

Views from the Upper San Pedro River Basin: Local Perceptions of Water Issues

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INTRODUCTION

This report presents a sampling of public perspectives on water management, policy, and research in the Upper San Pedro River Basin. The information presented is derived from interviews, surveys, and public meetings conducted in the basin between April 1998 and December 2000. This report is not intended to provide scientific data or an assessment of water conditions in the basin; rather, it provides an introduction to public opinions and concerns regarding water issues. It is intended to serve as starting point for discussions of public perspectives and opinions on water issues in the basin. Hopefully, this report will also help researchers, policymakers, and educators focus their efforts on the issues of most concern to the residents of the basin.

NATURAL ENVIRONMENT

In recent years, considerable national and international attention has focused on the San Pedro River in the Upper San Pedro Basin, an area of approximately 7,600 square kilometers (3,000 square miles) in northeastern Sonora and southeastern Arizona (Figure 1). More specifically, interest has focused on the perennial stretches of the San Pedro River that support a riparian ecosystem, dominated by cottonwood and willow trees, which extends from just south of the international border north to Benson, Arizona. The U.S. Bureau of Land Management manages a 23,500-hectare (58,000-acre) San Pedro Riparian National Conservation Area along much of this stretch of the river. The riparian ecosystem in the Upper San Pedro Basin is considered to be of critical importance to regional biodiversity and is a major North American migratory bird corridor, used by over 350 species of birds. This riparian habitat is considered threatened by groundwater withdrawals in the basin that exceed natural recharge from rainwater and snowmelt.

HUMAN ENVIRONMENT

Approximately 114,000 people live and work in seven incorporated towns and several unincorporated communities in the Upper San Pedro River Basin.

The Mexican population of the basin is centered in Cananea, Sonora, a 100-year-old mining town with about 32,000 residents, most of whom are economically dependent on the large copper and silver mine located adjacent to the town. Naco, Sonora is growing border town with a population of 5,300 that can swell to over 7,000 with migrant workers waiting to cross into the United States. The four ejidos in the basin are ranching and farming communities that are experiencing a major shift in land ownership and a decline in their traditional agricultural economies.

The major population center on the U.S. side of the border is centered on the city of Sierra Vista, which includes the U.S. Army base, Fort Huachuca. Over 50,000 people live in or near Sierra Vista. Tombstone, population 1,500, and Bisbee, a town of approximately 6,100 located on the perimeter of the basin, are former mining towns now largely supported by tourism and government services. Benson, the northernmost town in the Upper San Pedro Watershed, has a population of about 4,700 and is transitioning from a ranching community to a service- and tourism-based economy. St. David (population 1750), a historical Mormon farming settlement located along the river five miles south of Benson, remains an active agricultural community.

The residents of and governments in these communities both influence and are affected by policy and management decisions. Local governments and residents sometimes feel under siege from researchers, federal agencies, and interest groups intent on studying and influencing ecosystems, hydrology, water use, and water policy in the basin. Yet local residents and local governments play an important role in water management and water policy in the Upper San Pedro River Basin. The success or failure of any water management strategy will, to a great extent, depend on them.

PURPOSE AND METHODS

The Udall Center's work in the Upper San Pedro River Basin aims to facilitate information exchange and collaboration on water policy in the basin and to help local residents have a voice in research, management, and policy. This report summarizes the Udall Center's initial efforts to identify the perspectives and preferences of the people who live and work in the Upper San Pedro River Basin.

The Udall Center conducted surveys, interviews, and public workshops to gather information on the views of basin residents. The Mexican views summarized in this report are based on the results of a survey conducted in October and November 2000. Udall Center staff worked with local governments, federal agencies, and interested citizens in the basin to survey residents on the Mexican side of the basin regarding their views of water issues and water policy options in the basin. The summary of U.S. residents' views is based on a public survey, workshops, and meetings organized by the Udall Center between 1998 and 2000. To address the more specific question of hydrologic information needed for the development of water policy options, the Udall Center interviewed individuals with extensive experience with water research, water policy, or water management. These interviews were conducted in November and December 2000. In all, approximately 300 Mexicans and over 500 U.S. residents provided input to this report.

The final section of this report provides recommendations for future water research, management, and policy based on residents' views.

MEXICAN RESIDENTS' VIEWS

A water-interest questionnaire administered in November 2000 surveyed adult residents of the Sonora, Mexico, portion of the Upper San Pedro River Basin regarding water-management and government issues. Native, Spanish-speaking residents of the Mexican communities in the basin administered the questionnaires as interviews. A total of 285 residents throughout the Mexican portion of the basin completed questionnaires, representing approximately 0.75 percent of the total population and 1.4 percent of the population 15 years and older.

The questionnaire asked participants about water issues in their neighborhoods and in the basin as a whole, and about their water-policy and water-management preferences. Respondents were also asked their age, household size, neighborhood of residence, and length of residence in the basin. (A copy of the questionnaire is available in Appendix II.)

CHARACTERISTICS OF SURVEY RESPONDENTS

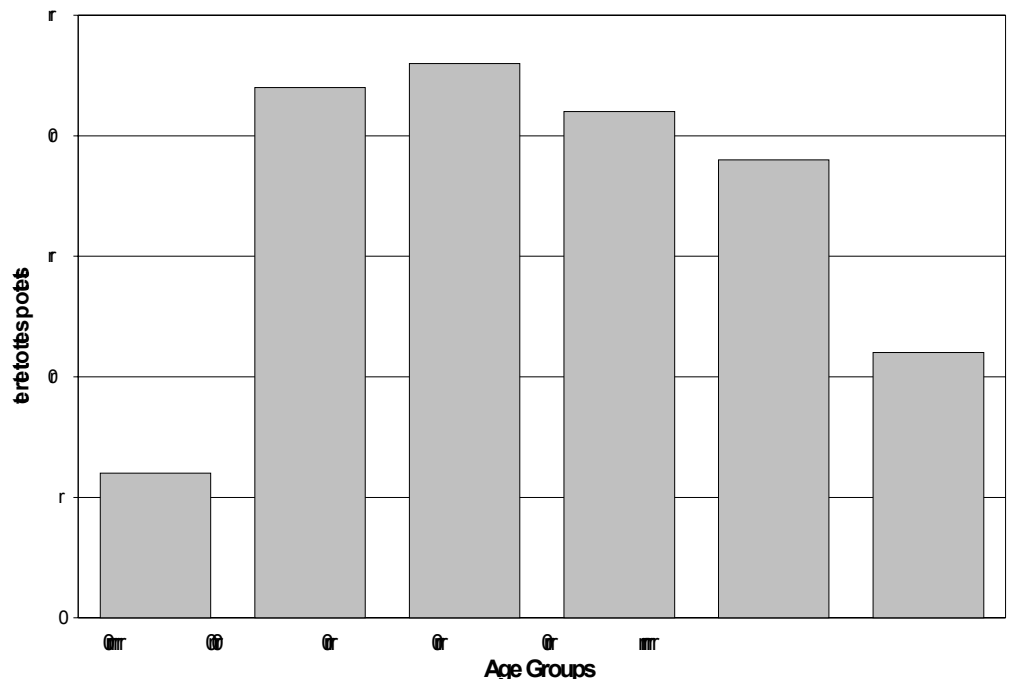
The questionnaire was completed by 201 residents from Cananea, 70 from Naco, and 14 from ejidos and surrounding ranches. Respondents included residents of all the colonias of Naco and Cananea, and each of the four ejidos in the basin (Table 1). Of the total persons surveyed, 54 percent were female and 46 percent were male. Respondents ranged from 18 to 84 years in age; 95 percent were between 21 and 60 years of age (Figure 2). Household sizes ranged from one to over nine persons per dwelling. The average household size is 5 persons.

Table 1. Neighborhoods surveyed

Cananea	N*		N	Naco	N
Abasto	1	Leyes de Reforma 2	3	Barrio Nuevo	3
Agropecuaria	4	Linda Vista	4	Centro	13
Ave Sinaloa	2	Los Pinos	7	Colosio	13
Ayuntamiento	3	Martires de Cananea	7	Ejidal	14
Barrio el Llanito	2	Mesa de Garibay	3	Esperanza	9
Barrio el Penascal	2	Mesa Norte	1	Hidalgo	2
Barrio la Estacion	3	Mesa Sur	14	Jesus Garcia	1
Barrio la Monarca	1	Minera	14	Minera	12
Boulevares	3	Molina	1	Unknown	3
Buena Vista	1	Napoleon Gomez		<i>SubTotal</i>	<i>70</i>
Burocrata	8	Sada	1		
Callejon Bravo	1	Nuevo Cananea	7		
Capestre Oriente	3	Ojo de Agua de Arvayo	1		
Cananea Viaje	11	Petroleos	1		
Cementerio Viejo	5	Planta Nueva	5		
Centro	18	Rio Blanco	1	Ejidos & Ranches	
Colonia de Green	1	Roca	12	Emiliano Zapata	3
Correo	3	Ronquillo	1	Ignacio Zaragoza	4
Ejido Barrilito	1	San Isidoro	2	Jose Maria Morelos	3
Ejido Cananea		San Jose	2	Los Corrales	1
Vieja Sector Sur	1	Santa Teresa	2	Rancho Las Chivas	2
El Romerio	2	Valle del Cobre	6	San Pedro Palominas	1
El Taste Bacoachi	4	Valle Dorado	1	<i>SubTotal</i>	<i>14</i>
Infonavit 1 de Junio	11	Unknown	9		
Leyes de Reforma 1	2	<i>SubTotal</i>	<i>201</i>		

*N = number of individuals surveyed

Figure 2. Age distribution of survey respondents



**WATER ISSUES
OF CONCERN**

Respondents were asked to rate the importance of several water issues (Table 2). Drinking water availability and surface water pollution were the issues of most concern, followed by maintaining surface water flows. Groundwater pollution, water availability for farming, and maintaining groundwater supplies were also considered very important issues by the majority of respondents. Availability of water for mining and manufacturing was considered less important than the other issues.

Table 2. Issues of concern (percent of respondents who said the issue was “very important”)

	Cananea	Naco	Ejidos & Ranches	Total
<i>Number of respondents*</i>	185	60	11	256
Availability of water for drinking & washing	91%	94%	100%	92%
Pollution of springs, washes, & the river	91%	81%	91%	89%
Maintaining water in the river and springs	85%	79%	90%	84%
Pollution of underground water	78%	74%	80%	77%
Availability of water for farming	77%	61%	100%	74%
Maintaining underground water supplies	67%	73%	40%	68%
Availability of water for mining & manufacturing	36%	43%	9%	37%

* Average number of respondents-numbers varied among issue items.

Water availability for drinking and washing was rated as the most important water-related issue in the basin, followed closely by surface water pollution. Residents from Cananea, Naco, and rural portions of the basin all rated water availability for domestic use as more important than water availability for local industry, agriculture, and the natural environment. Residents of Cananea were as concerned with surface water pollution as they were with domestic water supply; respondents from Naco and the ejidos also ranked surface water pollution highly.

Maintaining water flows and water quality in the environment was also a high-priority issue. It is notable that maintaining water in springs, the river, and washes was considered more important than assuring water availability for farming and assuring water availability for mining and other industrial uses. The fact that several people ranked maintaining surface water flows considerably higher than maintaining underground water supplies may mean that these respondents did not recognize a connection between groundwater and surface-water resources.

Water availability for farming was rated highly by rural residents but less highly by urban residents. All of the the ejiditarios and ranchers surveyed rated water availability for farming as very important, while only 61 percent of the residents of Naco thought the same. Seventy-seven percent of respondents from Cananea rated water availability for farming very important.

Water availability for mining and manufacturing was given relatively low priority by survey respondents. Only 37 percent of the respondents overall and only nine percent of the rural residents felt it was very important to assure water supplies for local industrial uses.

