Utah's Water Situation

Overview

The current drought began in 1999 and has impacted every water basin in Utah. Although it is not as severe as the drought in 1990, vigorous population growth raises concerns about demand outstripping supply even when drought conditions don't exist. Water use fluctuates and is dependent upon water basin, the type of water used, type of water user, and the drought cycle. Lot size of residential property also has an influence on the amount of water used for outdoor purposes. The concern that tax funded water systems are charging customers less than the full cost of the water and using tax revenue to make up the difference seems to be unfounded. Also, Utah's use of groundwater may be cause for concern as it is not as easily replenished as surface water.

Drought Cycles & Water Locality

The ongoing drought has impacted, to some extent, all of the water basins in Utah. The Utah Division of Natural Resources has designated 11 water basins in Utah. Each of these can be considered a discrete river system unto itself because each has unique features, geologically and climatologically. One unique feature of each basin is the amount of annual precipitation it receives.

The Palmer Drought Severity Index is used to determine dryness and uses temperature and rainfall information to do so. It has been used since 1895 to determine monthly precipitation relative to an area's "normal" or "average" amount. The Palmer Index ranges from +4 to -4, with a +4 signifying an extremely moist month and a -4 an extremely dry month. The Palmer Index data for Utah is made up of seven divisions, which roughly correspond to the 11 water basins. For each of the seven divisions, the Palmer Index was examined for five-year intervals from 1985 to 2000 as well as the last complete year of data, 2002. The years examined correspond with the U.S. Geological Service water use data by state.

The Palmer Index ranges monthly data on a continuum from extremely moist to extremely dry, however, the data is not arranged in chronological order. This puts researchers at a slight disadvantage when using this data; since the reader cannot tell whether, for example, if January 1990 was moderately dry while July 1990 was extremely dry. Only that there were four months of moderately dry conditions and eight months of extremely dry conditions within a given region during 1990. Since Utah is dependent on winter snow being captured by reservoirs and released during the summer months, a moderately dry January has a greater impact on water supply than an extremely dry July. Despite this limitation, the data are very important in quantifying Utah's drought cycles.

Utah Foundation tallied the number of moderate, severe and extreme dry months for each of the seven divisions in Utah. With the exception of Divisions 2 and 6, 1990 had more extremely dry months than 2002. However, when the division totals were tallied into one grand total, there were more moderately dry months in 2002 on an aggregate state basis than in 1990, but fewer severely and extremely dry months.

From this grand total, Utah Foundation created a weighted drought index for the entire state which weighs extremely dry months more heavily than those of less severity. By dividing this weighted figure against the "worst case scenario" twelve months of extremely dry conditions in all seven districts), a drought severity index can be calculated. An index reading of 100 would reflect the worst case scenario, while an index reading of 0 would mean no drought conditions exist. The index shows that at the aggregate state level, the drought during 1990 was more severe than during 2002. However, the rapid increase in the ratings between 2000 and 2002 is cause for concern. The current drought began in 1999, but vigorous population growth during 1990-2000 raises concerns about demand outstripping supply even when drought conditions don't exist.

The final piece of information gleaned from the Palmer Index is that the Southwest Corner and the Central Highlands, the divisions that have experienced the greatest impact from the current drought cycle, have not had as many extremely dry months as they had in 2002 since the turn of the last century. For the Southwest Corner, the year was 1900 and for the Central Highlands, it was 1902.

Statewide Water Usage

Every five years, the U.S. Geological Survey releases data on water usage by state. The data detail the amount of water used for agriculture, municipal and industrial uses (M&I- public or private water utility providers), mining, private industrial wells, and thermoelectric generation. The data also provide a look at the sources of water within the state, either surface sources, such as lakes, reservoirs, and rivers, or ground sources (such as wells and springs). Irrigation remains Utah's largest use category, and the percentage of water used for this purpose is up slightly from 79.2% in 1995 to 81.1% in 2000.

In addition to the increase in the percentage of water used for irrigation purposes, the consumption of municipal water per capita in Utah also increased from 1995 to 2000. In 1995, 269 gallons were used per person per day in the state. In 2000, that increased to 293 gallons. This was one of the largest increases in the country. Only four states, Colorado, Hawaii, Texas, and Louisiana, had larger increases in the amount of municipal water used per person, all four of which were also experiencing drought conditions in 2000. Utah's per capita usage also increased, ranking Utah 20th in the nation in terms of growth in per capita water consumption, Alabama saw the greatest growth, and Pennsylvania saw the greatest decline.

Utah's per capita usage fluctuates greatly between drought and non-drought years. In 1990, the rate was 308 gallons per day. In 2000, when the current drought started to become of greater concern statewide, the rate was 293 gallons per capita daily. The intermountain states mostly followed a similar trend in which water usage increased during the drought years of 1990 and 2000, but was lower in the normal-to-wet years of 1985 and 1995. In fact, Utah appears to have reduced water consumption over time from wet year to wet year (1985 to 1995) and from dry year to dry year (1990 to 2000).

