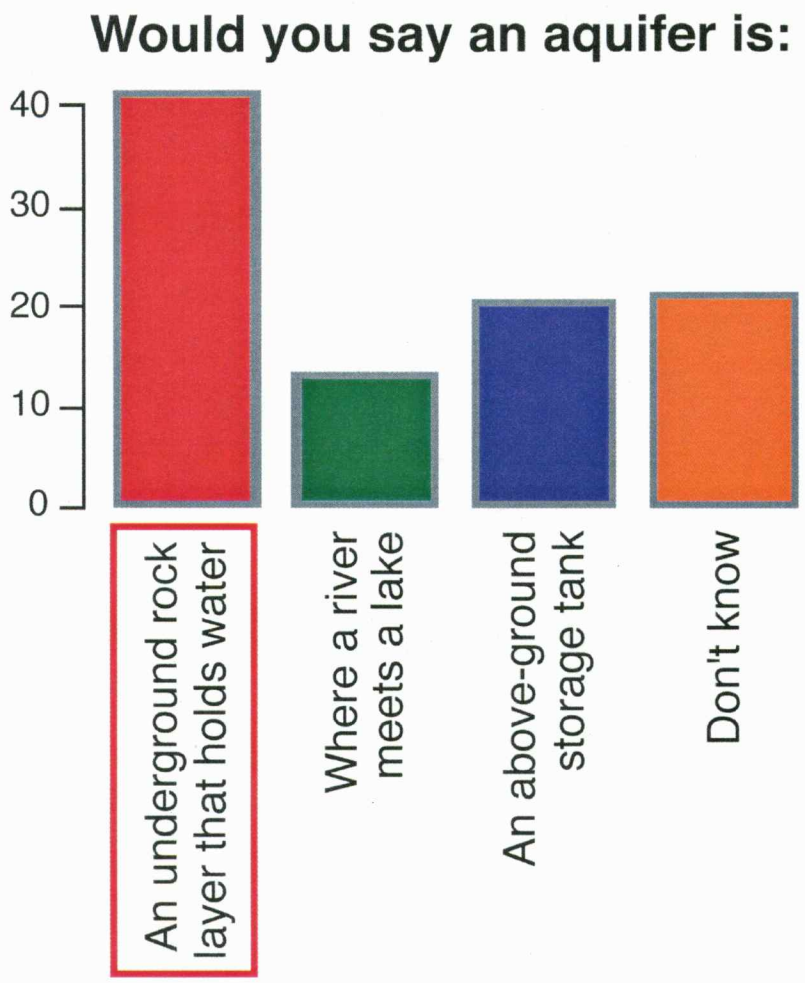
Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 44.1 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Neosho basin, however, 46.1 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 42.2 percent identified the correct definition (answer a). More than 20 percent of the respondents (22.6), however, said that they did not know the correct answer, and another 21.6 incorrectly identified an aquifer as an above-ground storage tank. This was the lowest correct response rate to this question of any of the basins.


Would you say an aquifer is:
40
30
20
10
0
An underground rock layer that holds water
Where a river meets a lake
An above-ground storage tank
Don't know

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 52 percent of the respondents identified the correct definition (answer b), 42 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 60.8 percent of the respondents identified the correct definition (answer b), 20.6 percent of the respondents, however, identified surface water as "water found on top of parking lots and roads" and 17.7 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (80.4 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 87.3 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (82.4 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in

western Kansas) was a finite water source. A high proportion of respondents (79.4 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (71.6 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 11.8 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 12.8 percent of respondents said "don't know," 14.7 percent said the Kansas Department of Health and Environment, and 16.7 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 44.1 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 47.1 percent rated the media as very important and 43.1 percent rated them as important. Thus, more than 90 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 32.4 percent rated agencies as very important sources while 50.1 percent rated them as important sources of information. Thus, 82.5 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 38.2 percent of respondents rated them as "very important" and 48.0 rated them as "important." Thus, 86.2 percent of respondents rated universities and extension offices as very important or important sources of information. These sources, then, are rated very slightly higher than governmental agencies, but below the media as sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 30.1 percent of respondents rated them as "very important," 41.2 percent rated them as "important," and 18.6 percent rated them as not very important. In total, 71.3 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 27.5 percent of respondents said they were "very important" sources of information and 48 percent said they were "important" sources of information. Thus, 75.5 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 45.1 percent said schools were a very important source of information, and 34.3 said they were an important source of information, for a total of 79.4 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, schools, non-profit organizations, and public water suppliers.

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SMOKY HILL-SALINE BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Smoky Hill-Saline basin, 104 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 22.9 percent of the respondents correctly identified irrigation. Nearly 40 percent (39.1) wrongly identified cities as the largest water user, and another 26.7 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 45.7 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Smoky Hill-Saline basin, however, 35.2 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer (answer a). 70.5 percent identified the correct definition. About 9.5 percent of the respondents said they did not know the correct answer, and 13.3 incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 55.2 percent of the respondents identified the correct definition (answer b), 34.3 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 59.1 percent of the respondents identified the correct definition (answer b). However, 23.8 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 16.2 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

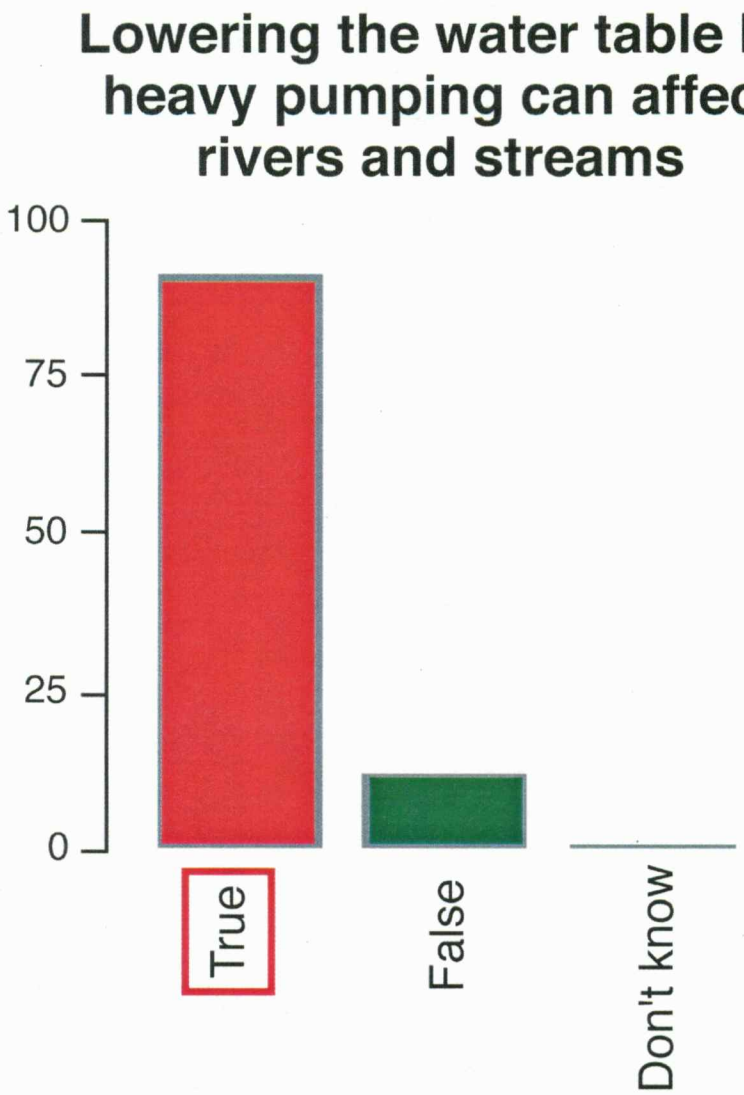
Question 7 asked for a definition of floodplain. A very high proportion of respondents (79.1 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 82.7 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (87.5 percent) selected the correct response (which is True). In fact, respondents from the Smoky Hill-Saline basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.


