Water-Related
Land Use
Inventories

UTAH

Sevier River Basin 2010 Inventory

A Water-Related Land Use Inventory Report of the Sevier River Basin

Prepared by:

Utah Department of Natural Resources
Division of Water Resources

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This report was prepared by Technical Services staff. The land use data summarized in this report were gathered under the direction of Todd Adams, Assistant Director, and supervised by Eric Edgley, Section Chief, Technical Services, Utah Division of Water Resources.

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SEVIER RIVER BASIN
WATER-RELATED LAND USE INVENTORY

INTRODUCTION

Authority

In the 1963 general session, the Utah State Legislature charged the Division of Water Resources with the responsibility of developing a State Water Plan. This plan is to coordinate and direct the activities of state and federal agencies concerned with Utah's water resources. As a part of this objective, the Division of Water Resources collects water-related land use data for the entire state. This data includes the types and extent of irrigated crops as well as information concerning phreatophytes[I], wet/open water areas, dry land agriculture and residential/industrial areas.

The data produced by the water-related land use program are used for various planning purposes. Some of these include: determining cropland water use, evaluating irrigated land losses and conversion to urban uses, planning for new water development, estimating irrigated acreages for any area, and developing water budgets. Additionally, the data are utilized by many other state and federal agencies.

Previous Methods

The land use inventory methods used by the division in conducting water-related land use studies have varied with regard to the procedures used and the precision obtained. During the 1960s and 70s, inventories were prepared using large format vertical -aerial photographs supplemented with field surveys to label boundaries, vegetation types, and other water use information.

After identifying crops and labeling photographs, the information was transferred onto a base map and then planimetered[II] or "dot-counted" to determine the acreage. Tables for individual townships and ranges were prepared showing the amount of land in each land use category within each section. Data were then available for use in preparing water budgets.

In the early 1980s, the division began updating its methodology for collecting water -related land use data to take advantage of the rapidly growing fields of Remote Sensing and computerized Geographic Information Systems (GIS).

For several years during the early 1980's, the division contracted with the University of Utah Research Institute, Center for Remote Sensing and Cartography (CRSC), to prepare water-related land use inventories. During this period, water-related land use data was obtained by using high altitude color infrared photography and laboratory interpretation, with field checking.

In March 1984, several division staff members visited the California Department of Water Resources to observe its methodology for collecting water-related land use data for state water planning purposes.

Based on its review of the California methodology and its own experience, the division developed a water-related land use inventory program. This program included the use of 35mm slides, United States Geological Survey (USGS) 7-1/2 minute quadrangle maps, field-mapping using base maps produced from the 35mm photography and a computerized GIS to process, store and retrieve land use data.

Areas for survey were first identified from previous land use studies and any other available information. The identified areas

were then photographed using an aircraft carrying a high quality 35mm single lens reflex camera mounted to focus along a vertical axis to the earth. Photos were taken between 6,000 and 6,500 feet above the ground using a 24mm lens. This procedure allowed each slide to cover a little more than one square mile with approximately 30 percent overlap on the wide side of the slide and 5 percent on the slide's narrow side.

The slides were then indexed according to a flight-line number, slide number, latitude and longitude. All 35mm slides were stored in files at the division offices and cataloged according to township, range and section, and quadrangle map location.

Water-related land use areas were then transferred from the slide to USGS 7-1/2 minute quadrangle maps using a standard slide projector with a 100-200mm zoom lens. This step allowed the technician to project the slide onto the back of a quadrangle map. The image showing through the map was adjusted to the map scale with the zoom lens. Field boundaries and other water-use boundaries were then traced on the 7-1/2 minute quadrangle map.

Next, a team was sent to use the map in the field to check the boundaries and current year land use field data on the 7-1/2 minute quadrangles.

The final step was to digitize and process the field data using ARC/INFO software developed by Environmental Systems Research Institute (ESRI).

Present Methodology

Starting in 2000 with the land use survey of the Uintah Basin, the division further improved its land use program by using digital data for the purposes of outlining agricultural and other land cover boundaries. The division uses satellite data, USGS Digital Orthophoto Quadrangles (DOQs), National Agricultural Imagery Program (NAIP), and other digital images in a heads-up digitizing[III] mode for this process. This allows the division to use multiple technicians for the digitizing process.

Digitizing is done as line and polygon files using ArcMap 9/10 or ArcView 3.2 with a satellite image or DOQ image as a background with other layers added for reference. Boundary files are created in logical groups so that the process of edge-matching along quad lines is eliminated and precision is increased. All boundaries of individual agricultural fields, urban areas, and significant riparian areas are precisely digitized.