Water availability a critical concern

Participants' comments confirmed that inadequate water supply for domestic use was the most important water-management issue to most of those. When asked to identify water problems, virtually all respondents spoke of problems with the water supply system. Sixty-three percent of respondents commented that lack of water supply was a problem in their community. Respondents from all communities in the basin cited problems with deteriorating water supply systems, including leaking pipes, low water pressure and frequent, unscheduled system shut-downs. In Cananea, several respondents complained that since the mining company stopped supplying water, water costs have increased but supply has deteriorated. In Naco, several people mentioned a need for new wells as well as replacing old pipes. Several respondents also identified water pollution or non-potable water as a problem, and others raised concerns about environmental degradation and identified a need for improved conservation practices. Only four percent of the respondents said they did not have any water problems.

Water shortages a common problem

Lack of domestic water supply is a frequent problem for residents of the Mexican portion of the basin. Only 20 percent of the respondents claimed to always have enough water for drinking and bathing, while 28 percent sometimes have no water available (Table 3). Water supply problems were most severe in Naco, where 41 percent reported that they sometimes had no water for drinking and bathing. Water supply problems were less severe in the ejidos and ranches in the basin.

Table 3. Water availability for drinking and bathing (percent of respondents)

	Cananea	Naco	Ejidos & Ranches	Total
<i>Number of respondents</i>	<i>200</i>	<i>70</i>	<i>13</i>	<i>284</i>
We always have enough water for drinking and bathing.	22%	13%	38%	20%
We usually have enough water for drinking and bathing.	43%	34%	15%	39%
We often have to ration water for drinking and bathing.	11%	11%	31%	12%
Sometimes we have no water for drinking and bathing.	24%	41%	15%	28%
Total	100%	100%	100%	100%

In Cananea, most residents who reported that they were sometimes without water live in Colonia Centro and Mesa Sur, older neighborhoods near the center of town. The most significant water shortages in Naco were reported in the communities of Colonia Centro and Colosio, also central, older neighborhoods.

Poor water quality a recognized health risk

Water quality is another major concern for Mexican residents of the Upper San Pedro River Basin (Table 4). Seventy percent of the questionnaire respondents in Naco and Cananea knew of water-related illnesses in their communities. Of those, almost two-thirds had heard of cases of diarrhea, 44 percent had heard of incidents of parasites, and 25 percent knew of cases of hepatitis. Participants also cited cases of vomiting, kidney infections, amoebas, cholera, and skin infections.

The 14 residents of ejidos and ranches reported lower rates of water-borne diseases: Only one-third knew of water-related illnesses in their communities. One ejido resident attributed illness in cattle to water pollution.

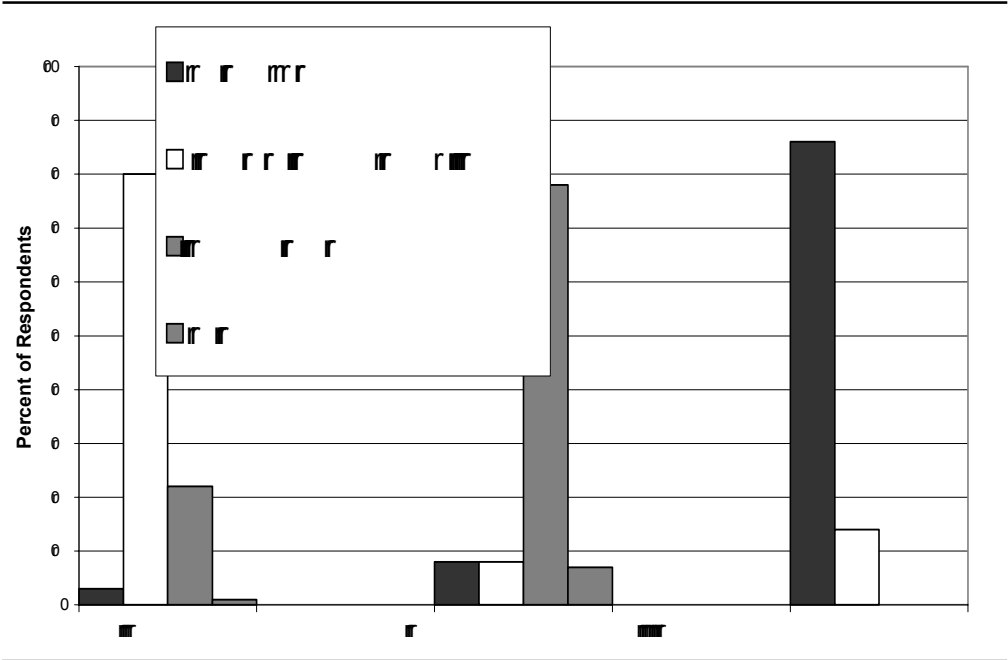
Table 4. Water-related illnesses (percent of respondents)

	Cananea	Naco	Ejidos & Ranches	Total
<i>Number of respondents</i>	195	70	12	277
Have heard of water-related illnesses in the community.	70%	70%	33%	68%
Have heard of diarrhea.	58%	60%	33%	58%
Have heard of parasites.	44%	44%	0%	42%
Have heard of hepatitis.	25%	26%	8%	24%
Have heard of other water-related illnesses.	4%	9%	8%	5%

PERCEPTIONS OF WATER USE

Residents' perceptions of basinwide water use differed significantly among Naco, Cananea, and the rural communities (Figure 3). When asked what activity in the basin uses the most water, the majority of the Cananea respondents identified mining. When persons in Naco were asked the same question, most believed that households use the most water. Eighty-six percent of the respondents from ejidos and ranches said agriculture uses most of the water. These figures suggest that residents were not aware of rates of water use beyond their own communities. However, they may also reflect confusion about whether this question referred to the Mexican portion of the basin as a whole or to the respondents' home community, specifically.

Figure 3. Who uses the most water in the basin?



Because local governments wanted to know how residents use water, the questionnaire included questions about domestic water use. Most respondents, regardless of location, used water daily for cooking and drinking, bathing, washing dishes by hand, and cleaning the house (Table 5). Most also used water to wash clothes and to garden several times per week. Many residents used water at least once per week to wash cars and to wash sidewalks. However, 25 percent said they never use water to wash cars, and 40 percent said they never use water to clean sidewalks.

Table 5. Frequency of domestic water uses (percent of respondents)

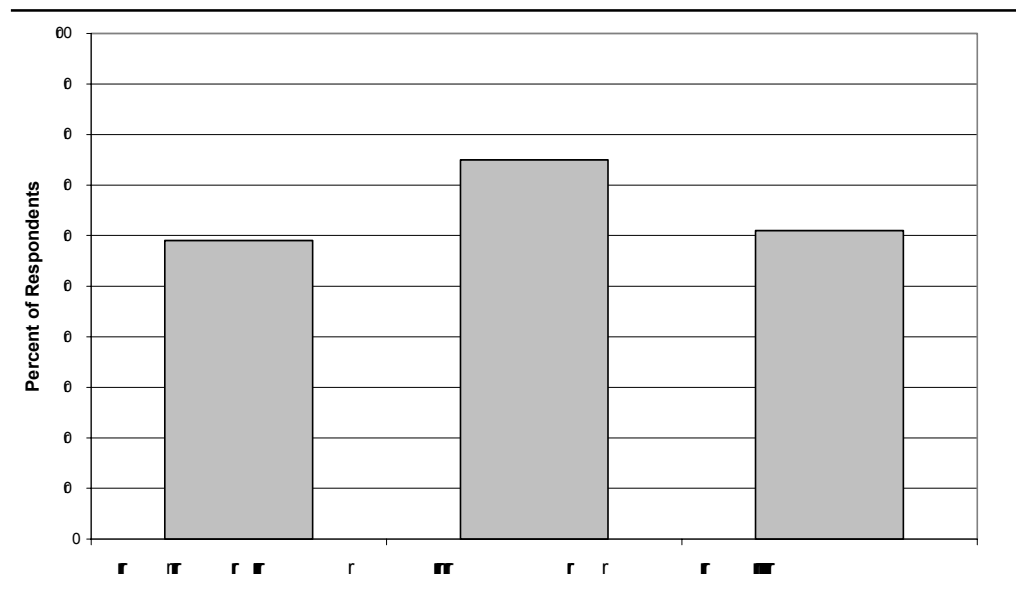
	N*	Daily	4-6 times per week	1-3 times per month	Never
Wash dishes in a dishwasher	230	7%	0%	1%	92%
Wash clothes by hand	230	7%	20%	10%	63%
Wash car	260	3%	40%	32%	25%
Wash sidewalk	248	4%	38%	19%	40%
Water garden	258	12%	59%	16%	14%
Wash clothes in machine	277	37%	59%	1%	4%
Clean house	273	84%	15%	0%	1%
Bathe	276	91%	8%	1%	1%
Wash dishes by hand	280	92%	6%	1%	1%

N* = number of respondents

PERCEIVED CHANGES IN THE ENVIRONMENT

Basin residents were asked to identify how long they had lived in the basin, what type of environmental changes they had witnessed during that time, and what they thought had caused the changes. Nearly half of those surveyed have lived in the Upper San Pedro River Basin their entire lives, and the majority has lived there over 20 years. Respondents reported considerable environmental changes in the basin during their residency (Figure 4).

Figure 4. Percent of respondents who have observed changes



Warmer temperatures, less precipitation

The majority of the respondents (75%) said they had observed changes in the climate. Most cited warmer temperatures overall and less rain and snowfall than in the past. They attributed these changes to pollution, global warming, drought, depletion of the ozone layer, and forest fires.

Less water, fewer plants and animals, and more pollution

Fifty-nine percent had witnessed changes in the plants and animals in the basin, and 61 percent reported changes to the rivers and washes. The most common observations included dry or underdeveloped plants, sick and dead animals, and fewer plants and animals generally; less water flowing in rivers and washes; and dirty or contaminated surface water. Most of the respondents attributed these changes to decreased precipitation, water extraction through pumping, and pollution from the Cananea mine.

PERCEPTIONS OF GOVERNMENT

Residents were generally able to identify their water suppliers (Table 6). They identified government agencies, particularly the water-supply agencies, as the most common sources of water information and of assistance when residents have a water problem. However, respondents were only somewhat satisfied with the government's water-management practices.

Table 6. Recognized water suppliers (percent of respondents)

Source	Cananea	Naco	Ejidos & Ranches
<i>Number of respondents</i>	198	70	14
CoAPAES or PAC	87%	16%	21%
OOMAPAS	0%	50%	0%
Government	6%	34%	0%
Mining Company	1%	0%	21%
No one	1%	0%	7%
Other*	5%	0%	50%
Total**	100%	100%	99%

* Other responses included "the community", "the ejido", and "the electric plant."

** Numbers in columns may not total 100% due to rounding.

Most know who supplies their water

In Cananea, almost everyone correctly identified CoAPAES (Commission of Potable and Waste Water of the State of Sonora) or PAC (City Water Program) as their water provider. PAC is the municipal office for CoAPAES. A few thought that the mining company or municipal government provides water to their community. The different responses from Cananea residents are not surprising, as there has been a recent

shift in water supply responsibility in that city. Until 1999, when it transferred responsibility for water provision to the municipality, the mining company provided the city with water. Since then, the city has sought assistance from the state.

In Naco, approximately half the residents surveyed knew that OOMAPAS (Municipal Operating Organism of Potable Water and Water Treatment of the State of Sonora) is responsible for domestic water supply; others identified CoAPAES, PAC, or “the government.” In the ejidos and ranches, responses regarding water sources were more variable, perhaps because government services are fewer.

Government agencies are a primary source of information and aid

Most survey respondents identified their water supply agencies as the place they would go if they had a water problem (Table 7). However, 10 percent of Cananea respondents and four percent in Naco said they would not go to anyone if they had a water problem.

Table 7. Where people go when they have a water problem (percent of respondents)

	Cananea	Naco	Ejidos & Ranches
<i>Number of respondents</i>	191	69	13
CoAPAES or PAC	78%	14%	23%
OOMAPAS	0%	70%	0%
Ejido leaders	0%	0%	38%
Government	4%	8%	0%
Radio	4%	0%	0%
Mining company	1%	0%	15%
No one	7%	4%	0%
Other	6%	4%	23%
*Total	100%	100%	100%

* Numbers in columns may not total 100% due to rounding.