Lowering the water table by heavy pumping can affect rivers and streams
100
75
50
25
0
True
False
Don't know

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (76 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (78.9 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 7.7 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 12.5 percent of respondents said "don't know," 13.5 percent said the Kansas Department of Health and Environment, and 17.3 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 49 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 46.2

percent rated the media as very important and 48.1 percent rated them as important. Thus, more than 92 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 36.5 percent rated agencies as very important sources while 49.0 percent rated them as important sources of information. Thus, 85.5 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 41.4 percent of respondents rated them as "very important" and 48.1 rated them as "important." Thus, 89.5 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 26.9 percent of respondents rated them as "very important," 43.3 percent rated them as "important," and 18.3 percent rated them as not very important. In total 70.2 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 30.8 percent of respondents said they were "very important" sources of information and 43.3 percent said they were "important" sources of information. Thus, 74.1 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 42.3 percent said schools were a very important source of information, and 37.5 said they were an important source of information, for a total of 79.8 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, schools, non-profit organizations, and public water suppliers.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

MARAIS DES CYGNES BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Marais des Cygnes basin, 103 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 25.2 percent of the respondents correctly identified irrigation. Nearly a third (32 percent) wrongly identified cities as the largest water user, and another 20.1 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 54.4 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Marais des Cygnes basin, however, 35.9 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 60.2 percent identified the correct definition (answer a). About 19.4 percent of the respondents said they did not know the correct answer, and 15.5 incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 48.5 percent of the respondents identified the correct definition (answer b), 40.8 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 48.5 percent of the respondents identified the correct definition (answer b). However, 39.8 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 10.7 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (85.4 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 85.4 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (85.4 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (82.5 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (79.6 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 9.7 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 10.7 percent of respondents said "don't know," 9.7 percent said the Kansas Department of Health and Environment, and 19.4 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 50.5 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 52.4 percent rated the media as very important and 43.7 percent rated them as important. Thus, more than 96 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 37.9 percent rated agencies as very important sources while 51.5 percent rated them as important sources of information. Thus, 89.4

percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 41.8 percent of respondents rated them as "very important" and 48.5 rated them as "important." Thus, 89.5 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 34 percent of respondents rated them as "very important," 44.7 percent rated them as "important," and 18.5 percent rated them as not very important. In total 78.7 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 25.2 percent of respondents said they were "very important" sources of information and 53.4 percent said they were "important" sources of information. Thus, 78.8 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 41.8 percent said schools were a very important source of information, and 35.9 said they were an important source of information, for a total of 77.7 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, public water suppliers, schools, and non-profit organizations.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

SOLOMON BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Solomon basin, 100 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Thirty-six percent of the respondents correctly identified irrigation. However, a larger percentage (38 percent) wrongly identified cities as the largest water user, and another 17 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 54 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Solomon basin, 33 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. Sixty-one percent identified the correct definition (answer a). Fifteen percent of the respondents said they did not know the correct answer and 19 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 51 percent of the respondents identified the correct definition (answer b), 28 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 52 percent of the respondents identified the correct definition (answer b). However, 29 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 15 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (86 percent) identified the correct definition (answer c). In fact, respondents from the Solomon basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 87 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (86 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in

western Kansas) was a finite water source. A high proportion of respondents (84 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (76 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 12 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. Sixteen percent of respondents said "don't know," 8 percent said the Kansas Department of Health and Environment, and 22 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 42 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 44 percent rated the media as very important and 39 percent rated them as important. Thus, more than 83 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 35 percent rated agencies as very important sources

while 45 percent rated them as important sources of information. Thus, 80 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 33 percent of respondents rated them as "very important" and 52 rated them as "important." Thus, 85 percent of respondents rated universities and extension offices as very important or important sources of information.

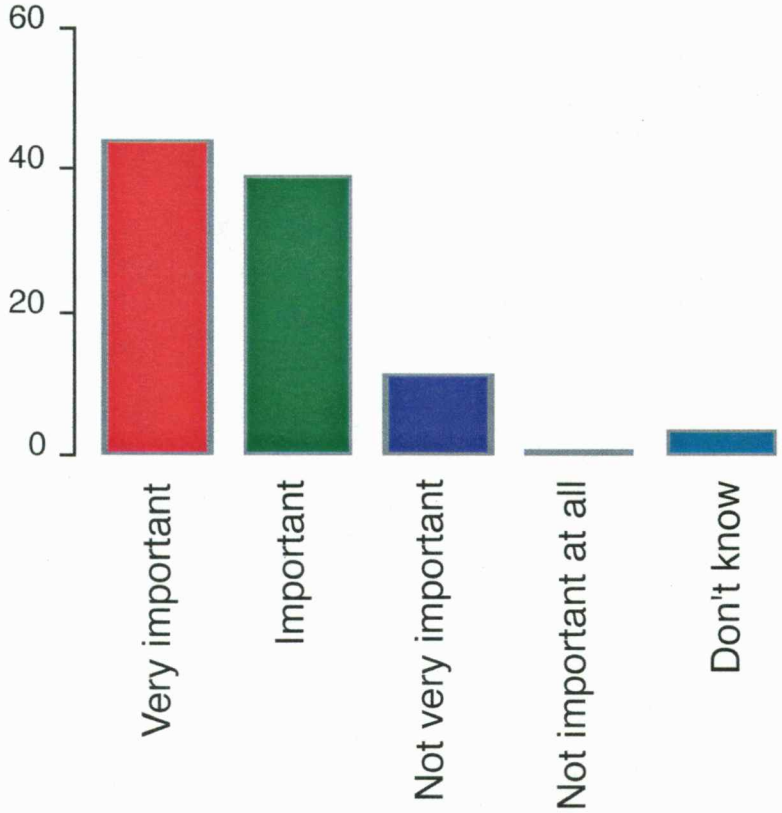
When asked to rate public water suppliers, such as water companies, as sources of information, 29 percent of respondents rated them as "very important," 47 percent rated them as "important," and 17 percent rated them as not very important. In total, 76 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 21 percent of respondents said they were "very important" sources of information and 39 percent said they were "important" sources of information. Thus, 60 percent of respondents rated private organizations as "very important" or "important." However, nearly a third of respondents (32 percent) said that these organizations were not very important sources of information.

Finally, respondents were asked to rate schools as a source of information. In response, 42 percent said schools were a very important source of information, and 36 said they were an important source of information, for a total of 78 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be university and extension offices, the media, governmental agencies, schools, public water suppliers, and non-profit organizations.

How important to you are newspapers, radio, and television as sources of information?



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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

VERDIGRIS BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

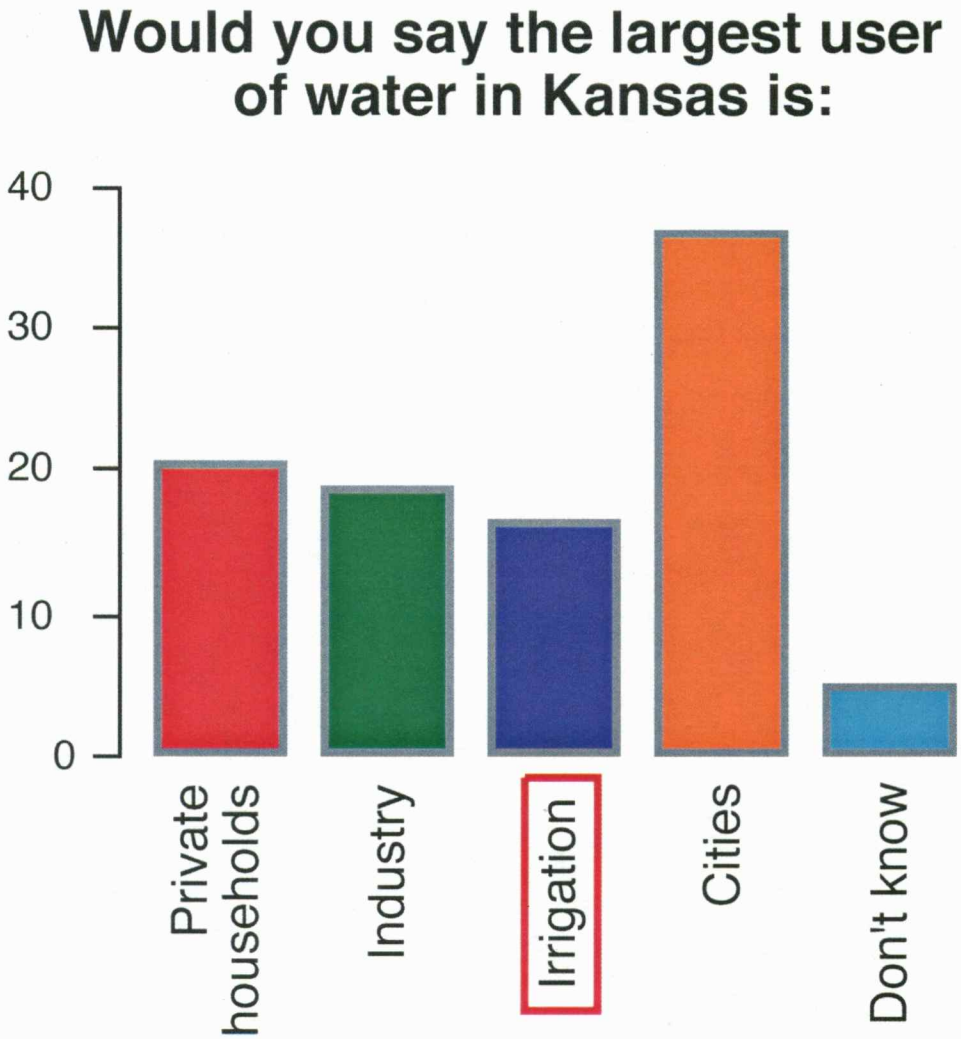
Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Verdigris basin, 110 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 17.3 percent of the respondents correctly identified irrigation. More than a third (37.3 percent) wrongly identified cities as the largest water user, and another 20.9 percent wrongly identified private households. In fact, respondents from the Verdigris basin had the lowest rate of correct responses to this question when compared to respondents from any of the other basins.



Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 37.3 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Verdigris basin, however, 47.3 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 45.5 percent identified the correct definition (answer a). About 29.1 percent of the respondents said they did not know the correct answer (the highest percentage of "don't knows" of any of the basins), and 20 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 51.8 percent of the respondents identified the correct definition (answer b), 32.7 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 48.2 percent of the respondents identified the correct definition (answer b). However, 32.7 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 16.7 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (74.6 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 82.7 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (79.1 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (71.8 percent) correctly answered that the aquifer contained a limited amount of water, although 28.2 either answered incorrectly or didn't know.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (66.4 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 17.4 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. About 11.9 percent of respondents said "don't know," 11.0 percent said the Kansas Department of Health and Environment, and 25.7 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 33.9 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 57.8 percent rated the media as very important and 35.8 percent rated them as important. Thus, more than 93 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 45 percent rated agencies as very important sources while 44 percent rated them as important sources of information. Thus, 89 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 40.4 percent of respondents rated them as "very important" and 45.9 rated them as

"important." Thus, 86.3 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 43.1 percent of respondents rated them as "very important," 35.8 percent rated them as "important," and 15.6 percent rated them as not very important. In total 78.9 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 31.2 percent of respondents said they were "very important" sources of information and 40.4 percent said they were "important" sources of information. Thus, 78.8 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 51.8 percent said schools were a very important source of information, and 32.7 said they were an important source of information, for a total of 84.5 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, schools, public water suppliers, and non-profit organizations.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

WALNUT BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed data-bases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Walnut basin, 103 responses were completed. The following discussion applies only to responses from that basin.

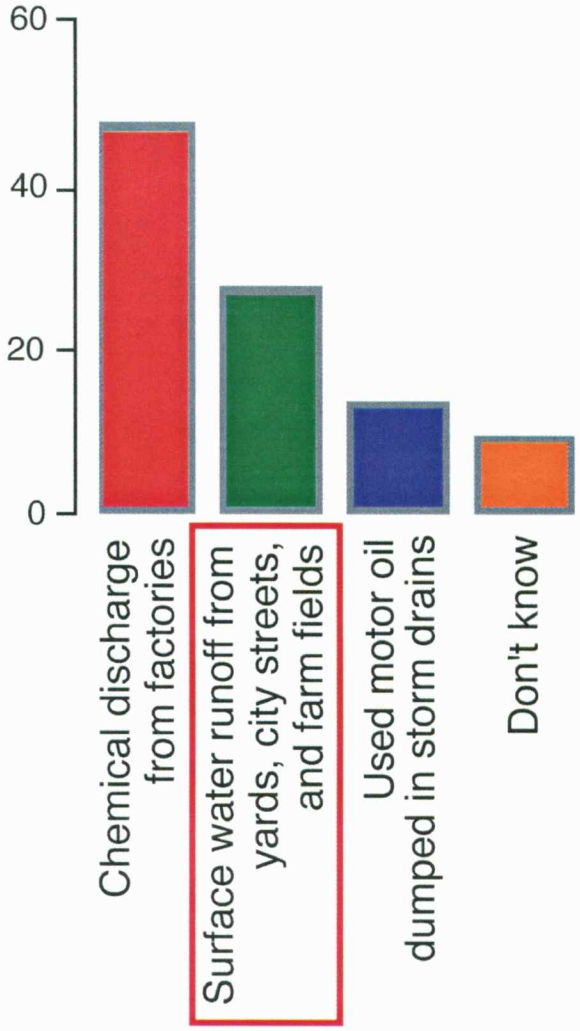
Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. 20.4 percent of the respondents correctly identified irrigation. However, a much larger percentage (44.7 percent) wrongly identified cities as the largest water user, and another 18.5 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 28.2 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Walnut basin, 47.6 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey). Walnut basin respondents had the lowest rate of correct response to this question among all the basins.

What would you say the most common cause of pollution in Kansas streams?



Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 55.3 percent identified the correct definition (answer a). 19.4 percent of the respondents said they did not know the correct answer, and 15.5 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 54.4 percent of the respondents identified the correct definition (answer b), 31.1 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 52.4 percent of the respondents identified the correct definition (answer b). However, 27.2 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 13.6 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

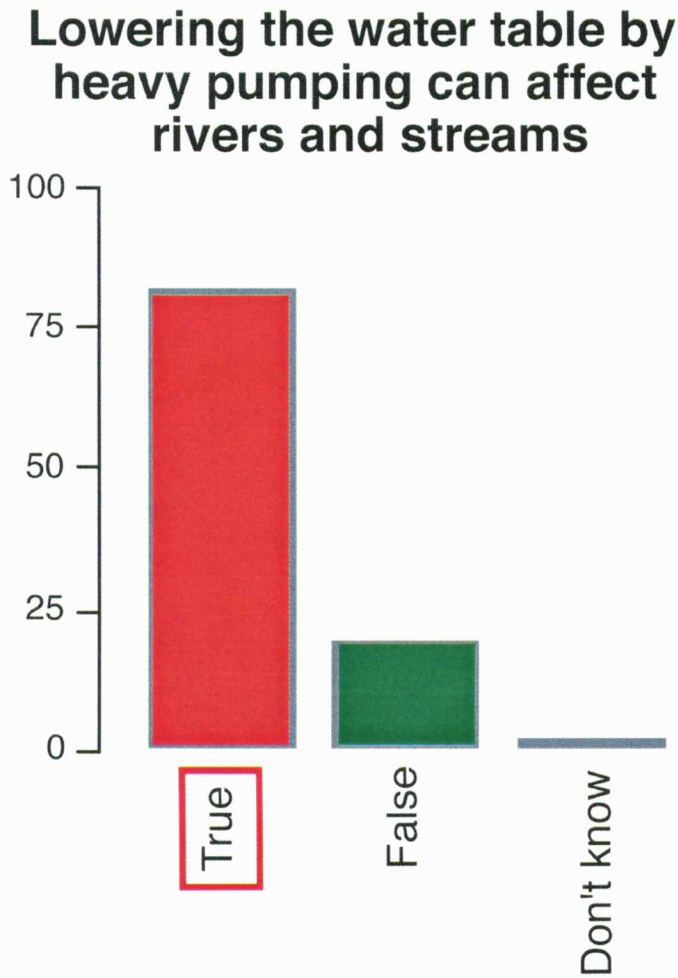
Question 7 asked for a definition of floodplain. A very high proportion of respondents (78.6 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 77.7 percent of the respondents, made the correct response (which is True). However, 21.4 percent gave the incorrect answer, the highest percentage of incorrect answer for this question among all the basins.

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (78.6 percent) selected the correct response (which is True), although 19.4 percent gave an incorrect response, the highest percentage of incorrect answer for this question among all the basins.



Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (75.7 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (70.9 percent) correctly identified the purpose of the plan (answer a), although 20.4 percent of respondents answered "find new ways to drill for water."