Water Usage by Basin

There is a surprising amount of variation in water usage among Utah's water basins. However, there are two important notes to these data provided by the Division of Water Resources. First, the volume of water for each basin only includes water utilized in public M&I systems. It does not include privately supplied industrial or residential entities that have their own well system, nor does it include agricultural water. Yet, the volume does count secondary water systems that municipalities employ for outside watering by residents and businesses. Second, some of these data are dated, collected at the time each basin's latest water plan was authored. Despite these limitations, the data can be

used to compare one basin against another.

The different categories of water customers include residential, commercial, institutional (including schools and churches) and industrial. Overall water use, potable and non-potable, ranges from a low of 263 gallons per capita daily (GPCD) in the Jordan River basin, to 439 GPCD in the Kanab/Virgin River basin. Additionally, the residential users in the southern part of the state have the highest GPCD rate of total potable and non-potable residential use, while the Sevier basin has the lowest rate.

Residential customers are both the largest customer type and the largest water consumers for community water systems. Residential customers range from a low of using 56.5% of the basin's total public system in the Sevier basin, to a high of 75.7% in the Uintah basin. Commercial and institutional each account for 20.0% or less of consumption within public systems, with two exceptions. In the Cedar/Beaver basin, commercial customers account for approximately 25.0% of all water consumed. In the Sevier basin, institutional customers make up 32.4% of consumption. Finally, industrial users range from a high of 9.0% of water consumed in the Bear River basin to a low of 1.3% in the Cedar/Beaver basin.
The Weber Basin has the highest secondary water utilization rate, followed by Sevier and the West Colorado Basin. On the opposite end of the spectrum, the Jordan Valley Basin has the lowest rate of secondary system utilization, 94.0% of outdoor water comes from the culinary system. However, Jordan Valley uses the second lowest amount (113 GPCD) and proportion (62.0%) of residential water that is used outside, ranking only behind the West Desert Basin.

Water Use within a Basin
There are also differences in water use patterns within a basin in the amount and proportion of outdoor residential use. Homeowners that are part of Salt Lake City Public Utility system (SLPU) have a lower level of outdoor water use, and secondary water use is insignificant. Residential customers in the rest of the Jordan Valley Basin are more reliant on secondary water than SLPU customers; they also use a larger percentage of their water outside.

The differences between utilization of water resources within the Jordan Valley Basin may have several root causes. First, residents of the SLPU service area don't have much access to secondary systems; therefore all water comes from the culinary system. Culinary water is more expensive, and SLPU has recently restructured the water rate system into an increasing block rate model that couples high water usage with increasingly high rates. This type of pricing structure is meant to discourage overuse of water for outdoor purposes. Beyond these measures, SLPU residential customers seem to be more receptive to ideas such as voluntary drought restriction measures and investment in xeric landscaping. Lot sizes may be another factor that should be considered.

A cursory examination of residential property for sale revealed an interesting trend in lot sizes. Properties listed for sale were grouped by two variables- location and lot size. Location was defined as Salt Lake City, other cities within Salt Lake County, and Utah County. Lot sizes were placed into categories by 0.10 of one acre increments. This data does not include homes that are for sale by owner, which are especially prevalent in Utah County. Therefore the data on houses in Utah County may not be representative of all homes for sale within the county. Also, condominiums, townhouses and other multi-family units for sale are included in the category 0.0 to 0.9. The decision to include these dwellings was made because most multi-family homes do have common landscaped areas and lawns that draw on municipal water. However, there were also some single-family detached dwellings in all three areas that were situated on lots less than 0.10 of an acre. Within Salt Lake City, 3.9% of total homes for sale had lot sizes smaller than 0.10 of an acre. For the rest of the county, 2.3% of total homes for sale had lot sizes smaller than 0.10 of an acre. In Utah County, it was 1.3% of the total.

The percent of Salt Lake City lots that are between 0.10 and 0.19 of an acre are significantly higher than other cities in the county or in Utah County. Additionally, Salt Lake City has a smaller percentage of lots that are above 0.20 of an acre than the other two areas. It also appeared that houses of higher price ranges ($350,000 and up) were just as likely in Salt Lake City to be on small lots as lower priced houses. This was not true in the rest of Salt Lake County or in Utah County. Both the lot size and price factors are important. Smaller lots require less water, and wealthier homeowners are more likely to have the monetary ability to install xeric landscaping.

Combining this information with the water use data implies that smaller lot sizes lead to a lower proportion of outside water use. However, smaller lots also usually mean more households (water users) per acre, and it is not clear whether this increased density would lead to aggregate reductions in water use.