When asked, most survey respondents from Cananea and Naco said they did not know of any non-governmental community groups that address water issues, while five of the 14 respondents from the ejidos said they knew of such groups. Those that knew of community groups that deal with water issues in Naco and Cananea generally identified their colonia or neighbors as the community groups.

Low satisfaction with local government efforts

Overall, only 17 percent of those surveyed thought that the local government is doing all it can to meet their water needs (Table 8). Forty-four percent believed that the government was trying to meet their needs, but could be doing more, and 20 percent said the government was not trying to satisfy their water needs. Residents of the ejidos and ranches were most dissatisfied with local government's efforts, while residents of Naco tended to think the government was trying but could do more. Twenty percent of those surveyed said they did not have enough information to judge local government's efforts.

Table 8. Satisfaction with local government (percent of respondents who agree with statement)

<i>Number of respondents</i>	Cananea 201	Naco 13	Ejidos & Ranches 68	Total 282
The local government is doing all it can to satisfy my water needs.	16%	21%	23%	17%
The local government is trying to satisfy my water needs, but it could do more.	41%	54%	23%	44%
The local government is not trying to satisfy my water needs.	21%	12%	31%	20%
I do not have enough information.	21%	13%	23%	20%
Total*	100%	100%	100%	100%

* Numbers in columns may not total 100% due to rounding.

Responsibility for water should be shared

Respondents were asked who they thought should be responsible for making water decisions in the basin. Sixty-nine percent of those surveyed believed that water should be a shared responsibility between the government and users, while 18 percent said water should be the responsibility of the users alone (Table 9).

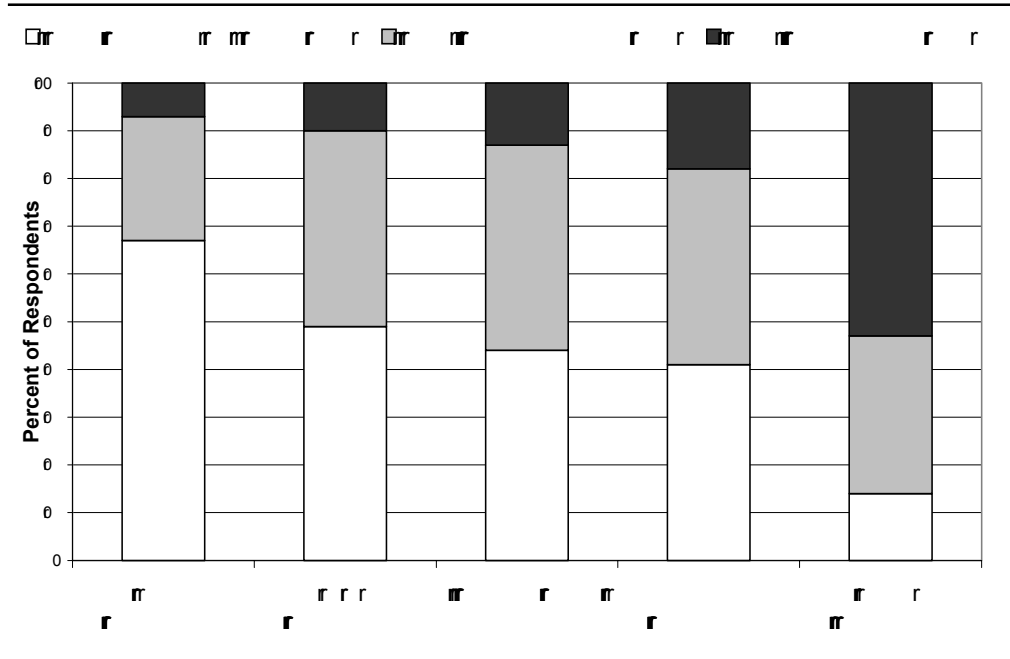
Table 9. Responsibility for water (percent of respondents who agree with statement)

<i>Number of respondents</i>	Cananea 199	Naco 70	Ejidos & Ranches 14	Total 283
Water is the government's responsibility.	7%	1%	7%	5%
Water is the user's responsibility.	19%	11%	43%	18%
Water is a shared responsibility between government and users.	65%	84%	43%	69%
Do not know	10%	3%	7%	8%
Total*	100%	100%	100%	100%

*Numbers in columns may not total 100% due to rounding.

Most of the survey respondents thought water-management responsibilities should be shared among local, state, and federal government and water users—although the majority would give more authority to local government than to state or federal government or to local users. Additionally, 53 percent did not think private companies should have any authority over water (Figure 5).

Figure 5. Preferred water authorities



POLICY PREFERENCES

Communication and ecological reserves considered important water-policy tools

When asked to rank five water-policy tools in terms of their utility for maintaining water quality and water quantity in the basin, respondents ranked all of them either very important or somewhat important (Table 10). The most important tools, according to respondents, are the creation of ecological reserves and communication among water users, scientists, and government. It is notable that ecological reserves, specifically the expansion of the Ajos-Bavispe Reserve, had been receiving considerable media coverage at the time of the survey.

Table 10. Ranking of water-policy tools

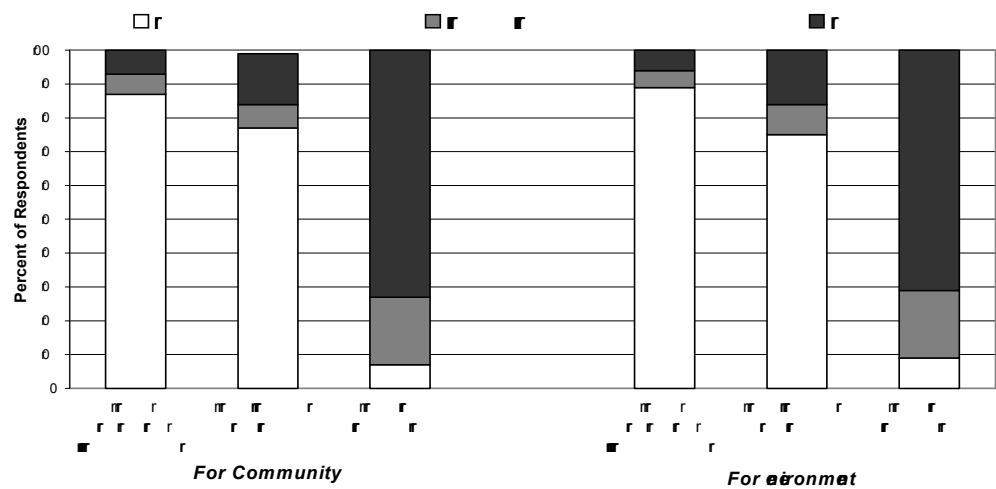
Tool	N*	Rank	Percent of respondents who said tool is "very important"
Ecological reserves	237	1	87%
Communication among water users, scientists, and governments	249	2	85%
Public education	230	3	75%
Scientific research	230	4	74%
Laws and regulations	234	5	70%

N* = number of respondents

Water conservation supported

When asked what user contributions were agreeable, respondents were willing to practice voluntary water conservation both to improve municipal water supplies and to protect the environment, but they were not willing to accept higher taxes (Figure 6). Several respondents in Naco commented that they would be willing to pay more for water use if service improved.

Figure 6. Willingness to conserve water



When asked, 80 percent of the respondents from Cananea, 89 percent from Naco, and 92 percent from the ejidos and ranches said they already try to conserve water in their homes or work places. Several respondents said they take care to turn off water when washing or brushing their teeth, that they use buckets rather than hoses when washing their cars or sidewalks, and that they water plants at night or otherwise avoid wasting water when gardening. Some respondents also reported saving water in containers for times of inadequate supply.

Over 90 percent of the survey respondents were interested in learning water-conservation techniques. They preferred to acquire such information through pamphlets (55%), neighborhood trainings (41%), or radio programs (38%). They were less interested in receiving information through the schools (28%). In Cananea, one person recommended a conference to teach water-conservation techniques. Another said he would cooperate to help fix leaks in the water-supply system.

Paying per unit of water used preferred over fixed rates

Over 60 percent of respondents believed water users' payments should depend on the amount of water used per month as opposed to a flat rate charged to users each month regardless of the amount of water consumed. Nine respondents from Naco and five from Cananea commented that meters should be installed to measure water use.

PERCEPTIONS OF U.S. WATER USE AND MANAGEMENT

Forty-four percent of the Mexican respondents thought that the United States needs to do more to protect water in the basin. Specifically, respondents said the U.S. should be doing more to avoid water pollution and conserve water. Respondents in Naco also thought the U.S. should be doing more to clean and care for the river and protect the aquifer. A few Naco residents suggested people on the U.S. side of the basin consider constructing dams and creating binational projects. Nearly 80 percent of the respondents were interested in learning more about the use and management of water resources on the U.S. side of the basin.

U.S. RESIDENTS' VIEWS

The viewpoints summarized in this section come from individuals who live and work in the U.S. portion of the Upper San Pedro River Basin. This information was gathered through a variety of public outreach activities conducted by the Udall Center between April 1998 and December 2000. The first section below reports the results of a water-interests survey conducted in January and February 2000. The survey was developed by Dialogue San Pedro, a group of Sierra Vista-area residents interested in water information exchange that was convened and facilitated by the Udall Center. The sections on management, policy, and research are based primarily on written comments, focus-group discussions, and public workshops held during the summer of 1998 to provide public input on the report, *Sustaining and Enhancing Riparian Migratory Bird Habitat on the Upper San Pedro River*, that was prepared by a team of science and policy experts for the Commission for Environmental Cooperation (San Pedro report). The San Pedro report included summaries of the ecology, hydrology, and water use in the basin, and a discussion of opportunities for sustaining and enhancing the river and its riparian habitat.

UNDERSTANDING OF AND INTEREST IN WATER ISSUES

In 2000, Cochise College's Center for Economic Research surveyed residents of the Sierra Vista Subbasin, using questions developed by Dialogue San Pedro. The survey asked residents about their interest in and desire for information on water issues in the Upper San Pedro River Basin. The survey was administered at local post offices and grocery stores by a team from the Center for Economic Research.

Characteristics of survey respondents

A total of 420 adults were surveyed, a number determined by the Center for Economic Research to reflect the area's population with a 95 percent degree of confidence and a sampling error of +/- 2.5 percent. Respondents resided in the communities of Bisbee, Huachuca City, Whetstone, Tombstone, Sierra Vista, Fort Huachuca, and Hereford, and ranged in age from 18 to over 60. Respondents had lived in the area for an average of nearly 12 years; however, nearly 35 percent had lived in the area less than five years.

Residents are interested in water issues

Nearly 89 percent of respondents indicated they were either somewhat or very interested in receiving more information on local water issues; only 11.2 percent indicated they had no desire for further information.

Respondents were asked to rate seven water-related topics according to their level of interest in each topic. Most respondents indicated they were somewhat to very interested in all of the topics (Table 11). Like the Mexican residents surveyed, U.S. residents were most interested in issues affecting their personal water use and in water policy. U.S. respondents were somewhat less interested in scientific studies.

Table 11. Residents' interest in water-related topics

Topic	Rank	Average rating on a scale of 1-5*
Personal water usage	1	3.93
Public water policy	2	3.91
Underground aquifer	3	3.84
Public works project	4	3.74
River flows	5	3.72
San Pedro River Conservation Area	6	3.68
Scientific studies	7	3.64

* Respondents were asked to rank topics on a scale from 1 to 5, where 1 indicates "not interested" and 5 indicates "very interested."

PERCEIVED INFORMATION NEED AND PREFERRED SOURCES

Although most residents surveyed felt somewhat informed on water issues in the basin (Figure 7), only 3.9 percent felt they were very well informed on area water issues. Fifty-five percent felt somewhat well informed, and almost 27 percent felt they were not at all informed on area water issues.