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 12.6 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. 7.8 percent of respondents said "don't know," 23.3 percent said the Kansas Department of Health and Environment, and 18.5 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 37.9 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the

mass media (defined as television, newspapers, and radio) as source of information, 65.1 percent rated the media as very important and 28.2 percent rated them as important. Thus, more than 93 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 40.8 percent rated agencies as very important sources while 45.6 percent rated them as important sources of information. Thus, 86.4 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 40.8 percent of respondents rated them as "very important" and 44.7 rated them as "important." Thus, 85.5 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 33 percent of respondents rated them as "very important," 45.6 percent rated them as "important," and 15.5 percent rated them as not very important. In total 78.6 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 28.2 percent of respondents said they were "very important" sources of information and 38.8 percent said they were "important" sources of information. Thus, 67 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 50.5 percent said schools were a very important source of information, and 29.1 said they were an important source of information, for a total of 79.6 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, governmental agencies, university and extension offices, schools, public water suppliers, and non-profit organizations.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

UPPER REPUBLICAN BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Starch Roper survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

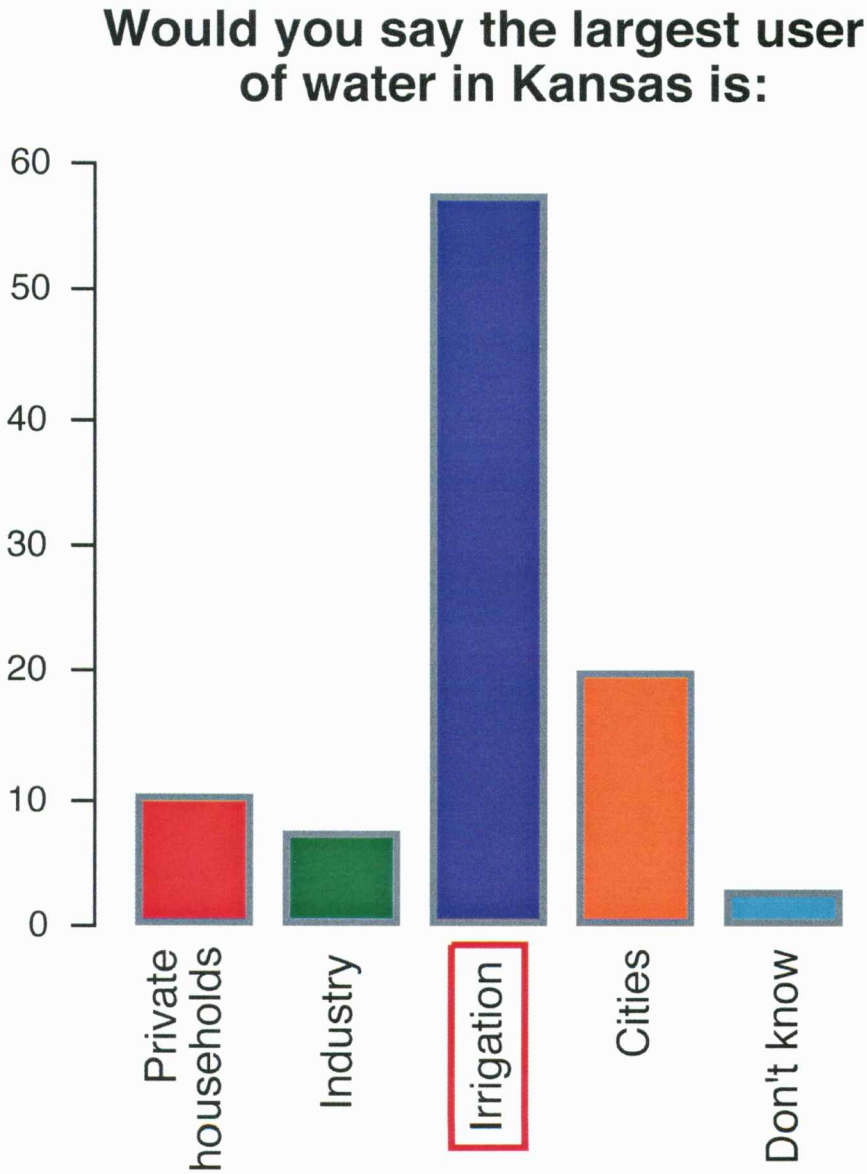
Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Upper Republican basin, 103 responses were completed. The following discussion applies only to responses from that basin.

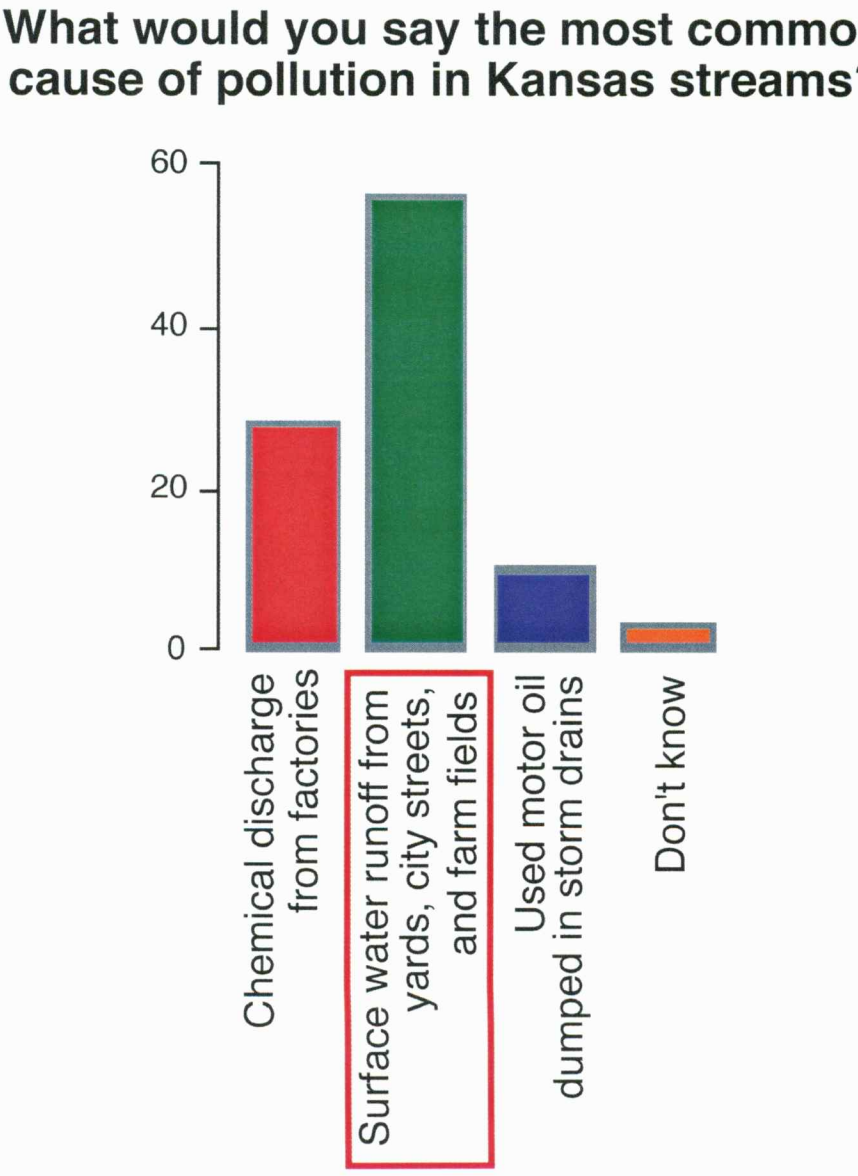
Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. 58.3 percent of the respondents correctly identified irrigation. A much smaller percentage (20.4 percent) wrongly identified cities as the largest water user, and another 10.7 percent wrongly identified private households. Of all the basins, the Upper Republican basin had the highest rate of correct response to this question.