Pricing
In most counties, there is one large water system with the majority of connections and several smaller systems. The largest system is the Salt Lake Public Utilities which has 89,126 connections. The next largest system is the Sandy Water System, which has 26,411 connections. Additionally, while tax revenue accounts for 11.8% of overall statewide revenue, it varies from county to county. Tax revenue as a percentage of total revenue is the highest in Box Elder County at 39.4%. Kane County is excluded from the ranking, because it has one small water system using tax revenue as its major funding source.

One of the concerns around water systems that collect tax revenue in addition to billing for water use is that the system can charge customers less than the full cost of the water and use tax revenue to make up the difference. In this broad analysis, it does not seem to be the case when comparing county averages. Of the 13 counties that have an average monthly cost higher that the statewide average, only five were counties with water systems that collect tax revenue.

Water Sources in Utah and the West
Water is classified as having two sources of origin. Water comes from either surface sources (lakes, rivers, and streams) or from ground sources (springs and wells). Ground water tends to be of a higher quality and requires less treatment to reach drinking water quality. In Utah, 78.6% of total water withdrawals are from surface sources. However, for public drinking water supplies, 57.1% comes from ground water sources; this ranks the state 10th in the nation for the percentage of public drinking water that originates from ground sources. Colorado is the lowest ground water user in the nation; only 6% of Colorado's publicly supplied drinking water originates from ground sources. Conversely, both Idaho and New Mexico receive over 88% of their drinking water from ground sources, ranking them thrid and fifth respectively. In the case of New Mexico, there is little potable surface

water to utilize in public systems. In Idaho, it appears to be a case of water rights as most of the surface water in the state is used for irrigation.

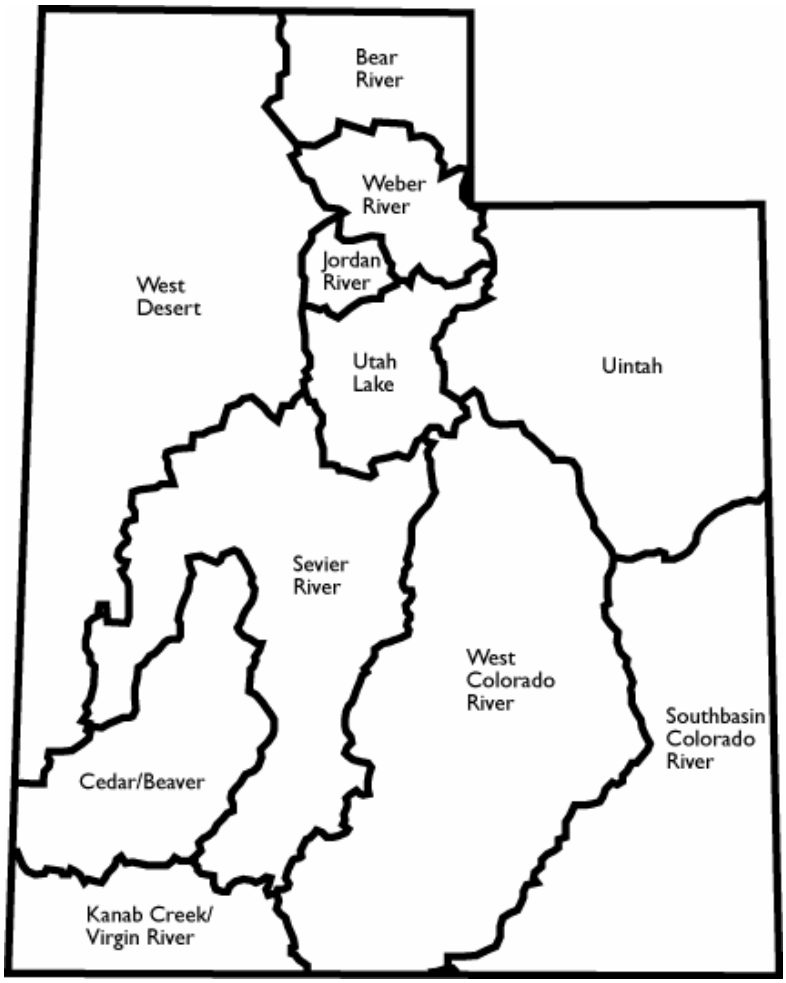
Nationally, there seems to be an increase in the proportion of ground water used. There are concerns with ground water usage because this water is not as readily replenished as surface water, and over-usage of this resource may dry up deep aquifers. In the Intermountain West as well as in Utah, ground water usage has fluctuated over the time series with a peak in 1990. Both indicators suggest there is reason to be concerned about overuse of groundwater sources, and that perhaps groundwater is being used to cushion residents in western states from the full impact of drought conditions.