Once the process of boundary digitizing is done, boundary line files are converted to polygons and loaded onto tablet PCs. Field crews are then sent to label and field check the boundary file as well as the crop or land cover type for each polygon. Each tablet PC is attached to a GPS unit for real-time tracking to continuously update the field crew's location during the field labeling process. This improved process has saved the division much time and money and even greater savings will be realized as the new statewide field boundaries are completed. When the time comes to re-inventory a basin, existing boundaries will be used and will only be modified in areas where they have actually changed.

Once processed and checked, the data is filed in the State Geographic Information Database (SGID) maintained by the State Automated Geographic Reference Center (AGRC). Once in the SGID, the data becomes available to the public. At this point, the data is also ready for use in preparing various planning studies.

In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Areas not inventoried are mainly desert, rangeland and forested areas.

Wet/open water areas and dry land agriculture areas are mapped if they are within or border irrigated lands. As a result, the numbers of acres of wet/open water areas and dry land agriculture reported by the division may not represent all such areas in a basin or county.

During land use inventories, the division uses 11 hydrologic basins as the basic collection units. County data is obtained from the basin data. The water-related land use data collected statewide covers more than 2,700,000 acres of dry and irrigated agricultural land. This represents about 5 percent of the total land area in the state.

SEVIER RIVER BASIN
WATER-RELATED LAND USE DATA

Basin Description

The Sevier River Basin covers approximately 10,575 square miles (about 12.5 percent of Utah) in the south-central portion of the state. The northern boundary generally follows the Sheeprock Mountains and the Tintic Range. Landforms such as the Wasatch, Awapa, Aquarius and Paunsaugunt Plateaus. The Pink Cliffs and Tushar Mountains surround the eastern bend of the basin. The Crickett, Beaver, San Francisco and Wah Wah Mountains along with the House Range help comprise the boundary of the western bend of the basin.

The Sevier River Basin covers all or part of eight Utah counties: Garfield, Iron, Juab, Kane, Millard, Piute, Sanpete and Sevier. Furthermore, the basin divides into the Delta, East Fork Sevier, Fillmore, Gunnison, San Pitch, Sevier, Sevier Lake and Upper Sevier subareas. .

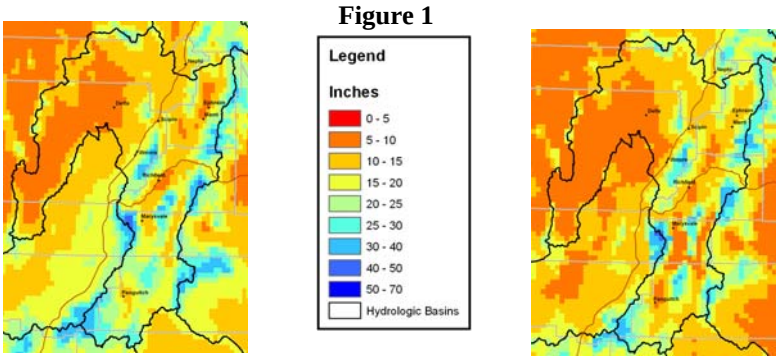
The shape of the basin generally resembles a large horseshoe and is made up of high plateaus, narrow valleys and broad deserts. The mountains of the basin generally trend from southwest to northeast. Valleys in the basin are generally long and narrow, except where the river flows into Sevier Lake. Drainage in the basin is primarily to the north and west. However, because the basin offers no outward drainage, most precipitation stays within the basin.

The climate varies widely with the physiography of the basin. The basin records a low elevation of 4,519 feet near Delta and a high elevation of 12,169 feet at Delano Peak near Marysvale. Precipitations range from 6 to 13 inches per year in the valleys to more than 40 inches in the mountains (Figure 1). In addition, the higher elevations experience short, mildly warm summers and long, cold winters. At lower elevations, temperatures and seasons are more moderate and less varied.