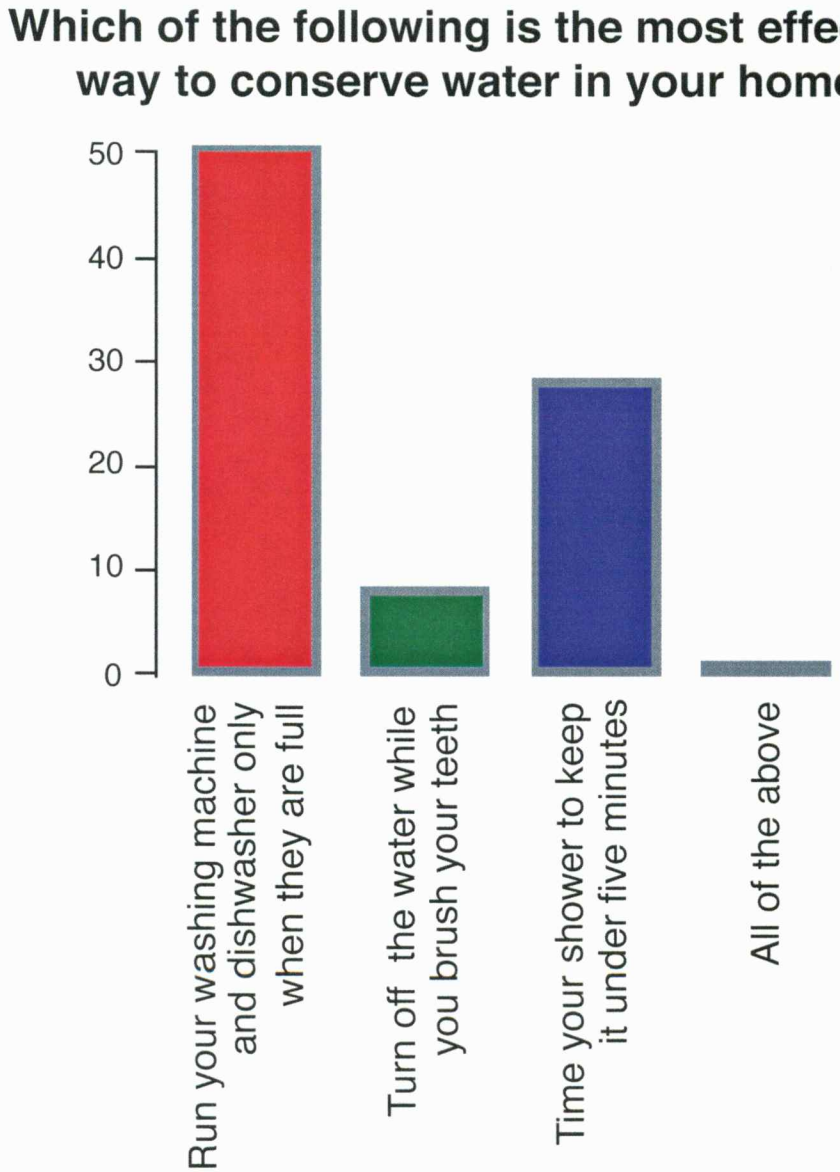
Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 56.3 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. Of all the basins, the Upper Republican basin had the highest rate of correct response to this question. In the Upper Republican basin, 29.1 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).



Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.



Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 75.7 percent identified the correct definition (answer a). 7.8 percent of the respondents said they did not know the correct answer and 7.8 percent incorrectly identified an aquifer as an above-ground storage tank. Of all the basins, the Upper Republican basin had the highest rate of correct response to this question.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 59.2 percent of the respondents identified the correct definition (answer b), 28.2 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 68.0 percent of the respondents identified the correct definition (answer b). However, 14.6 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 14.6 percent said it was "water found below the surface of the earth."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (82.5 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 88.4 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (86.4 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (79.6 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (79.6 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 12.6 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. 9.7 percent of respondents said "don't know," 7.8 percent said the Kansas Department of Health and Environment, and 15.5 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 54.4 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices

d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 46.6 percent rated the media as very important and 47.6 percent rated them as important. Thus, more than 94 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 33 percent rated agencies as very important sources while 45.6 percent rated them as important sources of information. Thus, 78.6 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 35 percent of respondents rated them as "very important" and 52.4 rated them as "important." Thus, 87.4 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 30.1 percent of respondents rated them as "very important," 45.6 percent rated them as "important," and 17.5 percent rated them as not very important. In total 75.7 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 30.1 percent of respondents said they were "very important" sources of information and 41.8 percent said they were "important" sources of information. Thus, 71.9 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 48.5 percent said schools were a very important source of information, and 28.2 said they were an important source of information, for a total of 76.7 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, schools, public water suppliers, and non-profit organizations.

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CIMARRON BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

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The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

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average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Cimarron basin, 112 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. 51.8 percent of the respondents correctly identified irrigation. A much smaller percentage (19.6 percent) wrongly identified cities as the largest water user, and another 13.4 percent wrongly identified private households.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 37.5 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Cimarron basin, 36.6 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

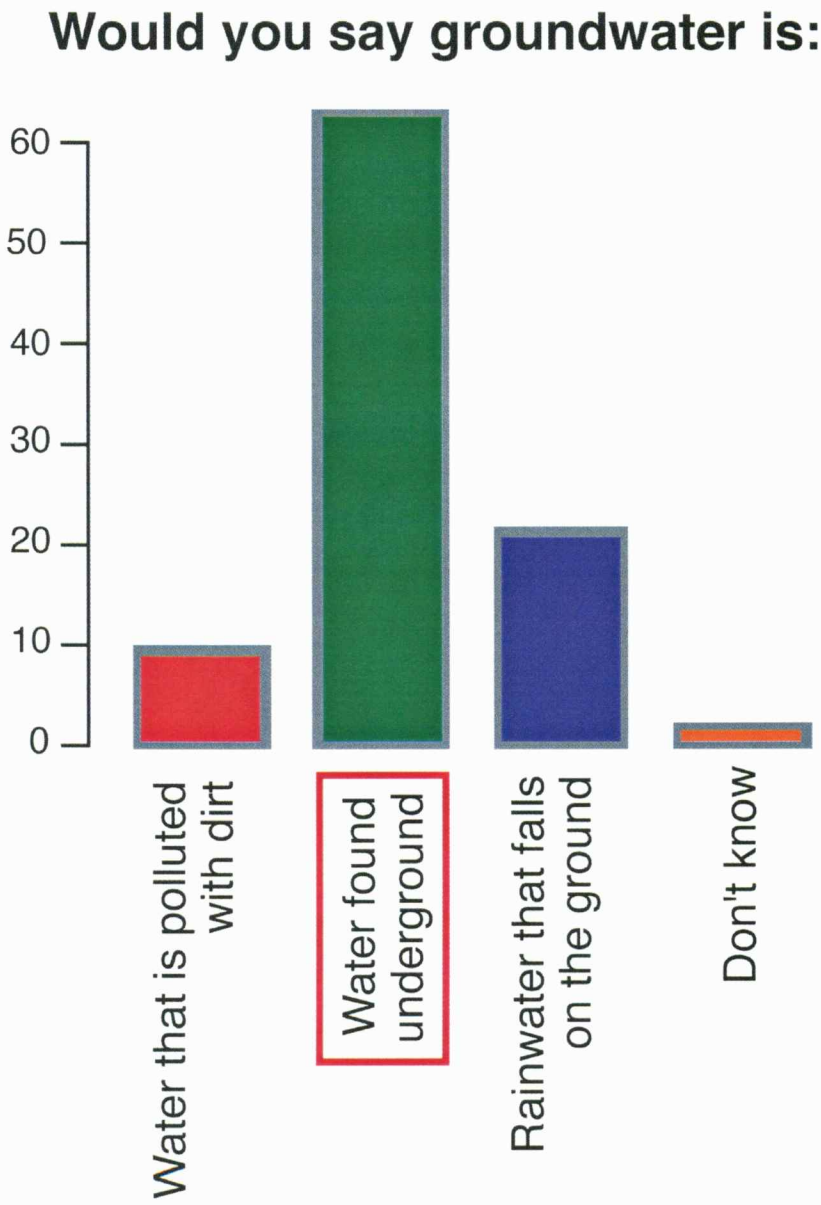
Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 68.5 percent identified the correct definition (answer a). 13.5 percent of the respondents said they did not know the correct answer and 13.5 percent incorrectly identified an aquifer as an above-ground storage tank.

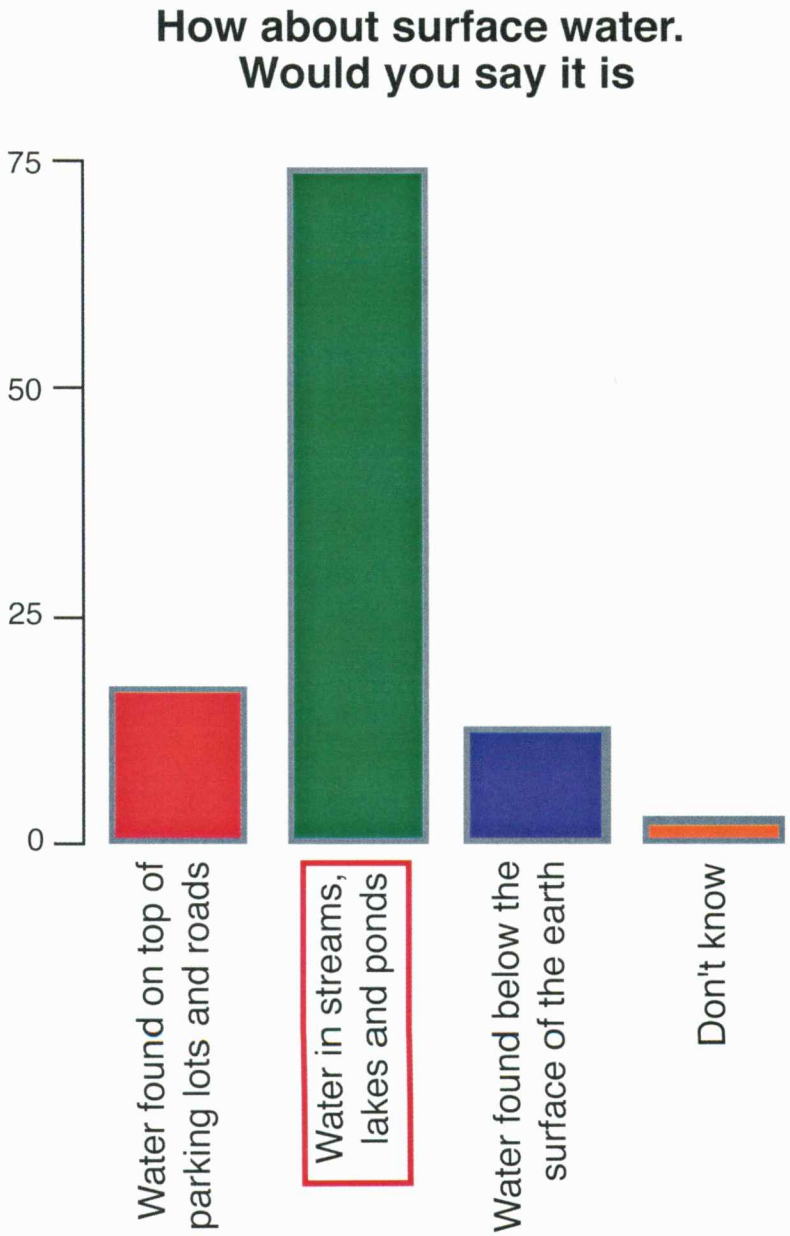
Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 64 percent of the respondents identified the correct definition (answer b), 22.5 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground." Respondents from the Cimarron basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.



Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 68.5 percent of the respondents identified the correct definition (answer b). However, 16.2 percent of the respondents identified surface water as "water found on top of parking lots and roads" and 12.6 percent said it was "water found below the surface of the earth." Respondents from the Cimarron basin had the highest percentage of correct responses to this question, when compared to respondents from other basins.



Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (73 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 87.4 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (83.8 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (80.2 percent) correctly answered that the aquifer contained a limited amount of water, although 16.2 percent of respondents said that the statement was false.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (75.7 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of

Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 10.8 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. 10.8 percent of respondents said "don't know," 13.5 percent said the Kansas Department of Health and Environment, and 25.2 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 39.6 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 49.1 percent rated the media as very important and 38.2 percent rated them as important. Thus, 87.3 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 22.7 percent rated agencies as very important sources while 58.2 percent rated them as important sources of information. Thus, 80.9 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 37.3 percent of respondents rated them as "very important" and 48.2 rated them as "important." Thus, 85.5 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 31.8 percent of respondents rated them as "very important," 43.6 percent rated them as "important," and 17.3 percent rated them as not very important. In total 75.4 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 29.1 percent of respondents said they were "very important" sources of information and 45.5 percent said they were "important" sources of information. Thus, 74.6 percent of respondents rated private organizations as "very important" or "important." 19.1 percent rate these organizations "not very important."

Finally, respondents were asked to rate schools as a source of information. In response, 40.9 percent said schools were a very important source of information, and 31.8 said they were an important source of information, for a total of 72.7 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, university and extension offices, governmental agencies, public water suppliers, non-profit organizations, and schools.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

MISSOURI BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Missouri basin, 109 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 18.4 percent of the respondents correctly identified irrigation. This was the low correct response rate, as compared to other basins, and probably a reflection of the lack of irrigation in this area. A much higher percentage (35.8 percent) wrongly identified cities as the largest water user, and another 23.9 percent wrongly identified industry.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 49.5 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Missouri basin, 33.9 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 51.4 percent identified the correct definition (answer a). 28.4 percent of the respondents said they did not know the correct answer and 11.9 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 46.8 percent of the respondents identified the correct definition (answer b), 38.5 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 51.4 percent of the respondents identified the correct definition (answer b). However, 36.7 percent of the respondents identified surface water as "water found on top of parking lots and roads."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A very high proportion of respondents (77.1 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 78.9 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (77.1 percent) selected the correct response (which is True). However, a higher percentage (17.4 percent) of respondents answered this question incorrectly.

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in

western Kansas) was a finite water source. A high proportion of respondents (78.9 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (76.2 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. Only 13 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. 16.7 percent of respondents said "don't know," 12 percent said the Kansas Department of Health and Environment, and 20.4 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 38 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 43.5 percent rated the media as very important and 47.2 percent rated them as important. Thus, 90.7 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 43.5 percent rated agencies as very important

sources while 47.2 percent rated them as important sources of information. Thus, 90.7 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 41.7 percent of respondents rated them as "very important" and 47.2 rated them as "important." Thus, 88.9 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 38 percent of respondents rated them as "very important," 46.3 percent rated them as "important," and 8.3 percent rated them as not very important. In total 84.3 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 16.7percent of respondents said they were "very important" sources of information and 56.5 percent said they were "important" sources of information. Thus, 73.2 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 49.1 percent said schools were a very important source of information, and 32.4 said they were an important source of information, for a total of 81.5 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media and governmental agencies, university and extension offices, public water suppliers, schools, and non-profit organizations.

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This study was funded by the Kansas Water Plan, Kansas Water Office contract 01-120.

UPPER ARKANSAS BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed databases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Upper Arkansas basin, 104 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. 46.2 percent of the respondents correctly identified irrigation. A much smaller percentage (22.1 percent) wrongly identified cities as the largest water user, and another 16.4 percent wrongly identified industry.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 34.6 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Upper Arkansas basin, 34.6 percent of the respondents incorrectly identified factory discharge as the correct response (compared to 44 percent on the nationwide survey). 15.4 percent answered "used motor oil dumped in storm drains" and 15.4 percent answered "don't know."

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 54.8 percent identified the correct definition (answer a). However, 26 percent of the respondents said they did not know the correct answer and 15.4 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 63.5 percent of the respondents identified the correct definition (answer b), 22.1 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 62.5 percent of the respondents identified the correct definition (answer b). However, 21.2 percent of the respondents identified surface water as "water found on top of parking lots and roads."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A high proportion of respondents (59.6 percent) identified the correct definition (answer c), although 24 percent of respondents said they did not know the correct answer.

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 81.7 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (79.8 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in

western Kansas) was a finite water source. A high proportion of respondents (53.9 percent) correctly answered that the aquifer contained a limited amount of water. However, 36.5 percent of respondents said that the Ogallala aquifer was unlimited. This was the highest response of percentage of "unlimited" responses of any of the basins.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (63.5 percent) correctly identified the purpose of the plan (answer a).

Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. 22.1 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. For this question, this was the highest correct response rate of any of the basins. 17.3 percent of respondents said "don't know," 8.7 percent said the Kansas Department of Health and Environment, and 15.4 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 36.5 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 50 percent rated the media as very important and 42.3 percent rated them as important. Thus,

more than 92 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 41.4 percent rated agencies as very important sources while 45.2 percent rated them as important sources of information. Thus, 86.6 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 30.8 percent of respondents rated them as "very important" and 54.8 rated them as "important." Thus, 85.6 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 29.8 percent of respondents rated them as "very important," 46.2 percent rated them as "important," and 17.3 percent rated them as not very important. In total 76 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 25 percent of respondents said they were "very important" sources of information and 43.3 percent said they were "important" sources of information. Thus, 68.3 percent of respondents rated private organizations as "very important" or "important." Twenty-six percent said these organizations were "not very important" sources of information.

Finally, respondents were asked to rate schools as a source of information. In response, 50 percent said schools were a very important source of information, and 39.4 said schools were an important source of information, for a total of 89.4 percent of respondents who thought that schools were a "very important" or "important" source of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the media, schools, governmental agencies, university and extension offices, public water suppliers, and non-profit organizations.

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LOWER ARKANSAS BASIN

Summary

The Kansas Water Office contracted with the Kansas Geological Survey to develop and carry out a statewide, random phone survey to determine Kansans' knowledge of water terminology and issues and their sources of water-related information. A statistically valid sample was collected by the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University for each of the twelve drainage basins in Kansas; slightly more than 1,200 responses were collected for the entire state. The survey found that Kansans were generally familiar with water-related terminology, such as aquifers and groundwater. On a water-pollution question that is identical to a question asked in a nationwide survey, Kansans scored significantly better than did respondents to the nationwide survey. And they appear to understand the limited nature of groundwater resources in western Kansas. They were less able to identify the primary use of water in the state, and they did poorly on a question that asked about the roles of different state water agencies. Respondents identified the importance they place on various sources of water-related information, generally rating the media as most important. The survey found that a higher proportion of correct answers were given by respondents in western Kansas than in eastern Kansas, that there was no statistically significant difference in the proportion of correct responses given by Kansans who lived in urban settings as compared to those who lived in rural areas, nor was there a significant difference in the proportion of correct responses given by men as compared to women.