Currently, the best way to gauge groundwater use conditions is to examine the parts of Utah that are open or closed to new groundwater claims through the Division of Water Rights. There are certain portions of the state in which new water rights claims for groundwater can be filed, there are also areas that have restrictions on those filings and some which are closed to new claims. The areas closed to new claims include the Wasatch Front and areas in the southwest, both of which are experiencing population growth. Restricted areas include most of eastern Utah. Contained in the restricted area are the source springs for many of the rivers and streams that feed into the surface water supply. The areas of the state that are still open to groundwater claims are in the western portion of the state, where water is scarce and may not be potable. In addition, groundwater mining in southwestern Utah is causing water levels to drop faster than they can be replenished.

Conclusion

Utah's water use has been largely dependent on the drought cycle. A comparative analysis of drought conditions versus statewide water usage confirms that in times of scarce precipitation, residents rely more heavily on water stored in reservoirs and from deep wells. Much of Utah's M&I water is still used outdoors; however, more of it is coming from secondary systems. Water usage, outdoor use specifically, varies from basin to basin. Even within basins, there can be significantly different patterns of water usage. Finally, Utah's reliance on groundwater in the municipal system may be affected as the population increases and continues to move into urban and suburban areas.

Figure 72
Water Basins in Utah

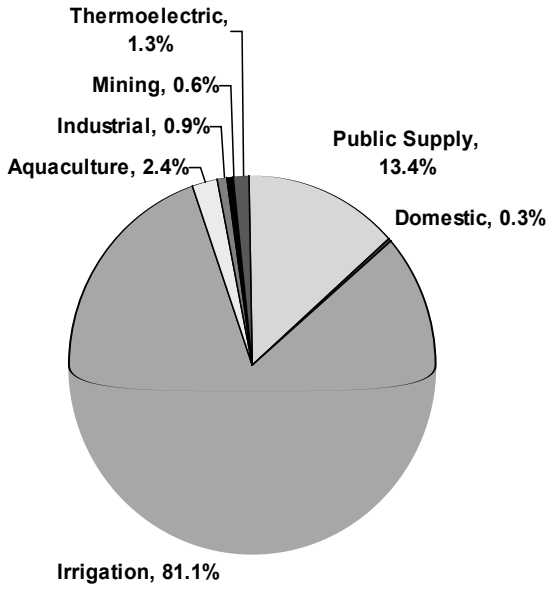


Source: Utah Division of Water Resources

Figure 73
Groundwater Permitting Availability in Utah

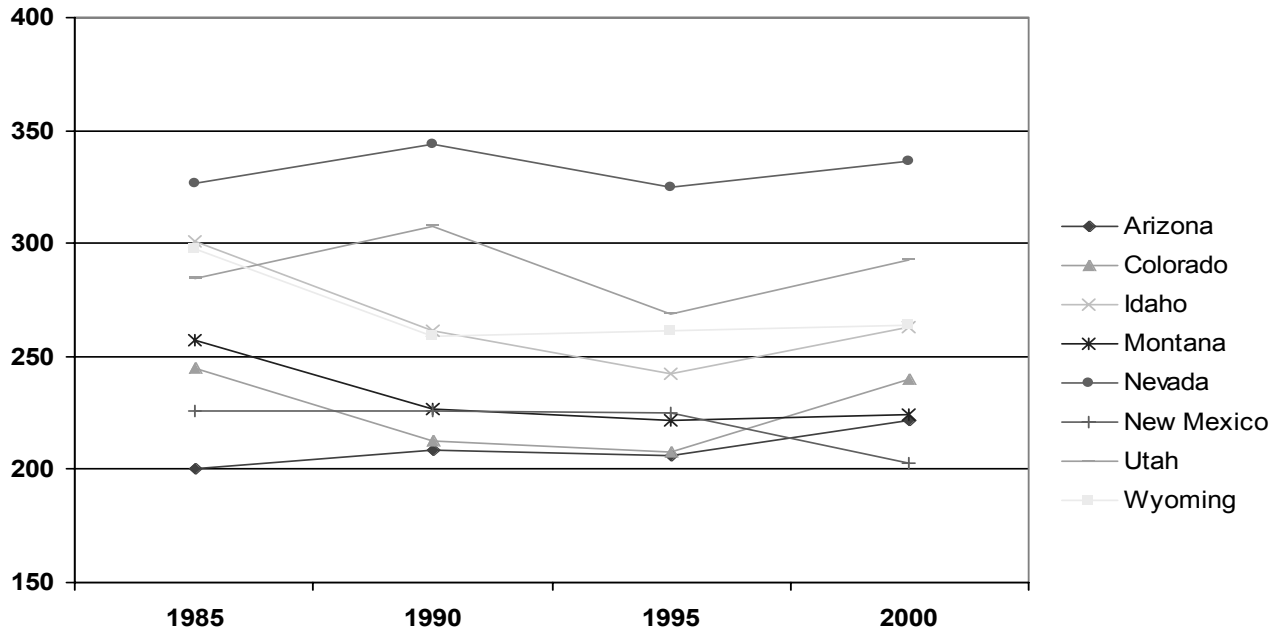
Source: Utah Division of Water Rights

Figure 74
Utah Fresh Water Use by Category: 2000



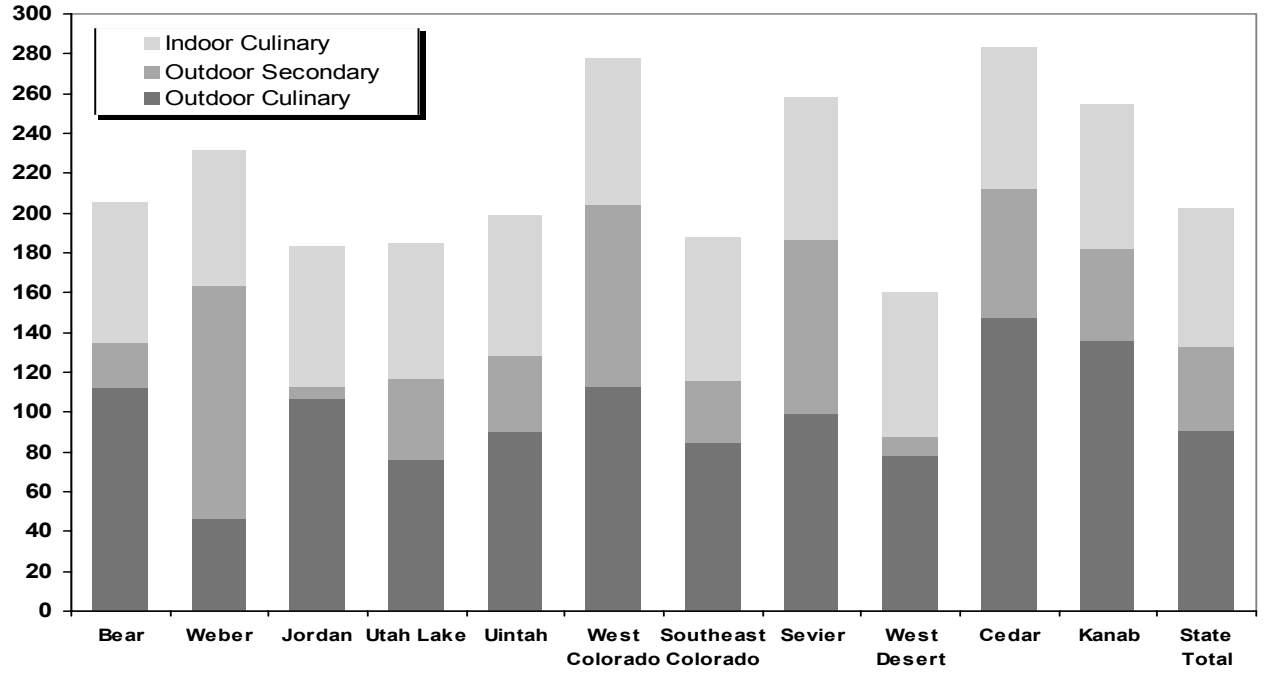
Source: United States Geological Survey (USGS)

Figure 75
Intermountain States Water Use (Gallons Per Capita Daily)