Figure 7. How informed are residents about water issues?

Newspapers are most preferred information source

When asked to identify their sources of information on water issues, over 70 percent of U.S. survey participants identified newspapers, almost 64 percent listed word of mouth, and 50 percent relied on radio or television (Figure 8). Fewer than 20 percent used public meetings or library resources to acquire water-related information.

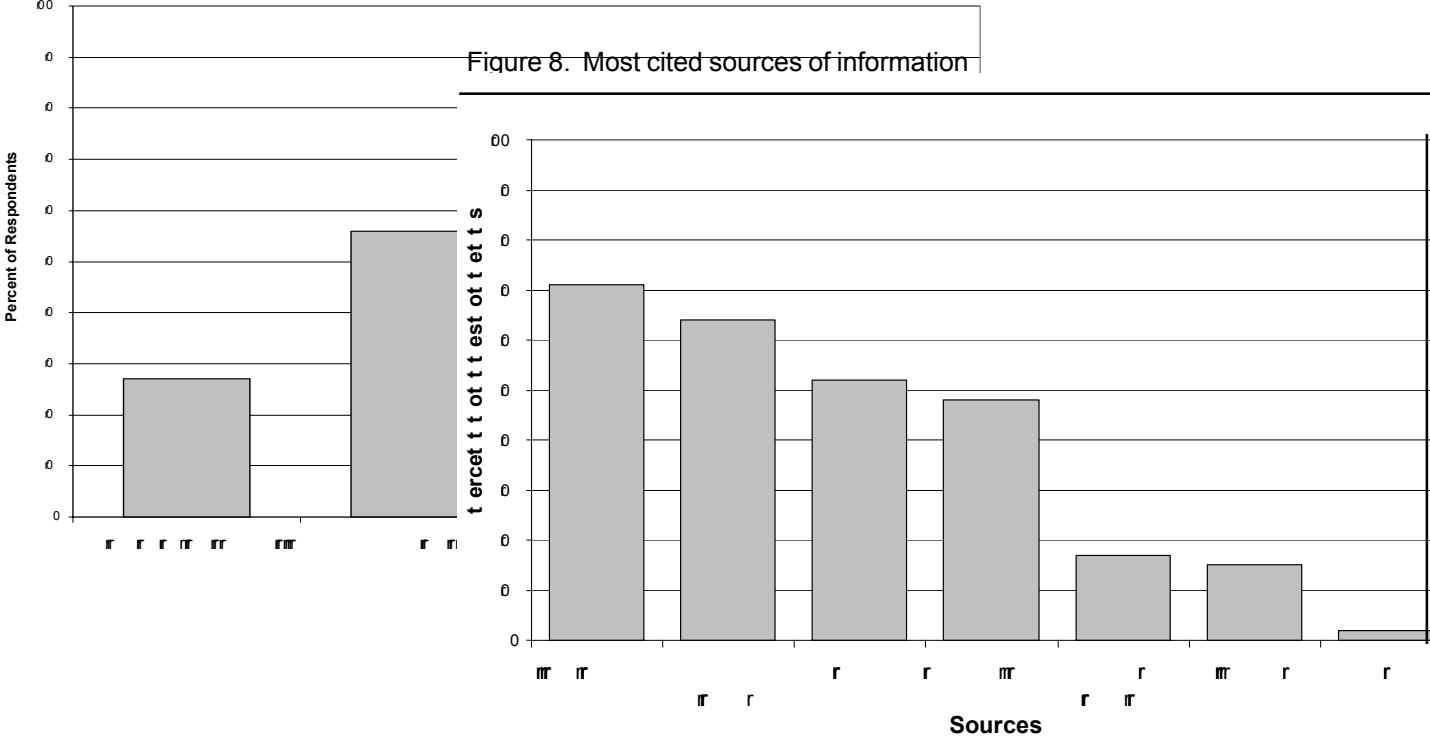
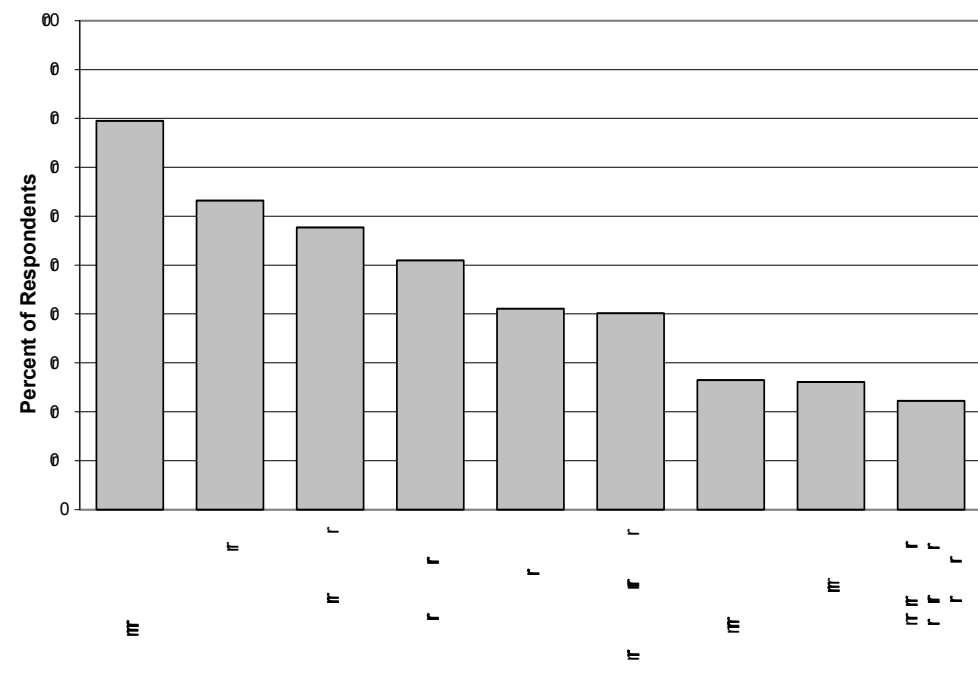


Figure 8. Most cited sources of information

Survey respondents were also asked to identify their preferred source of water information (Figure 9). The three most preferred media were newspapers (80%), television (64%) and Web sites (62%). The three least preferred information sources were public meetings and workshops, libraries, and interpretive information centers. This information was of particular interest to Dialogue San Pedro participants, who were considering developing a San Pedro water information center. It is also noteworthy that 26 respondents wrote in electronic mail under the “other” category.

Figure 9. Preferred information sources



WATER-MANAGEMENT AND WATER-POLICY PREFERENCES

The following water-policy preferences are drawn primarily from public comments made in 1998 on the San Pedro report, *Sustaining and Enhancing Migratory Bird Habitat on the Upper San Pedro*. Over 500 people participated in focus groups and public workshops during the 60-day public comment period, and over 300 written comments were received on the report. Individuals commenting on the San Pedro report were generally reacting to the “solution opportunities” for sustaining and improving the river and its riparian habitat that were discussed in that report (Table 12). Additional comments have been drawn from the minutes of Dialogue San Pedro meetings held between February 1999 and October 2000.

Table 12. “Solution opportunities” for sustaining and enhancing the Upper San Pedro River and its associated riparian habitat (based on 1998 San Pedro report).

-
- Limit agricultural extractions on the U.S. side of the border.
 - Reduce irrigated agriculture on the Mexican side of the border.
 - Utilize water conservation and recycle/recharge initiatives.
 - Improve mountainfront recharge along the Huachuca Mountains.
 - Reintroduce beavers into the river to improve instream recharge.
 - Improve vegetation on the basin floor to increase recharge.
 - Pump groundwater to maintain streamflow during droughts.
 - Close Fort Huachuca.
 - Import water from another basin.
 - Redistribute pumping to minimize the cone of depression near Sierra Vista.
 - Limit domestic well development in rural areas.
 - Create a coordinated resource management process.
-

Recharge efforts should be expanded

In addition to large-scale effluent and mountainfront recharge projects, many groups and individuals responding to the San Pedro report expressed the belief that stormwater retention (designing landscapes to reduce runoff) can significantly improve recharge and suggested that it should be more widely applied and perhaps required in all new developments. Some residents also supported vegetating both washes and cleared land with native grasses to reduce runoff and improve recharge rates. Other recommendations included removing vegetation with high water demand, such as cottonwood trees, and using prescribed fire as a tool to manage vegetation.

Residential growth management should be addressed

Several U.S. residents reviewing the San Pedro report called for growth management to address increasing water demand in the basin. However, some also acknowledged that current state law restricts local governments’ ability to control growth. Commentators also raised issues related to planning, zoning, water pricing, and charging developers for conservation.

Some residents who commented on the San Pedro report, particularly those representing agricultural groups, said agriculture and Fort Huachuca had been targeted for reduced water consumption because they are the only water-user groups that can legally be challenged. These individuals felt that other interests, like residential development around Sierra Vista, were not as easily controlled through policy and legal initiatives, and thus difficult problems like rapid residential growth were not being addressed.

Provide federal or international funding to protect the river

Several U.S. residents also felt that the basin will need funds to support conservation and recharge strategies and that the federal government, national interest groups, and international interests should not rely on locals to pay to preserve a river for national or international benefit. In their feedback on the San Pedro report, residents suggested that funds for large-scale efforts to improve recharge and conservation may have to (and perhaps should) come from outside the basin.

Provide economic incentives to conserve

U.S. residents commenting on the San Pedro report also recommended several policy options to encourage conservation, including tax breaks for recycling water or keeping land undeveloped, use of conservation easements, payment or tax breaks for constructing water retention structures on private property to improve recharge, purchase of irrigation rights on both sides of the border, and incentives and/or subsidies for retrofitting high water-use appliances. A few individuals called for raising water rates, which would require authorization by the Arizona Water Commission. Some people believed that the state should license, meter, and tax wells; others were strongly opposed to this option.

Water importation rejected

U.S. residents unanimously rejected the San Pedro report's suggestion that the San Pedro basin might import water from an adjacent basin. This option was perceived as too costly, illegal, and simply inappropriate.

Coordinated water management with equal representation supported

Many residents supported the coordinated resource management process discussed in the San Pedro report. Local residents stressed the belief that it is counter-productive to single out individual groups or communities as the source of or solution to the basin's water problem. However, some also expressed concern that with cooperative management, representation is usually skewed toward certain interests, like federal agencies. Residents reiterated the need to make sure local interests, notably agricultural interests, are adequately represented in coordinated resource-management forums. Several people commented that without local coordination, federal and, possibly, state governments were likely to step in and impose more regulation. Participants in the Dialogue San Pedro process specified a need for coordinated water management, research, and decisionmaking. They supported bringing together federal, state, and local governments to coordinate their efforts and creating a cross-border technical review committee where scientists and water managers could share information. People responding to the San Pedro report and Dialogue San Pedro participants specifically identified a need to work with the Mexican government and its citizens in cooperative planning and management.

Provide public education and access to information and government processes
Some commenting on the San Pedro report said that many basin residents are basically unaware of water problems and concerns regarding the river, and others recommended educating the public on water conservation and water recycling options.

Participants in the Dialogue San Pedro group focused extensively on the need for improved public access to water-related information and public education. They were particularly interested in creating an information clearinghouse that would include technical information, displays, and other educational materials. Dialogue San Pedro participants also expressed a need to learn more about the general public's fears and preferences regarding water issues.

Some of the U.S. commentators on the San Pedro report called for more resident involvement in government planning through processes like town hall meetings. They expressed a preference for small, accessible meetings over large public forums.

RESEARCH NEEDS

The following summarizes public comments on the 1998 San Pedro report *Sustaining and Enhancing Riparian Migratory Bird Habitat on the San Pedro River*. That report included a description of the basin's ecological features, an assessment of water needs of riparian habitat, a discussion of groundwater-surface water interactions, a summary of human water-use patterns, and a basinwide water budget, based on a review of existing research. It should be noted that, since these comments were gathered in 1998, considerable research has been undertaken in the basin that addresses some of the issues listed below.