Introduction

The current Kansas Water Plan includes the following objectives: "By 2010, provide educational activities to ensure that Kansans increase their knowledge of the State's water resources, to enable them to make better personal and public decisions on water conservation, development and management" and "By 2010, Kansas Water Plan public information activities should be directed at ensuring the public is aware of the Kansas Water Plan and knows where and how to obtain current, reliable information on the status of water resources in Kansas" (Kansas Water Plan, 2000). The Water Plan calls for a statewide survey to assess knowledge of water issues "using a random digit dialed survey" and utilizing, to the extent possible, the format of the National Environmental Education and Training Foundation/Roper Starch Survey. The Water Plan also recommended that the survey be conducted by basin, if possible. The purpose of the survey is to provide baseline information on Kansans' level of knowledge about water.

The survey results can guide information and educational programs. If the survey is repeated periodically, the responses can be used to assess progress toward the 2010 objective of the Kansas Water Plan.

Previous surveys have measured public attitudes toward water issues and the levels of public awareness about water in Kansas. Stephen White and David Kromm at Kansas State University conducted extensive surveys aimed at determining public perception of groundwater-related issues and the sources of information for individuals in western Kansas, particularly irrigators (Kromm and White, 1981; Kromm and White, 1985; Kromm and White, 1990). More recently, the Kaw Valley Heritage Alliance studied attitudes about surface-water quality among people in a twelve-county area of northeastern Kansas, using both a survey and focus groups (Burress and Harris, 2000). Several national surveys have included responses from Kansans on their attitudes about environmental issues and their levels of information on the subject. Of particular interest is the Starch Roper survey, which measured knowledge about nine environmental issues, although those results are not broken out on a state-by-state basis (National Environmental Education and Training Foundation and Roper Starch Worldwide, 1999).

These prior surveys have addressed specific audiences, such as irrigators, or specific issues, such as water quality. However, little information has been gathered about levels of knowledge concerning water in the general population of Kansas. Under contract from the Kansas Water Office, with funding from the State Water Plan, a statistically accurate survey was conducted by the Kansas Geological Survey, subcontracting with the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. This report describes the methodology and results of that survey.

Methodology

Based on the Kansas Water Plan, survey questions were developed in consultation with the Kansas Water Office, the Kansas Association for Conservation and Environmental Education, the Kansas Department of Wildlife and Parks, and the Interdisciplinary Communication Research Institute (ICRI) at Wichita State University. The questions were designed to gauge the respondent's knowledge of water terminology and water-related issues in Kansas, and to determine the relative importance of alternative sources of information about water. One question was taken directly from the Roper Starch survey of knowledge levels about environmental issues.

The survey consists of the set of thirteen questions listed in the appendix. Nine questions are multiple choice, three are true/false, and six questions ask respondents to rate the relative importance of different sources of information. Two questions provide

demographic information. At the conclusion of the survey, respondents were given information about where to obtain water information in the state.

The survey was designed for statewide application. The Kansas Water Plan also called for the survey to be conducted so that information could be obtained about the level of water-resource knowledge within each of the major drainage basins in the state. The Kansas Water Office staff developed data-bases showing the distribution of telephone exchanges within each of the twelve drainage basins. For a statistically valid result, a sample size of 100 successful responses from the telephone exchanges in each drainage basin was required, resulting in a total sample size of approximately 1,200 respondents for the entire state. Although the design of the survey resulted in a random sample from each drainage basin, it yields a biased estimate of statewide responses because the populations of the basins differ significantly. This bias was removed from the statewide results by weighting the response from each basin by the proportion of the state's population that lives in the basin, then summing the basins.

Wichita State's ICRI conducted the random telephone survey. The questions were pre-tested by ICRI to ascertain that respondents understood the questions and could respond effectively. Random telephone surveys for each drainage basin were conducted from February 12 to March 15, 2001. Respondents were limited to individuals over the age of 18. Callers identified themselves as employees of the survey lab at Wichita State University (and not the Kansas Water Office or the Kansas Geological Survey) in order to avoid influencing responses. About 14.5% of the random phone calls resulted in completed surveys. Many of the uncompleted calls were the result of no answers, busy signals, answering machines, disconnected lines, business and government numbers, and fax numbers. Of the calls that were actually completed to working phone numbers of Kansas residents, 42 percent resulted in completed questionnaires.

The results were provided by ICRI to the Kansas Geological Survey, where the responses were statistically analyzed to determine if there were significant differences in responses between basins or between demographic factors. Differences are considered "statistically significant" if they are so great that the differences could not have arisen by random chance in the selection of respondents fewer than one time in twenty surveys. Contingency table tests of marginal homogeneity were applied to the responses to each question. This procedure assesses whether the same proportions of the different possible answers were given by people living in different basins, or by men and women, or by rural and urban residents. The statistical technique is sometimes called "profile analysis," because it is equivalent to comparing the shapes of bar graphs of responses. The test does not specify how many basins have different responses, nor does it identify which basins are different. A correspondence analysis plot can help identify which basins are different, and how they differ in terms of their responses. Correspondence analysis projects the

average response for each basin onto a graph, along with the responses to the questions. Basins that are similar will group close together and basins that are different will be far apart. The positions of the responses on the plot suggest which responses are important in grouping the basins.

Responses

A total of 1,257 to 1,263 valid responses were received for each question. Of the respondents, approximately 38 percent were male, 62 percent were female. This introduces a bias in the results of the survey, because the survey does not reflect the composition of the Kansas population. According to census data, the state's population is 50.9 percent female and 49.1 percent male (U.S. Census Bureau, 2000). Approximately 63 percent of the respondents identified themselves as living in a rural setting and 36 percent as living in an urban setting. This introduces an additional bias, because according to census figures, 30.9% of the population of Kansas is rural, and 69.1 percent is urban (U.S. Census Bureau, 2000). The disparity results from the clustered design of the survey in which 100 valid responses are required from each drainage basin, most of which are predominately rural in population. The final demographic variable considered is the educational levels for respondents. Seven percent had attended high school, 24.4 percent had completed high school but did not attend college, 32.4 percent had attended college, 19.8 percent had a college degree but did not attend graduate school, 5.2 percent had attended graduate school, and 9.5 percent had a graduate degree. (Of those completing the survey, 1.8 percent did not respond to the level of education question.) In general, the profile of the survey respondents reflects the educational levels of the Kansas population.

For the Upper Arkansas basin, 106 responses were completed. The following discussion applies only to responses from that basin.

Question 1: Would you say that the largest user of water in Kansas is: a) private households b) industry c) irrigation d) cities or e) don't know.

Question 1 asked respondents to select the largest user of water in Kansas from among four choices. Only 24.5 percent of the respondents correctly identified irrigation. A much larger percentage (34 percent) wrongly identified cities as the largest water user, and another 19.8 percent wrongly identified industry.

Question 2: What would you say is the most common cause of pollution in Kansas streams? a) chemical discharges from factories b) surface water runoff from yards, city streets, and farm fields c) used motor oil dumped in storm drains d) don't know.

Question 2 asked respondents to identify the most common cause of pollution in Kansas streams. This question was based on a question from the Roper Starch survey. Surface-water runoff was correctly identified by 43.4 percent of the respondents, compared to 24 percent of the respondents on the nationwide poll. In the Lower Arkansas basin, 43.4 percent of the respondents incorrectly identified factory discharge as the correct response (almost identical to the 44 percent response on the nationwide survey).

Question 3: Which of the following is the most effective way to conserve water in your home: a) run your washing machine and dishwasher only when they are full b) turn off the water while you brush your teeth c) time your shower to keep it under five minutes d) all of the above e) don't know.

Question 3 was designed to ascertain the respondents' knowledge of water conservation. As worded, unfortunately, the question contains a logical flaw because it asks respondents to identify *the* most effective way of conserving water, but includes a choice which incorporates multiple ways ("all of the above"). The correct response to this question is both a) and c). The consequent confusion may account for the high variability in responses.

Question 4: Would you say an aquifer is: a) an underground rock layer that holds water b) where a river meets a lake c) an above-ground storage tank d) don't know.

Question 4 asked respondents to correctly define an aquifer. 65.1 percent identified the correct definition (answer a). However, 17 percent of the respondents said they did not know the correct answer and 13.2 percent incorrectly identified an aquifer as an above-ground storage tank.