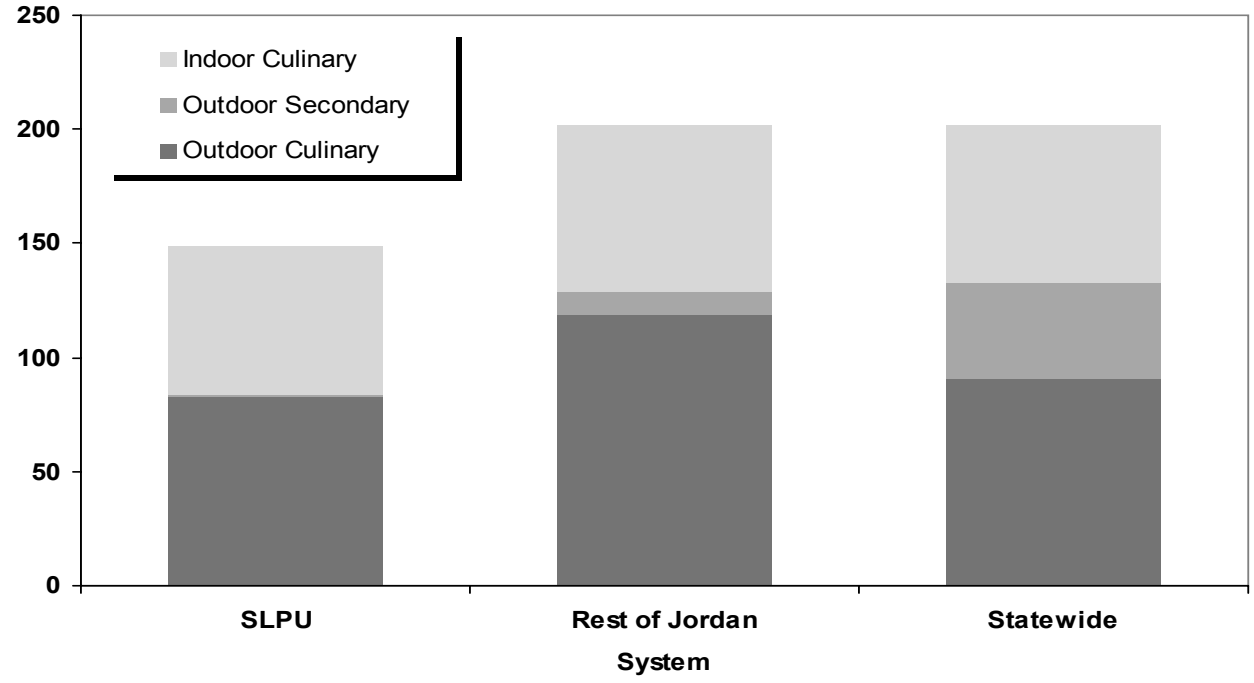
Source: USGS

Figure 76
Indoor & Outdoor Residential Water Use by Basin: 2000 (Gallons Per Capita Daily)



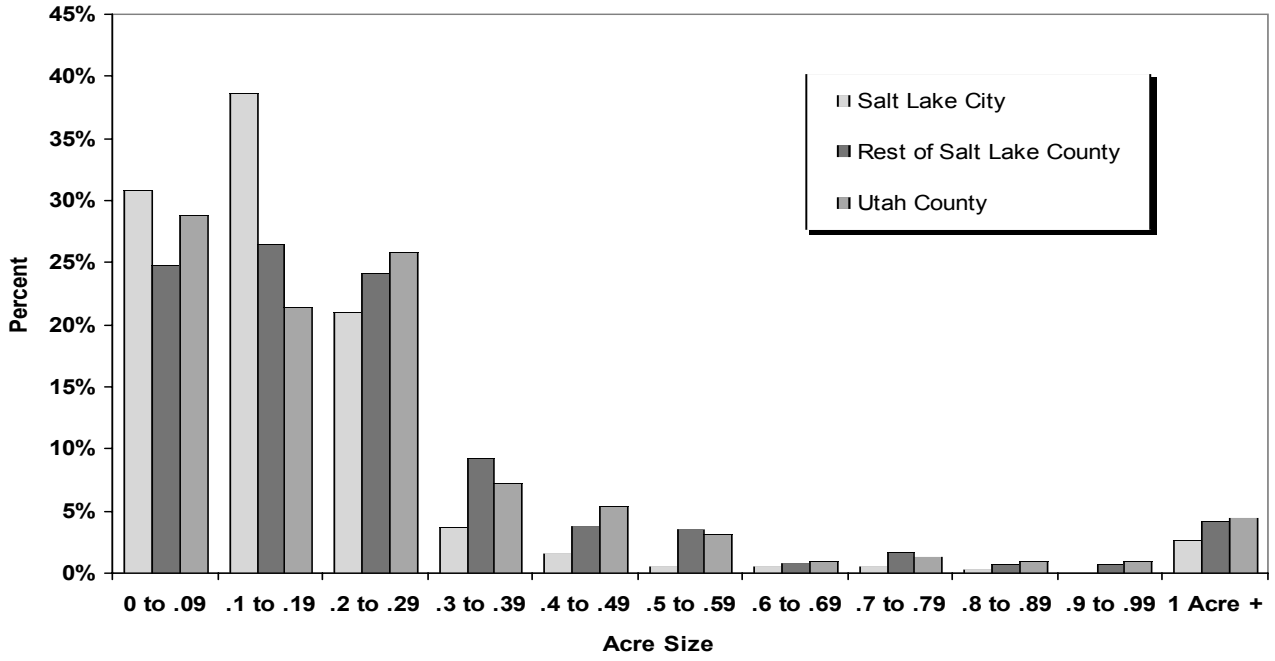
Source: Utah Division of Water

Figure 77
Utah Indoor & Outdoor Residential Water Use: 2000 (Gallons Per Capita Daily)