Much research is suspect

Several who commented on the San Pedro report questioned its scientific validity. Some noted that conflicting scientific studies make different pronouncements and predictions, limiting the credibility and value of the research. Others expressed a strong desire for empirical, replicable data on which to base management and policy decisions. Computer models were particularly suspect to some people who believed such tools to be based on broad assumptions rather than direct measurements.

Include local knowledge and consider impacts of historical changes

Basin residents said they were offended by research reports that failed to take into account local knowledge. They suggested that researchers need to consider historical changes, such as earthquakes, climate change, floods, and shifts in land-use management, and their respective impacts on hydrologic and biologic conditions in the basin. Local residents who lived near the river reported observing changes in flow that appear to be related to changes in the vegetation, and said they would like to discuss such observations with researchers.

Study effects of water use by riparian vegetation, residential developments, irrigation, and mining

Several U.S. citizens mentioned the need for better measurement of water used for specific uses, such as residential development and riparian vegetation. Local residents also expressed an interest in knowing how reducing agricultural irrigation might affect the river and the groundwater regime, and how much irrigation water makes its way back into the groundwater aquifer as recharge water. Others asked for better information on the effects of pumping for mining in the Bisbee area and in the Cananea area.

Study benefits of recharge-enhancement projects

Several commentators were interested in the possible benefits of projects intended to improve recharge into the underground aquifer. They asked about the potential benefits of enhancing recharge in the basin from vegetation improvements, of building small water-retention structures, and of large recharge projects.

VIEWS OF SCIENTISTS, MANAGERS, & POLICYMAKERS

In November and December 2000, Udall Center staff interviewed 16 individuals who work on water issues in the Upper San Pedro Basin (eight from Mexico and eight from the United States) to determine their opinions on policy options and research needs related to water sustainability. Interviewees included elected officials, federal and state agency scientists, local water-company managers, academics, and interest-group representatives (Table 13) and were selected for their experience with water management, policy, or research in the Upper San Pedro Basin.

Table 13. Individuals interviewed

	Mexico	United States
Elected officials	1	2
Water-company managers	0	1
Agency representatives and university scientists	6	4
Interest-group representatives	1	1

The interviewees were asked to consider the Upper San Pedro Basin as a whole, including both Mexican and U.S. portions of the basin, and to assess: (1) existing scientific understanding of water supply and water demand in the basin, (2) the utility and feasibility of a range of water policy options, and (3) research needs to address water sustainability in the basin.

It is important to note that, because of time and funding constraints, these individuals were chosen because of their experience in the San Pedro, not by random selection, and that the sample size is very small. Therefore, the following summary should not be interpreted as being representative of elected officials, water-company managers, agency representatives, scientists, or interest groups. Neither does this section attempt to provide the latest or most accurate science or policy information available. It simply presents the opinions of 16 well-informed individuals.

**UNDERSTANDING
THE WATER BUDGET**

*“The water budget is the heart of the issue. Until we define the water budget, any attempt to develop policy is not well enough informed.”
- U.S. elected official*

Interviewees were asked to assess the accuracy of available data and scientific estimates for both precipitation and groundwater reserves (supply) and water use (demand) in the Upper San Pedro River Basin.

Availability and accuracy of water supply data

Technical experts and scientists agreed that the best existing precipitation (rainfall and snowfall) and groundwater hydrology data for the Mexican portion of the basin have been collected by private consultants commissioned by Grupo México, the owners of the Cananea mine. They also agree that these data are held by Grupo México and the Comisión Nacional del Agua (CNA), and are not currently available to the public or to researchers. Similarly, only Grupo México and CNA have estimates for current water use in the basin. However, the numbers publicly released by these organizations are considered suspect by both academics and government officials at agencies other than CNA.

One U.S. scientist said current State of Arizona water supply estimates on the U.S. side of the border are considered accurate within about plus or minus 25 percent. He cautioned, “Remember, we can only measure two things: depth to water in wells, and water flow past a point. Everything else is estimated.” New research and additional data collection currently underway—including new gages in washes that feed the San Pedro River and new efforts to measure groundwater flow—are expected to improve water budget estimates for the Sierra Vista subbasin within the next few years. Several of the interviewees said the lack of information about groundwater flows between the U.S. and the Mexican portions of the basin compromises water-budget estimates for the Sierra Vista subbasin.

Accuracy of water-use estimates

Technical experts on both sides of the basin agreed that the major water users in the basin are the Cananea mine, Fort Huachuca, domestic and commercial water use in municipalities, agriculture and ranching, and the environment. They also agreed that only water use by the mine and Fort Huachuca has been accurately measured, and of those two, only the fort’s water-use information is publicly available.

In Mexico, few data are available on domestic, commercial, or environmental water use. Grupo México has reported a water-extraction rate for the Cananea mine, but other scientists in the basin said they believe the mine's actual extraction rate is much higher than the publicly released numbers. There are no current estimates for agricultural water use in the Mexican portion of the basin, but scientists noted that since the reform of Article XVII (changes to federal law that allow the privatization of communal farms in Mexico), much of the agricultural land is underutilized and many water pumps are not working. Therefore, they said, agricultural water use in the Mexican portion of the basin is likely lower now than has been estimated in the past.

Scientists and government officials in Mexico said they could not judge the state of the groundwater resource in the Mexican portion of the basin without more accurate information. However, CNA does report a groundwater deficit in the Mexican portion of the basin.

On the U.S. side of the basin, interviewees mentioned per capita water use and irrigation rates as the water use data that are most difficult to acquire. One U.S. policymaker pointed out that there is little information on human water use in the basin: "We are working really hard on figuring out what the plants are using, but we're not doing the same with regard to the people." A U.S. scientist noted that data on water use in the Sierra Vista subbasin are currently being studied by a subcontractor to the Upper San Pedro Partnership and the City of Sierra Vista. However, another noted that that study will not include private well use in rural areas, information that is protected under Arizona state law. Because of this law, per capita water use and irrigation in rural parts of Arizona are estimated rather than directly measured.

**Trends:
Residential
development and
mining will
increase water
demand**

Mexican and U.S. technical experts agreed that demand for water in the basin is largely dependent on two variables: population trends and mining. On both sides of the border, officials expected that agricultural water use would continue to decline as crop area is reduced and irrigation technologies become more water-efficient. Water use by riparian vegetation is not expected to increase, but there are questions about water use by mesquite tree stands, which are expanding into areas previously dominated by grasses. A number of technical experts also cited climate change and a related decline in precipitation as potential threats to water sustainability in the basin.

In general, the Mexican scientists and policymakers interviewed agreed that water sustainability in the Mexican portion of the basin depends on the Cananea mine's water extraction rate. Some Mexican scientists said that if the mine continues to use

water at current rates, and especially if the mine increases its water usage, then they expect that there will not be enough water to meet future water needs of Mexican communities in the basin. They also noted that the mine has talked about reducing water use and recycling water.

U.S. scientists said that current growth projections for the U.S. portion of the basin (2.5 to 3 percent per year for the Sierra Vista area) are expected to turn perennial stretches of the San Pedro River intermittent within five to 40 years. U.S. interviewees considered the Cananea mine to be “the wild card” in estimates of current and future water use, since no one in the United States knows how much water the mine is pumping or understands the groundwater hydrology in Mexico. Interviewees said the Cananea mine is expected to double production in the near future, and there are frequent rumors that the Bisbee mine (located outside the basin but using water from the basin) will begin production again.

**WATER POLICY
PREFERENCES**

Interviewees were asked to discuss the feasibility and desirability of a number of water-policy options. They also identified challenges posed by historical or potential water conflicts in the basin.

Interbasin transfers

Mexican scientists and government officials unanimously rejected water importation from another basin as a viable option.

*“Very few, if any, cases of interbasin water transfers have been justified if both basins are taken into account.”
- Mexican scientist*

In the United States, however, technical experts expressed differing views on the utility and viability of an interbasin water transfer to help achieve water sustainability in the San Pedro basin. Their reactions to the concept of water importation ranged from “dead on arrival” to “it’s the only way” to address overpumping. In general, U.S. technical experts and scientists rejected water importation from an adjacent basin as politically—and fiscally—ineffective, but several thought importation of Central Arizona Project (CAP) water should be carefully studied. As one interviewee pointed out, “If the federal government thinks this river is a national treasure, they should help out.” Another said, “Bringing CAP to the San Pedro basin is an issue of political will, not money. It’s more desirable than drying up the river.”

Economic incentives and legal restrictions

“Until people understand the true cost of water and are personally affected [by that cost], we won’t get a change in attitudes. Only an increase in water cost will change water use.”
- U.S. scientist

Mexican officials and scientists were divided on the utility of economic incentives to encourage water conservation. (Economic incentives could include payments to encourage people to adopt conservation practices or conservation pricing, whereby users are charged more per unit of water as their use increases.) Most of those interviewed felt that economic incentives could be effective, but a few disagreed and one objected to increasing the cost of water because it is a basic human need. On the other hand, the Mexican experts unanimously supported both imposing legal limits on water use (i.e., creating laws that restrict the amount of water that may be used for specific uses) and charging users per unit of water consumed rather than a flat rate.

U.S. interviewees were generally lukewarm about the utility of economic incentives to reduce water use, which they consider costly and only moderately useful. One pointed out that it is very expensive to provide conservation incentives that really encourage reduced consumption, and another asked how impacts could be monitored to determine that payments to encourage conservation practices or switch to low-water-use appliances actually reduced overall water use. However, one U.S. scientist said that charging people the full cost of water treatment and delivery would make them more likely to conserve.

Most U.S. experts considered placing legal limits on water use “political suicide.” Imposing legal limits on water use is “a tremendously good idea,” one U.S. scientist said, “but who is willing to fall on their political sword to make it happen?”

Growth management

“I believe we need a formal management structure created through enabling legislation. We should allow local control to the maximum extent possible, but we do need some control. Without it, the river will dry up.”
- U.S. water manager

Noting that residential development presents the greatest threat to water sustainability on the U.S. side of the border, several of the water managers and scientists interviewed said the greatest challenge policymakers there face is the growth issue. One of the Mexican officials also identified “uncontrolled growth in the southern United States” as a primary threat to water in the basin. U.S. officials noted that current state law does not give county governments much authority to control growth.

Public education

Among the water-policy options interviewees discussed, public education was the most popular.

“Before you even talk policy, you have to get people to understand concepts. You have to take voluminous, technical data and put it in a form where it can be understood.”
 - U.S. agency representative

Scientists and elected officials on both sides of the border agreed that public education to improve voluntary water conservation should begin in the elementary schools and include adult education.

Some of the Mexican officials noted that since environmental and ecological education became standard curricula in their schools, an environmental consciousness has emerged among the younger generations.

U.S. experts stressed the importance of putting technical information about water, such as volumes used and recharge rates, into a form that is understandable to the general populace. It’s one thing to generate data, they said; the real challenge comes when one tries to use it in a plan to make policy recommendations.

Some scientists stressed that the public needs to understand the uncertainties in water budget estimates and the limits of hydrologic models. One interviewee, for instance, noted that the public tends to either accept model outputs as “fact” or reject all model results because they are based on assumptions and cannot be proven. “Models are essential for getting us in the ballpark and we should continue to invest in refining them, but [people shouldn’t] expect models to be exact,” she said. The public needs to learn to “look at models as sidebars that frame the issues and decisions.”

Water conflicts

In Mexico, most of the technical experts interviewed did not believe they have water conflicts in the basin. A few noted conflicting interests among residential, mining, and agricultural water users. Ranchers and farmers reportedly are in conflict with the mine because the water table has dropped and pumping costs have subsequently increased and because pollution from the mine has reportedly contaminated land and surface water in the basin. The residents of Cananea are frustrated that the mine has stopped providing water to that city, and one person interviewed predicted that there would be increasing conflicts between rural and urban water users as municipal water grows increasingly scarce.