Question 5: Would you say groundwater is: a) water that is polluted with dirt b) water found underground c) rainwater that falls on the ground d) don't know.

Question 5 asked respondents to define groundwater. Although 61.3 percent of the respondents identified the correct definition (answer b), 29.3 percent of the respondents incorrectly identified groundwater as "rainwater that falls on the ground."

Question 6: Would you say that surface water is: a) water found on top of parking lots and roads b) water in streams, lakes, and rivers c) water found below the surface of the earth d) don't know.

Question 6 asked for a definition of surface water, and 60.4 percent of the respondents identified the correct definition (answer b). However, 26.4 percent of the respondents identified surface water as "water found on top of parking lots and roads."

Question 7: Would you say a floodplain is a) the amount of water in a river channel during drought b) land covered by water because of a dam c) the portion of a river valley that is covered by water when the river is flooding d) don't know.

Question 7 asked for a definition of floodplain. A high proportion of respondents (80.2 percent) identified the correct definition (answer c).

Question 8: Planting trees and grasses along a stream will help protect the quality of water in the stream. True or false?

Question 8 was a true or false question that asked if respondents thought that planting trees and grasses (known as "buffer strips") would help protect water quality in streams. A very high proportion, 82.9 percent of the respondents, made the correct response (which is True).

Question 9: Lowering the water table by heavy pumping can affect rivers and streams. True or false?

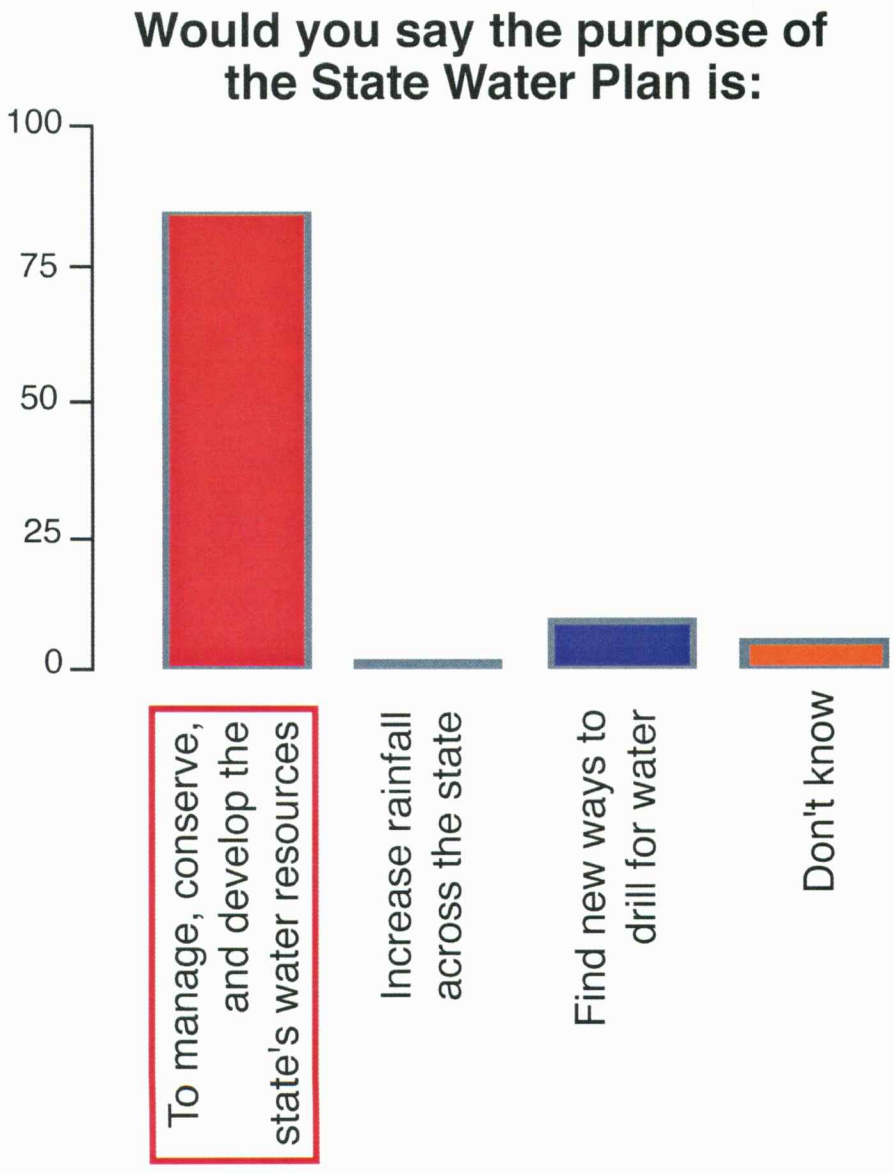
Question 9 was also a true/false question that asked if respondents thought that lowering the water table would affect rivers and streams. A very high proportion of all respondents (83.8 percent) selected the correct response (which is True).

Question 10: The major source of water in western Kansas is called the Ogallala aquifer, and its water is used for irrigation, industry, cities, and domestic purposes. The supply of water in the aquifer is unlimited. True or false?

Question 10 was also true/false. Its purpose was to discern if respondents understood that the Ogallala aquifer (which was identified as a primary water source in western Kansas) was a finite water source. A high proportion of respondents (80.1 percent) correctly answered that the aquifer contained a limited amount of water.

Question 11: Would you say the purpose of the State Water Plan is: a) to manage, conserve, and develop the state's water resources b) increase rainfall across the state c) find new ways to drill for water d) don't know.

Question 11 was designed to test the general knowledge about the concept of the State Water Plan. A high proportion of respondents (82.9 percent) correctly identified the purpose of the plan (answer a). This was the highest correct response rate among all the basins.



Question 12: Would you say that the state agency with overall responsibility for planning and coordinating water resource management in the state is: a) the Kansas Department of Health and Environment b) the Division of Water Resources/Kansas Department of Agriculture c) the State Conservation Commission d) the Kansas Water Office e) don't know.

Question 12 was designed to determine if Kansans understood the role of the Kansas Water Office in water management in the state. 7.6 percent of respondents correctly identified the Water Office as the agency responsible for planning and coordinating water-resource management. For this question, this was the lowest correct response rate of any of the basins. 15.2 percent of respondents said "don't know," 17.1 percent said the Kansas Department of Health and Environment, and 24.8 percent said the State Conservation Commission. The leading answer was the Division of Water Resources in the Kansas Department of Agriculture, with 35.2 percent of responses.

Question 13: How important to you are the following sources of information about water issues? Would you say they are Very Important, Important, Not Very Important, or Not Important At All? a) newspapers, radio, and television b) the government, such as federal, local, and state governmental agencies c) universities, such as extension offices d) public water supplies, such as water companies e) private, non-profit organizations, such as farming organizations or environmental organizations f) school.

Question 13 was designed to determine Kansans' preferred source of information for water and water issues. They were asked to rate media and organizations in terms of their importance as a source of information. When asked to rate the importance of the mass media (defined as television, newspapers, and radio) as source of information, 49.5 percent rated the media as very important and 37.1 percent rated them as important. Thus, more than 86.6 percent of respondents rated the media as important or very important sources of information.

When asked about governmental agencies (including federal, state, and local agencies) as a source of information, 25.7 percent rated agencies as very important sources while 56.2 percent rated them as important sources of information. Thus, 81.9 percent of respondents rated governmental agencies a very important or important source of information.

When asked to rate the importance of universities and their extension offices, 27.6 percent of respondents rated them as "very important" and 60 rated them as "important." Thus, 87.6 percent of respondents rated universities and extension offices as very important or important sources of information.

When asked to rate public water suppliers, such as water companies, as sources of information, 27.6 percent of respondents rated them as "very important," 41.9 percent

rated them as "important," and 23.8 percent rated them as "not very important" (the highest percentage of "not very important" for any of the basins). In total 69.5 percent of respondents rated water suppliers as very important or important sources of information.

When asked to rate private, non-profit organizations, such as environmental organizations or farming organizations, as sources of information, 24.8 percent of respondents said they were "very important" sources of information and 49.5 percent said they were "important" sources of information. Thus, 74.3 percent of respondents rated private organizations as "very important" or "important."

Finally, respondents were asked to rate schools as a source of information. In response, 42.9 percent said schools were a very important source of information, and 36.2 said they were an important source of information, for a total of 79.1 percent of respondents who thought that schools were a "very important" or "important" source of information. Twenty-six percent said schools were "not very important" sources of information.

Based on these responses, respondents consider all of these to be important sources of information, but the hierarchy of preference would be the university and extension offices, the media, governmental agencies, schools, non-profit organizations, and public water suppliers.

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