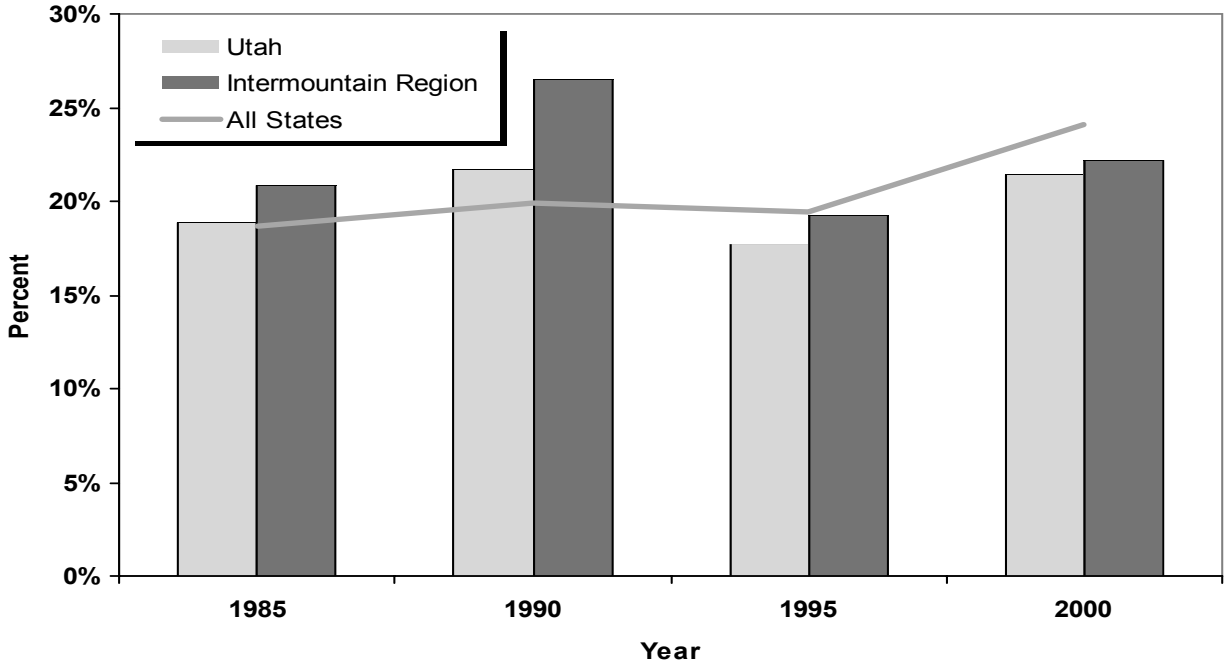
Source: Ibid

Figure 78
Residential Property for Sale by Lot Size



Source: Wasatch Front Regional Multiple Listing Service (MLS), calculation by Utah Foundation

Figure 79
Utah, Intermountain Region and U.S. Groundwater Use as a Percent of Total Water Withdrawals: 1985-2000



Source: USGS

Table 88
Palmer Indices and Utah Foundation Statewide Drought Rating for Selected Years

	Division 1-West Desert*			Division 2-Southwest Corner		
	Moderate	Severe	Extreme	Moderate	Severe	Extreme
1985	1	0	0	0	0	0
1990	0	5	7	4	6	2
1995	2	0	0	0	0	0
2000	5	3	4	5	5	0
2002	0	4	3	0	3	9

	Division 3-Wasatch Front			Division 4-South Central		
	Moderate	Severe	Extreme	Moderate	Severe	Extreme
1985	0	0	0	0	0	0
1990	0	0	12	0	2	10
1995	0	0	0	0	0	0
2000	4	3	0	1	0	0
2002	10	2	0	5	2	3

	Division 5-Northeast Mtn.			Division 6-Central Highlands		
	Moderate	Severe	Extreme	Moderate	Severe	Extreme
1985	0	0	0	0	0	0
1990	6	6	0	2	10	2
1995	0	0	0	0	0	0
2000	5	0	0	4	3	0
2002	10	2	0	0	6	6

	Division 7-Southeastern			Statewide Total			
	Moderate	Severe	Extreme	Moderate	Severe	Extreme	**Drought Rating**
1985	0	0	0	1	0	0	**0.6**
1990	1	4	7	13	33	40	**85.6**
1995	0	0	0	2	0	0	**1.2**
2000	5	4	0	29	18	4	**38.4**
2002	5	3	4	30	22	25	**67.9**