“We need data collected by an impartial group, a group outside the government and not answerable to the government, an institution the government cannot control.”
 - Mexican scientist

Although there are no explicit conflicts between water users and Mexican state and federal agencies, several researchers and water managers mentioned problems with CNA’s roles as both data provider and regulatory authority. Because of this duality, scientists and municipal officials appeared to mistrust information released by CNA.

Water conflicts have received considerable attention on the other side of the border, however. U.S. environmental groups have threatened lawsuits and initiated administrative actions against Fort Huachuca, local municipalities, and federal agencies, charging that their water use or water management is detrimental to the San Pedro River and riparian habitat in the basin. Private property rights interests have contested any effort to meter private wells or regulate water use, and agricultural interests claim they are under attack from both development and from environmental efforts to restrict irrigation. Local and federal governments have been pitted against each other in water policy debates. Citing local government intransigence, one interest group representative on the U.S. side of the border said, “The only thing that will cause us to deal with our water issues is a federal requirement that might get imposed.” U.S. interviewees also discussed a history of conflicts among scientists researching water issues in the basin. One said, “Dueling models and dueling hydrologists were cause for a great amount of conflict in the past.”

**Cooperative
management,
shared authority**

When asked, “Who do you think should have responsibility for setting water policy?” Mexican scientists and government officials gave disparate answers. Several said CNA, the federal agency currently charged with water management and regulation, should have primary authority over water-policy decisions. However, others said responsibility for water decisionmaking should be shared among the state and federal authorities, and a few argued for sharing water-policy responsibility among a broadly defined group of users. One Mexican federal agency official said, “We need to promote organized and legal participation of users in water conservation and regulation.” In general, representatives from regulatory and water management agencies tended to support maintaining centralized water policy while academics and representatives from research and conservation agencies wanted more decentralized water policy.

CNA itself advocates the development of a watershed council (*consejo de cuenca*) in the Mexican portion of the San Pedro Basin. A CNA official described this as a forum where “all the people—rural and urban, service organizations, non-governmental organizations, civil society, and other interested individuals—would have a voice and a vote.” One Mexican scientist called for more dialogue and possibly treaties between the United States and Mexico.

“Water responsibility should be shared among all users, defined in the widest possible sense. It should be representative of all interests, including the environment.”
 - Mexican scientist

When asked what policy changes would help the basin ensure a sustainable water supply most Mexican agency officials said the current laws and institutions were serving them well. Academics and representatives from research agencies, however, called for a less centralized water-policy system that would allow state and local governments and local water users greater input to water policy decisions. One interviewee said that it would be important to provide public education and technical training to local governments and users before giving them additional decisionmaking power.

Most of the technical experts interviewed on the U.S. side of the basin similarly felt there was a need for shared water responsibility at a regional or watershed level, but they were less inclined to include the general citizenry in policy decisionmaking. Most advocated a cooperative, regional, interagency effort like the Upper San Pedro Partnership, which is a consortium of agencies and organizations that own land and/or control land or water use in the Sierra Vista subbasin that works to facilitate and implement sound water resource management and conservation strategies in that portion of the Upper San Pedro River Basin.

RESEARCH NEEDS

Lastly, interviewees were asked to identify what they thought were the most important research needs related to water sustainability in the basin.

Water budget for Mexican side of the basin

“The great hydrological data gathering period is a thing of the past. Now we need to empower the user to administer and monitor the resource.”
 - Mexican scientist

Mexican technical experts called for an inventory of groundwater resources through more sophisticated measurements and scientific estimates of both water availability and water use. Several stressed that research commissioned or conducted by Grupo México or CNA would not have much credibility in the Mexican scientific community. They felt that a joint research effort by U.S. and Mexican scientists would be the most useful.

U.S. scientists similarly identified information on Mexican groundwater hydrology as their single greatest research need: “The cross-border issue is the most critical one. No one understands the conductivity of the aquifer between the upper basin and the border. It’s a huge, gaping, hole in the data,” one U.S. scientist said.

New water conservation technologies and growth-management options

“We need research on how to manage land and water on individual properties and developments to mitigate the impacts of growth on water supply. Growth is going to occur; we have to contend with it.”

- U.S. water manager

Water managers and elected officials on both sides of the border were interested in practical information that they could apply to their policy decisionmaking. They wanted to know how effective different recharge facilities are and can be, whether reuse is more cost-effective than recharge, and what alternative recharge technologies might be available. Given the growth projections for the basin, local officials were interested in information on new graywater reuse technology and other options for managing water on individual properties.

Others talked of a need for research on both land-management and land-regulation options that would help reduce water consumption. “What we really need,” one interviewee said, “is information from around the country or around the world about policies and actions being taken in other places to address their water issues.” Similarly, one Mexican official called for analyses of alternative, low water-use, economic development options for the basin.

Cost analyses of water and various conservation options

“We need to know the true costs associated with water use, water reuse, and recharge. Water bills don’t reflect the true cost of supplying water to consumers.”

- U.S. scientist

The U.S. water managers said one critical need is to identify the cost of treating and delivering water and compare it to current water pricing. Other U.S. officials called for cost analyses for different kinds of alternative water supply technologies, such as low-flow plumbing, rainfall harvesting, and alternative uses of graywater.

Computerized decision-support models

Several hydrologic models and at least one planning model have been developed for the San Pedro basin, and almost all of these are focused on the Sierra Vista subbasin. All of the Mexicans interviewed were interested in seeing existing computer models and having additional models developed that are specific to the Mexican side of the basin. U.S. scientists and elected officials, noting that model results are only as accurate as the model inputs, said they were more interested in refining existing computer models and dealing with model uncertainty. One U.S. interviewee said, “We already have models with ‘what if’ scenarios. The problem is the accuracy of the assumptions that go into them. How do you deal with that?”

Significance of climate variability

One U.S. scientist said better research on how climate variability is affecting water supply would be very useful. He thought researchers should be attempting to answer questions about how climate is affecting vegetation change, such as mesquite expansion into grassland areas; how changing vegetation patterns affecting evapotranspiration rates and flow in ephemeral streams; and how important snowpacks are to basin recharge.

Binational communication and coordinated research

Many of those interviewed, particularly U.S. scientists and policymakers, said that in order to address water sustainability in this binational basin, researchers and policymakers will have to apply a lot more resources, expertise, and communication to the U.S. - Mexico relationship. Interviewees expressed the need to open and sustain the lines of communication, politically as well as technically.

Both U.S. and Mexican interviewees said any research undertaken in the basin should be coordinated with other, ongoing research in the basin and with local officials. Scientists and policymakers on the U.S. side of the basin urged researchers working on water issues to join the Upper San Pedro Partnership, which is coordinating much of the ongoing research related to water sustainability in the Sierra Vista subbasin.

FINDINGS

People who live and work in the Upper San Pedro River Basin are an important source of information about water conditions, water management, and water-policy challenges in that basin. Residents are directly affected by water management and policy, and through their actions, they influence the development and effectiveness of management prescriptions and policy decisions.

This report presents the views of some of the people who live and work in the Upper San Pedro Basin. It is not representative of all the communities or all of the interests in the basin. However, it does indicate broad public preferences and the opinions of a few individuals with technical or policy expertise in San Pedro Basin water issues. These public viewpoints in turn suggest issues that may need additional attention from researchers, policymakers, and educators.

**MEXICAN
RESIDENTS WANT
WATER QUALITY AND
AVAILABILITY
ISSUES ADDRESSED**

Survey responses show that the Mexican residents of the Upper San Pedro River Basin are faced with major water supply and water quality problems, and their top priority for both water management and water policy is an assured supply of potable water. Several respondents were aware of specific problems with the water supply infrastructure, such as the need for new wells in Naco and the need for pipe replacements and repairs throughout the basin.

Mexican residents were also very aware of and concerned about environmental conditions in the region, particularly those related to the San Pedro River. Yet many of the survey respondents did not seem to connect surface water in rivers and streams with groundwater reserves, and while they are aware that the river is an internationally shared resource, most Mexican residents did not tend to think in terms of a “watershed” or “shared groundwater resources.”

Mexican residents were very interested in learning more about water issues and water management and policy options, including individual conservation practices. Mexican residents were also interested in learning water conservation techniques and more about water practices and issues on the U.S. side of the border. Survey respondents preferred to receive information through written materials, local trainings, or radio programs. Mexicans surveyed preferred improved communication and public education to laws and regulations, but also supported the creation of ecological reserves to protect water resources.

Both U.S. and Mexican water scientists and managers identified Mexican groundwater hydrology as a major research need. They also identified a lack of basic water-supply and water-use data on which to base management and policy decisions.

Recommendations:

- Conduct a water system/infrastructure study.*
- Conduct water-quality testing in municipios and ejidos.*
- Conduct groundwater hydrology research.*
- Measure water supply and demand on the Mexican side of the basin.*
- Develop public-education programs.*

**U.S. RESIDENTS
MOST INTERESTED
IN WATER
CONSERVATION**

Many U.S. residents were concerned about the health and viability of the San Pedro River and its associated riparian habitat. They specifically identified growth management, recharge, and conservation as water-policy and water-management priorities.

U.S. researchers and water managers similarly stressed the need for research on growth-management options, conservation options, and water pricing. They noted that considerable hydrologic research—including geohydrologic modeling, recharge studies, and evapotranspiration studies—is currently underway in the Upper San Pedro Basin.

Researchers and water managers also identified a need for improved public education on water-related research methods, research findings, and policy options. U.S. scientists talked about the challenge of making technical data tangible to the lay public. U.S. residents consider themselves less than well informed on water issues in the basin. U.S. residents preferred to receive information via the media, particularly newspapers.

Recommendations:

- Research growth-management options.*
- Study the relative efficiency of water conservation, recycling, and recharge technologies.*
- Develop accurate water-valuation measures that reflect the true cost of water delivery.*
- Study alternative water-policy options for a semi-arid basin.*
- Develop public-education programs.*

**EVERYONE
SUPPORTS
IMPROVED
COMMUNICATION
AND COOPERATION**

All information sources used in this report, including surveys of Mexican and U.S. residents of the basin, interviews with water managers and scientists, and group discussions of water issues and water-policy options, identified a need for improved communication and cooperation on water research, management, and policy in the Upper San Pedro River Basin. Both residents and elected officials in the basin iterated their frustration with research that is conducted in the basin but not shared with local communities. There is a particular need for improved information sharing across the international border.

Participants in a 1999 binational San Pedro conference, “Divided Waters—Common Ground,” similarly called for cooperation among water management agencies and water users. Several discussion groups at that conference, which included basin residents from both sides of the border as well as scientists and policymakers from outside the basin, emphasized the importance of improving binational communication on water policy and management. They also identified a number of opportunities for improving communication across the U.S.-Mexico border, including: student, researcher, and agency exchange programs; an annual, binational, watershed conference; and a binational watershed-management plan.

Recommendations:

- *Develop programs for binational and watershed-wide information exchange, including media-based, Internet-based, and community-based public education programs.*
- *Develop a Mexican watershed council-like forum that can interface with the Upper San Pedro Partnership.*
- *Share research results with communities.*

REFERENCES

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Population statistics were obtained from the 2000 U.S. Census and 2000 Instituto Nacional de Estadística Geografía e Informática (INEGI). Population statistics for Naco were modified based on interviews with local government officials.

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Moote, Ann, Maria Gutierrez, and Allison Howarth. 2001. *Water Resources Sustainability in the Upper San Pedro River Basin: Results of a Survey of Mexican Residents*. Udall Center for Studies in Public Policy, The University of Arizona, Tucson, Arizona.

A more detailed summary of public comments on the 1998 report, *Sustaining and Enhancing Migratory Bird Habitat on the Upper San Pedro River*, is available in:

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APPENDIX I

GLOSSARY OF NAMES AND TECHNICAL TERMS

Ajos-Bavispe Reserve: A protected area located in Sonora, Mexico and partially within the Upper San Pedro River Basin. This reserve is managed by the Protected Areas branch of the Mexican federal agency SEMARNAT (Secretaria del Medio Ambiente y Recursos Naturales). Also see *ecological reserve*.