*2002 data for Division 1 is incomplete
Source: Utah Division of Water Resources

Table 89
Utah Municipal Pricing Structure Comparisons by County

County	Avg. No. of Connections	Median No. of Connections	No. of Systems that Collect tax revenue	Percent of Systems that Collect tax revenue	Avg. Monthly Cost	Avg. Monthly Cost w/o Tax Revenue	Difference in Cost	Taxes as a Percent of Avg. Monthly Cost
Beaver	na	na	na	na	na	na	na	na
Box Elder	657	240	1	5.6%	$40.82	$24.73	$16.09	39.4%
Cache	1,507	563	0	0.0%	26.56	26.56	0.00	0.0%
Carbon	1,550	1,113	2	40.0%	30.76	29.24	1.52	4.9%
Daggett	na	na	na	na	na	na	na	na
Davis	4,364	2,971	1	8.3%	20.48	20.15	0.33	1.6%
Duchesne	378	349	2	40.0%	45.01	39.67	5.34	11.9%
Emery	989	428	1	25.0%	29.14	25.38	3.76	12.9%
Garfield	335	109	1	20.0%	21.73	21.41	0.33	1.5%
Grand	996	1,168	1	33.3%	41.92	41.68	0.25	0.6%
Iron	861	132	0	0.0%	28.11	28.11	0.00	0.0%
Juab	611	285	0	0.0%	38.54	38.54	0.00	0.0%
Kane*	363	64	3	50.0%	471.22	49.71	421.50	89.5%
Millard	373	246	0	0.0%	23.38	23.38	0.00	0.0%
Morgan	248	141	0	0.0%	39.19	39.19	0.00	0.0%
Piute	na	na	na	na	na	na	na	na
Rich	na	na	na	na	na	na	na	na
Salt Lake	13,459	3,940	2	14.3%	37.16	36.48	0.68	1.8%
San Juan	527	444	0	0.0%	46.47	46.47	0.00	0.0%
Sanpete	640	517	2	20.0%	26.87	25.14	1.74	6.5%
Sevier	463	220	0	0.0%	21.35	21.35	0.00	0.0%
Summit	860	335	1	14.3%	27.37	25.95	1.42	5.2%
Tooele	1,678	252	1	14.3%	21.36	21.25	0.11	0.5%
Uintah	1,067	630	4	66.7%	38.70	33.39	5.30	13.7%
Utah	4,138	1,532	0	0.0%	29.94	29.94	0.00	0.0%
Wasatch	839	127	0	0.0%	28.44	28.44	0.00	0.0%
Washington	1,180	268	0	0.0%	36.48	36.48	0.00	0.0%
Wayne	171	144	0	0.0%	19.46	19.46	0.00	0.0%
Weber	4,288	2,045	5	38.5%	25.22	23.97	1.25	5.0%
Statewide	2,442	389	27	11.8%	32.96	27.20	5.76	17.5%

*Kane County has one small (15 connections) water system that uses tax revenue as its major funding source. This system skews the figures for Kane County.
Source: Utah Division of Drinking Water

Table 90
Municipal & Industrial Water Use by State 1985-2000

State or Region	Per Capita Water Use (gallons per day) 1985	1990	1995	2000	% Change
Alabama	175	193	237	233	-1.7%
Alaska	218	245	213	190	-10.8%
Arizona	200	209	206	222	7.8%
Arkansas	153	174	191	181	-5.2%
California	219	229	184	203	10.3%
Colorado	245	213	208	240	15.4%
Connecticut	135	140	155	159	2.6%
Delaware	150	161	158	154	-2.5%
Florida	172	172	170	174	2.4%
Georgia	179	187	195	186	-4.6%
Hawaii	181	225	191	219	14.7%
Idaho	301	262	242	263	8.7%
Illinois	181	184	175	161	-8.0%
Indiana	157	151	156	150	-3.8%
Iowa	164	154	173	159	-8.1%
Kansas	158	167	159	166	4.4%
Kentucky	146	166	148	150	1.4%
Louisiana	161	171	166	191	15.1%
Maine	130	154	141	140	-0.7%
Maryland	217	203	200	189	-5.5%
Massachusetts	144	130	130	126	-3.1%
Michigan	170	184	188	159	-15.4%
Minnesota	175	176	145	133	-8.3%
Mississippi	138	167	152	164	7.9%
Missouri	156	166	161	183	13.7%
Montana	257	227	222	224	0.9%
Nebraska	188	251	222	239	7.7%
Nevada	327	344	325	336	3.4%
New Hampshire	140	137	141	128	-9.2%
New Jersey	156	152	150	141	-6.0%
New Mexico	226	226	225	203	-9.8%
New York	180	183	185	150	-18.9%
North Carolina	172	169	162	177	9.3%
North Dakota	135	157	149	129	-13.4%
Ohio	160	143	153	154	0.7%
Oklahoma	184	193	194	214	10.3%
Oregon	214	212	234	207	-11.5%
Pennsylvania	196	189	171	145	-15.2%
Rhode Island	131	109	130	129	-0.8%
South Carolina	142	166	200	179	-10.5%
South Dakota	146	137	146	149	2.1%
Tennessee	171	175	176	170	-3.4%
Texas	194	192	187	215	15.0%
Utah	285	308	269	293	8.9%
Vermont	155	117	149	166	11.4%
Virginia	138	151	158	136	-13.9%
Washington	271	221	266	208	-21.8%
West Virginia	115	136	133	146	9.8%
Wisconsin	184	174	169	172	1.8%
Wyoming	298	259	262	264	0.8%
Intermountain Region Average	267	256	245	256	4.4%
U.S. Average	184	186	184	183	-0.6%

Source: USGS