Aquifer: Underground bed or layer of earth, gravel, or porous stone that yields water.

Barrio: Spanish term meaning neighborhood or residential district.

Basin (Drainage basin): Region drained by one river system. Also referred to as a watershed. The runoff in a given drainage basin is distinct from that of adjacent areas.

Binational: Between two countries.

Biodiversity: Range of variability within and among living organisms, species, and ecosystems. Biodiversity includes ecosystem or community diversity, species diversity, and genetic diversity.

Bureau of Land Management (BLM): One of many U.S. federal agencies responsible for managing public lands and natural resources in the United States. BLM manages the 58,000-acre San Pedro Riparian National Conservation Area.

Central Arizona Project (CAP): Major U.S. public works project that carries Colorado River water in a canal from the Arizona-California border to south-central Arizona.

Climate variability: Change(s) in the long-term weather patterns of a region. The National Weather Service uses a 30-year time period to determine average climate conditions.

Colonia: Spanish word meaning residential development or neighborhood.

Comisión de Agua Potable y Alcantrillado del Estado de Sonora (CoAPAES):

Commission of Potable Water and Wastewater of the State of Sonora, a state agency that advises, coordinates, and manages drinking water and wastewater. CoAPAES provides technical assistance to municipalities that have no operating organization or other capabilities for providing water treatment and water supply services, including the City of Cananea.

Comisión Nacional del Agua (CNA): National Water Commission, the Mexican federal agency responsible for administering and protecting Mexican water sources and enforcing Mexican federal water laws.

Commission for Environmental Cooperation (CEC): International organization created by Canada, Mexico, and the United States under the North American Agreement on Environmental Cooperation, a side agreement to the North American Free Trade Agreement. In 1997, the CEC initiated a study of the Upper San Pedro River Basin that focused on sustaining and enhancing the migratory bird corridor along the San Pedro River.

Conductivity: See *hydraulic conductivity*.

Conservation easement: Legal agreement where a landowner voluntarily restricts or limits specified types of land use, such as development or agriculture. The landowner may receive financial compensation for giving up these uses.

Coordinated resource management: Process by which natural resource owners, managers, and users work together as a team to formulate and implement plans for the management of natural resources in a specified area and/or to resolve conflicts.

Decision-support model: Theory-based procedure or program that allows users to change known properties of a system and project possible outcomes.

Ecological: Of, or having to do with, ecology.

Ecology: Science of the relationships between organisms and their environments.

Ecological reserve: Protected parcel of land, designed to keep the existing ecosystem intact. In Mexico, an Ecological Reserve is a government-designated parcel of public and/or private land that is protected from certain uses by federal law.

Ecosystem: Complex system in nature where living organisms and their environment operate as a unit.

Effluent: Wastewater, especially sewage.

Ejido: Spanish word meaning a communally-owned land unit in Mexico.

Empirical: Derived from an observation or an experiment – not theoretical.

Ephemeral stream: Stream channel in which water flows only after precipitation or snowmelt, not year-round. See also *intermittent*.

Extraction: Removal of water from its source, such as pumping from a well (groundwater extraction) or diversion of streamwater for irrigation (surface water extraction).

Evapotranspiration: Sum water vapor given off by plants (transpiration) plus water vapor from land and surface water (evaporation).

Fort Huachuca: U.S. Army base located west of Sierra Vista in the Upper San Pedro River Basin. Fort Huachuca is the major employer on the U.S. side of the basin.

Gage (gaging station): Site on a stream, lake, reservoir or other body of water where direct, systematic observations of hydrologic data are obtained.

Graywater: Domestic wastewater composed of wash water from kitchen sinks and tubs, clothes washers, and laundry that can be used by homeowners for home gardening, lawn maintenance, landscaping, and other innovative uses.

Groundwater: Water beneath the earth's surface.

Groundwater connectivity: Physical relation between different aquifer systems or between the layered aquifer system and the water table.

Groundwater level: Depth to the confined aquifer. See *water table*.

Groundwater reserves: Water stored beneath the earth's surface; water in aquifers. Within Arizona, this term usually refers to the volume of water existing to a depth of 1200 feet below the ground surface.

Growth management: Process and policies used to direct and to some degree control population expansion and development within a region.

Grupo Mexico: Mexican mining corporation that owns and operates both the mine at Cananea and most of the wells on the Mexican side of the Upper San Pedro River Basin. Grupo Mexico is the major employer on the Mexican side of the basin.

Habitat: Natural abode of a plant or animal, including all biological and physical aspects.

Hydraulic conductivity: Aquifer's ability to transmit water.

Hydrologic: Of, or having to do with, hydrology.

Hydrology: Scientific study of the properties, distribution, and effects of water in the atmosphere, on and below the earth's surface.

Instream: Water in a river or stream channel; within the confines of a stream or wash.

Interbasin transfer: Water delivered from one basin (or watershed) to another.

Intermittent: Streamflow that occurs only part of the year, usually during periods of seasonal runoff, but more frequently than an ephemeral stream.

Interpretive information center: Hands-on learning center, accessible to the general public and designed to increase understanding and awareness of specific issues.

Irrigation: Application of water to dry land via ditches, pipes, or streams.

Low-flow plumbing: Toilets, showerheads, and other water-supply fixtures designed to use less water than standard plumbing fixtures.

Native: Indigenous to an area since prehistoric times; not introduced.

Organismo Operador Municipal de Agua Potable y Alcantarillado de Sonora (OOMAPAS): Municipal Operating Organism of Potable water and Wastewater Treatment of Sonora, a state agency that manages issues related to water and wastewater in some Sonoran municipalities, including Naco.

Overpumping: Removal and consumption of groundwater in excess of the rate of water recharge into the groundwater system. Also known as groundwater mining.

Perennial: Year-round water flow in a stream or river channel.

Precipitation: Any form of water, such as rain, snow, or sleet, that falls to the earth surface.

Programa de Agua para la Ciudad (PAC): Municipal Water Program, the Cananea city office of the state water management agency, Comision de Agua Potable y Alcantrillado de Estado de Sonora (CoAPAES).

Public works: Government construction projects, such as dams, water treatment plants, and power plants, built for the public and financed with public funds.

Rainfall harvesting: Capturing rain water for future use or for recharge.

Recharge: Movement of surface water into the underground aquifer.

Recycle: To use again or to reprocess to use again, as with treated effluent.

Replicable: Repeatable. A replicable experiment is one in which the controls and variables are readily identifiable.

Reuse: Application of water that has already undergone some form consumptive use, such as irrigating with treated effluent.

Riparian: Of, or pertaining to, the banks of rivers and streams.

Riparian habitat: Natural home for plants and animals that are dependent on groundwater, streams, or lakes.

Runoff: Precipitation that does not infiltrate into the soil, but flows over or just below ground surface.

San Pedro Riparian National Conservation Area (SPRNCA): 58,000-acre parcel of land stretching along 43 miles of the Upper San Pedro River from the international border to St. David, Arizona. The SPRCA is managed by the Bureau of Land Management for the protection and enhancement of the desert riparian ecosystem within its boundaries.

Secretaria del Medio Ambiente y Recursos Naturales (SEMARNAT): Secretary of the Environment and Natural Resources, the Mexican federal agency responsible for environmental regulations and their enforcement. SEMARNAT manages other Mexican federal environmental agencies, including the *Comisión Nacional del Agua*.

Sierra Vista subbasin: The southernmost drainage basin of the Upper San Pedro River Basin in the United States. See *subbasin*.

Snowpack: Volume of water retained in a frozen state that contributes to runoff and recharge. Snowpack is usually expressed as an equivalent depth of liquid water.

Stormwater retention: Delaying runoff so that rainwater is more likely to recharge the aquifer.

Subbasin: Hydrologically delineated region within a larger basin, contributing to outflow and for which a water budget can be established.

Surface water: Water that flows over the earth's surface.

Sustainability: Ability to maintain a resource in perpetuity.

Transfer rate: See *water transfer rate*.

Upper San Pedro Partnership (USPP): Consortium of agencies and organizations that own land and/or control land or water use in the Sierra Vista subbasin of the Upper San Pedro River Basin that works to facilitate and implement sound water resource management and conservation strategies in that subbasin.

Wash: Another name for an ephemeral or intermittent stream channel; an arroyo.

Water availability: Amount of water that can be accessed from a specified area in a given time frame.

Water budget (water balance): Assessment of the inputs and outputs for a given watershed.

Water conservation: Management of water resources so as to eliminate waste or maximize efficiency of use.

Water consumption: Use of water that is removed from and not returned to its original source. Most water consumption occurs through evaporation or evapotranspiration; water may also be consumed when vegetation is harvested.

Water deficit: Extent to which surface-water diversions and groundwater extractions exceed precipitation and recharge over a specified time frame.

Water demand: Amount of water used over a period of time at a given price.

Water importation: Moving water from one location to another; augmenting local water resources in one location with water resource from another (source) location.

Water pricing: Fixing a dollar value to be charged to the consumer per unit of water.

Water retention: Act of holding or retaining water that would otherwise be lost as surface runoff.

Water supply: Various components contributing to the availability of water in a region, including surface and groundwater sources and the precipitation that contributes to these sources.

Water table: The top of the aquifer.

Water transfer rate: Speed at which water moves through a porous media.

Watershed: Region draining into a river, river system, or other body of water.

Watershed council: Group of stakeholders from a given watershed who address issues of water use and supply within the watershed. In the United States, watershed councils are usually self-organizing groups and may or may not have administrative control over some water management decisions. In Mexico, a watershed council or *consejo de cuenca* is a legal entity which can be established only by the Comisión Nacional del Agua.

Zoning: Local regulatory land-use designations that specify minimum lot sizes, uses, and site development standards.

APPENDIX II

**ENGLISH
TRANSLATION OF
SURVEY CONDUCTED
ON THE MEXICAN
SIDE OF THE UPPER
SAN PEDRO RIVER
BASIN, OCTOBER-
NOVEMBER 2000.**

Survey

Water Resources Sustainability in the Upper San Pedro River Basin

This interview survey is being conducted by the Udall Center for Studies in Public Policy at The University of Arizona. It has been requested by researchers at a new, international arid hydrology center and by local government officials to help them identify and address water issues in the San Pedro River Basin. The survey is anonymous. All statements are confidential.

This first set of questions is specific to water in your local neighborhood or ejido.

1. What is the name of your neighborhood or ejido?

2. Please indicate whether the following statements are true for your community. Listen to all four options, then choose the one that is most accurate.
 - a. We always have enough water for drinking and bathing.
 - b. We usually have enough water for drinking and bathing, but sometimes we have to ration it.
 - c. We frequently have to ration water for drinking and bathing.
 - d. Sometimes we have no water for drinking and bathing.

3. Please indicate whether the following statements are true for your community. Listen to all four options, then pick the one that is most accurate.
 - a. We always have enough water for our plants and animals.
 - b. We usually have enough water for our plants and animals, but sometimes we have to ration it.
 - c. We frequently have to ration water for our plants and animals.
 - d. Sometimes we have no water for our plants and animals.

4. Have you heard of any water-related illnesses in your community?
yes no
- a. If yes, what types of illnesses?
- i. diarrhea yes no
 - ii. hepatitis yes no
 - iii. parasites yes no
 - iv. other: _____
5. Who provides water to homes and businesses in your community?
6. Who do you go to for water information?
7. Who do you go to when you have a water problem?
8. What kinds of water problems do you know of in your community?
9. Are there community groups in your area that deal with water issues?
yes no don't know
- a. If yes, name them:
- b. If yes, what types of issues do they deal with?
10. Which of the following activities would you participate in to help improve water supply in your community?
- a. Practice voluntary water conservation. yes no
 - b. Pay for water use. yes no
 - c. Pay higher taxes. yes no
 - d. Other: _____
11. Which of the following activities would you participate in to help preserve water in the environment and in the river?
- a. Practice voluntary water conservation. yes no
 - b. Pay for water use. yes no
 - c. Pay higher taxes. yes no
 - d. Other: _____

12. In cases where water users are charged for water, how do you think payment rates should be calculated? Please choose one answer only.
- Flat fee per month regardless of the amount of water used.
 - Based on the amount of water used per month: The more you use, the more you pay.
 - Other: _____
13. Which of the following statements do you most agree with? Please choose one answer only.
- Water is the responsibility of the government.
 - Water is the responsibility of the water users.
 - Water is a shared responsibility between government and water users.
 - I do not have enough information.
14. Which of the following statements do you most agree with? Please choose one answer only.
- I feel that the local government is doing all it can to meet my water needs.
 - I feel that the local government is trying to meet my water needs, but it could do more.
 - The local government is not trying to meet my water needs.
 - I do not have enough information.
15. How important are the following issues to you? Please indicate whether each issue is "very important," "somewhat important," or "not important."
- | | | | |
|---|------|----------|-----|
| a. pollution in springs, washes, and the river | very | somewhat | not |
| b. pollution in the underground water | very | somewhat | not |
| c. availability of water for drinking and washing | very | somewhat | not |
| d. availability of water for mining and manufacturing | very | somewhat | not |
| e. availability of water for farming | very | somewhat | not |
| f. maintaining underground water supplies | very | somewhat | not |
| g. maintaining water in the river and springs | very | somewhat | not |

The following questions deal with your personal water use. All of your answers are confidential.

16. How old are you? ___ years
17. How many people live in your household? ____ people

18. Where does your household water come from?
- | | | | |
|---------------------------------|--|-----|----|
| a. wells | | yes | no |
| b. the river | | yes | no |
| c. the city (delivered by pipe) | | yes | no |
| d. the mine (delivered by pipe) | | yes | no |
| e. other: _____ | | yes | no |
-
19. Please identify how often your household uses water for the following activities: daily, 4-6 times per week, 1-3 times per week, 1-3 times per month, or never.
- | | | | | | |
|-----------------------------------|-------|----------|----------|-----------|-------|
| a. washing dishes in a dishwasher | daily | 4-6/week | 1-3/week | 1-3/month | never |
| b. washing dishes by hand | daily | 4-6/week | 1-3/week | 1-3/month | never |
| b. washing clothes in a machine | daily | 4-6/week | 1-3/week | 1-3/month | never |
| c. washing clothes by hand | daily | 4-6/week | 1-3/week | 1-3/month | never |
| c. drinking and cooking | daily | 4-6/week | 1-3/week | 1-3/month | never |
| d. cleaning house | daily | 4-6/week | 1-3/week | 1-3/month | never |
| e. washing cars | daily | 4-6/week | 1-3/week | 1-3/month | never |
| f. watering the yard | daily | 4-6/week | 1-3/week | 1-3/month | never |
| g. washing sidewalks | daily | 4-6/week | 1-3/week | 1-3/month | never |
| h. gardening | daily | 4-6/week | 1-3/week | 1-3/month | never |
| j. bathing | daily | 4-6/week | 1-3/week | 1-3/month | never |
| h. other: _____ | daily | 4-6/week | 1-3/week | 1-3/month | never |
-
20. Do you practice water conservation at home or at work?
- | | | | |
|--|-----|----|------------|
| | yes | no | don't know |
|--|-----|----|------------|
- a. If yes, what do you do to conserve water?
-
21. Are you interested in learning water conservation techniques?
- | | | |
|--|-----|----|
| | yes | no |
|--|-----|----|
- a. If yes, how would you like to receive that information?
- | | | |
|--|-----|----|
| i. through water conservation trainings in your neighborhood | yes | no |
| ii. from brochures | yes | no |
| iii. through a radio program | yes | no |
| iv. through the schools | yes | no |
| v. other: _____ | | |

The next set of questions deals with the entire Upper San Pedro River Basin in Mexico, from Cananea to the border.

22. How many years have you lived in the San Pedro River Basin? _____
(years)
23. In the time that you have lived here, have you noticed a change in the plants or animals?
yes no
- a. If yes, how have the plants or animals changed?
- b. If yes, what do you think caused the change?
24. In the time that you have lived here, have you noticed a change in the climate, like a change in temperatures or amount of rain or snow?
yes no
- a. If yes, how has the climate changed?
- b. If yes, what do you think caused the change?
25. In the time that you have lived here, have you noticed a change in the river or arroyos?
yes no
- a. If yes, how have the river or arroyos changed?
- b. If yes, what do you think caused the change?
26. To the best of your knowledge, what activities use the most water in this region?
27. Do you think people should be doing more to protect water on the U.S. side of the San Pedro River Basin?
yes no don't know
- a. If yes, what do you think they should be doing?
28. Are you interested in learning more about water use and water management on the U.S. side of the San Pedro River Basin?

29. In your opinion, which of the following items are important to maintain water supplies and water quality in the San Pedro Basin? Please identify if the item is "very important," "somewhat important," or "not important."

- | | | | |
|--|------|----------|-----|
| a. laws and regulation | very | somewhat | not |
| b. public education | very | somewhat | not |
| c. scientific research | very | somewhat | not |
| d. communication among water users, scientists, and government | very | somewhat | not |
| e. nature reserves | very | somewhat | not |

30. Who do you think should have the most authority over water management in this region? Please state whether you think each of the following should have "no authority over water," "some authority over water," or the "most authority over water."

- | | | | |
|---------------------------|------|------|------|
| a. federal government | none | some | most |
| b. state government | none | some | most |
| c. local government | none | some | most |
| d. private companies | none | some | most |
| e. individual water users | none | some | most |

31. Do you have any other comments pertaining to the water situation in this region that you would like to add ?

32. Would you be willing to be interviewed again on this or related topics?

yes no

If yes, please write your mailing address, email address, or phone number on the detachable label.

33. Thank you for taking the time to answer these questions. The results of this report will be given to local government officials and to researchers to help them address water issues in this area. Would you like to receive a copy of the results?

yes no

If yes, please write your postal address or email address on the detachable label.

APPENDIX III

U.S. SURVEY

Water Issues Survey

Cochise College Center for Economic Research, in cooperation with a volunteer group of Cochise County residents and the Udall Center of the University of Arizona is conducting a study for "Dialogue San Pedro." The purpose of the study is to determine how best to inform people of the Upper San Pedro River Valley of area water issues. In so doing, it is important to learn how you currently receive, or prefer to receive, such information. Please complete the following survey. Your input is important.

1) The following is a list of some subjects relating to local water issues. Please rank your interest in each.

	Do not Understand	1	Not Interested	2	3	4	Very Interested	5
Personal water usage	0	1	2	3	4	5		
Public water policy	0	1	2	3	4	5		
Public works projects	0	1	2	3	4	5		
River flows	0	1	2	3	4	5		
San Pedro River Conservation Area	0	1	2	3	4	5		
Scientific studies	0	1	2	3	4	5		
Underground Aquifer	0	1	2	3	4	5		

2) What are your current sources for information about water issues? (Check all that apply.)

Newspapers Public meetings Radio
 TV Library Word of Mouth

3) How interested are you in gaining more information on local water issues?
___ Not at all interested ___ Somewhat interested ___ Very interested

a) If you indicated an interest, how would you prefer to get information on water issues?

Check your preference for each information source.

	Not at all preferred	Somewhat preferred	Highly preferred
Newspapers			
Public meetings/workshops			
Radio			
TV			
Word of mouth			
Direct mail			
Web site			
Interpretive Information Center			
Other:			

4) Overall, how well informed to you feel you are about water issues?
___ Not at all informed ___ Somewhat informed
___ Well informed ___ Very well informed

5) Demographics:

a) How long have you lived in the area? _____
b) What is your current zip code? _____
c) What is your age group?
___ 18 to 30 ___ 31 to 45 ___ 46 to 60 ___ 61 and over

APPENDIX IV

INTERVIEW SCRIPT

Preamble

The Udall Center is working with an interdisciplinary team of researchers to conduct a feasibility study that will assess the need for additional research on water sustainability in four basins in Southwestern Arizona and northern Mexico. The San Pedro is one of the basins.

This research is being conducted under the auspices of a new National Science Foundation Science and Technology Center for the Sustainability of Semi-Arid Hydrology and Riparian Areas (SAHRA) that is housed in the University of Arizona's Department of Hydrology and Water Resources.

We are conducting surveys and interviews to determine stakeholder issues, interests, and information needs to plan for water sustainability in the basin. Our recommendations for future SAHRA research and outreach in the basin will be based on the feedback we get in the surveys and interviews.

Water Sustainability in the Upper San Pedro River Basin

MEXICO INTERVIEW QUESTIONS

1. Do you (does your organization) have estimates of annual precipitation and existing groundwater resources for the San Pedro River basin? If yes, can you share them with us? If no, what do you think might be reasonable estimates for these water supply sources? What are your estimates based on?
2. Do you (does your organization) have estimates of the total current water use in the Upper San Pedro River Basin? If yes, can you share them with us? If no, what do you think might be a reasonable estimate for total water demand in the basin? What is this estimate based on?
3. As we understand it, the major water users in the Upper San Pedro River Basin have been identified as: Fort Huachuca, the mine at Cananea, municipalities (domestic water use), agriculture, and the environment (i.e. the river and associated riparian habitat). Is this list complete? Are you aware of other demands on water in the basin?
4. Do you think there is enough water available to meet the current needs of all water users in the basin? Why or why not?
5. Do you think the demand for water will increase or decrease in the next 50 years? Why?
6. Do you think there will be enough water available to meet the future needs of water users in the basin? Why or why not?

7. Do you think there are conflicts over water in the basin? If yes, please describe the conflict(s). If yes, what do you think might help diffuse the conflict(s)?

8. Who do you think should have primary responsibility for setting water policy?

9. What kinds of policy changes at the state or federal level would help ensure sustainable water supply to your organization/industry/municipality? What kinds of policy changes would hurt your water supply?

10. I am going to list different policy options that have been suggested to address a water deficit. Please tell me what you think about the feasibility and utility of each of these options.

- importing water from another basin
- providing economic incentives for voluntary domestic or industrial conservation
- imposing legal limits on water use
- metering all water use and charging users per unit of water used
- public education to encourage water conservation

11. What other factors might influence future water supply in the basin?

12. Are you aware of the Alternative Futures Study undertaken by the U.S. Army and Harvard University last year?

If yes, what do you think of it? (What do you like about the model? What do you dislike about it?) Do you think you can use this model to help you in your future water planning? (What changes, if any, would you make to the model?)

If no, are you interested in computer models that forecast the future impacts of different policy decisions?

13. What other research would assist you and other water managers in making decisions for current and future water management in the basin?

Water Sustainability in the Upper San Pedro River Basin

U.S. Interview Questions

1. What is known about the current water supply in the basin? (How accurate are estimates of the basin's water supply?)

2. What is the known about current water use in the basin?

3. Looking to the future, how do you expect water demand to change? Do you think certain water uses will increase or decrease? Why?

4. What are the major challenges policymakers face when addressing water issues in the basin?

5. Please share your thoughts on each of the following policy options:

- importing water from another basin
- providing economic incentives for voluntary domestic or industrial conservation
- imposing new legal limits on water use
- metering all water use and charging per unit of water used
- public education to encourage water conservation

6. Who do you think should have primary responsibility for setting water policy: the federal government, the state government, or local government?

7. Are you aware of the Alternative Futures Study undertaken by the U.S. Army and Harvard University last year?

If yes, what do you think of it? (What do you like about the model? What do you dislike about it?) Do you think you can use this model to help you in your future water planning? (What changes, if any, would you make to the model?)

If no, are you interested in computer models that forecast the future impacts of different policy decisions?

8. What additional data, research, or tools could researchers provide that would help water managers and water policymakers in the basin better address water sustainability?