Although a current 2010 population estimate for the basin is hard to come by (2010 Census data has yet to be released), based on previous estimates, the population is roughly 61,000 within the Sevier River

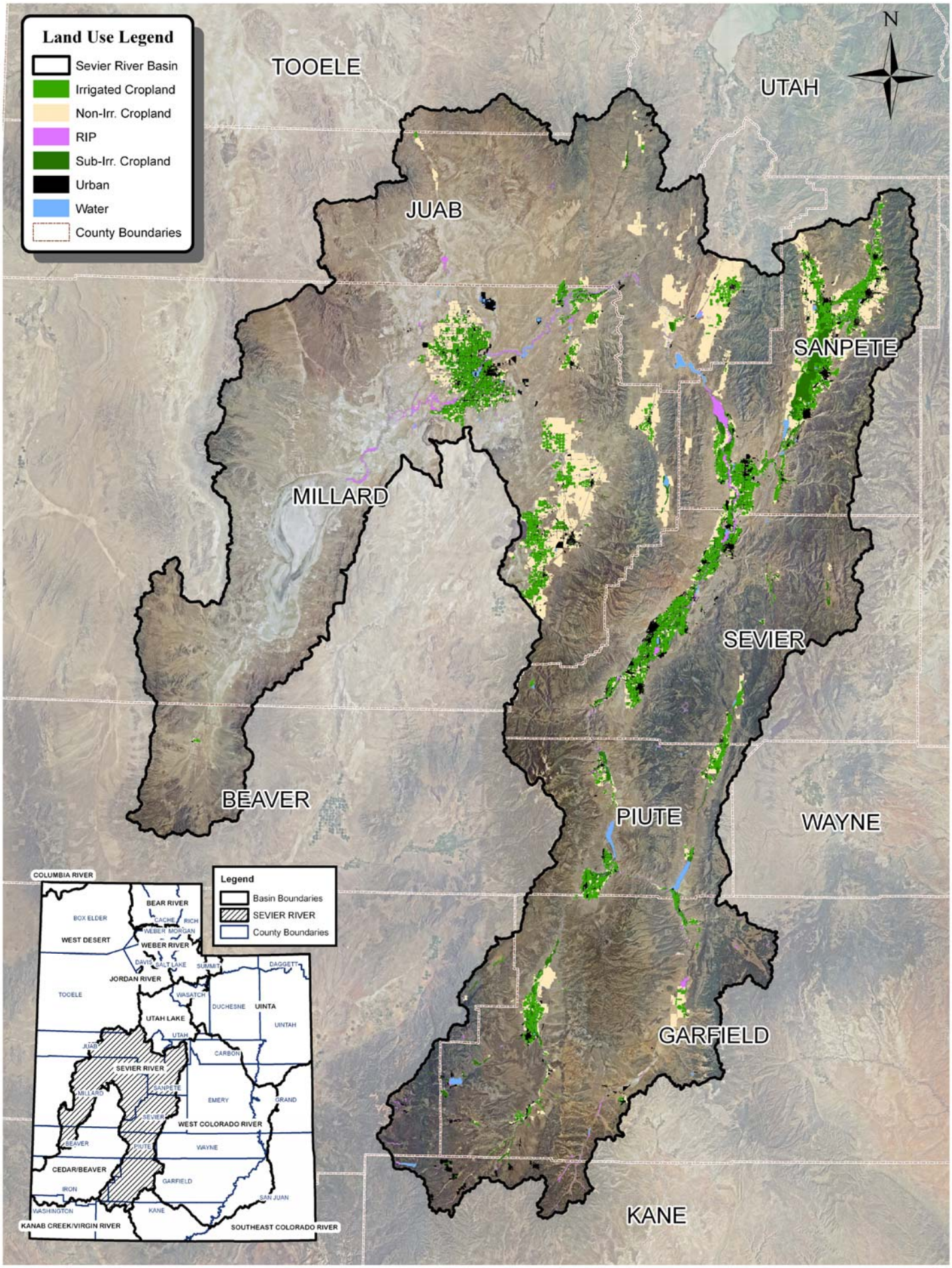
Figure 1

Annual Precipitation For 2010



Average Annual Precipitation 1971 to 2000

Figure 2 Mapped Water-Related Land Use in 2010 and Basin Location



Basin. Most of that number is spread throughout the basin in small farm communities. The largest of these farm communities is Richfield, located in the middle of the eastern bend of the basin. Other notable towns include Delta, Fillmore, Gunnison, Manti, Monroe, Panguitch and Salina. A notable feature of the basin is the Jericho Sand Dunes.

Data Collection

The Division inventoried water-related land use in the Sevier River Basin during the summer of 2010. Previous inventories were done in 1983*, 1986, 1995, and 2004. In 2010, the division inventoried nearly 468,000 acres of agricultural land in the Sevier River Basin. This represents roughly 7 percent of the total land area in the entire basin. Figure 2 illustrates the water-related land use of the Sevier River Basin and shows that most of the agricultural land use of the basin occurs in long, narrow valleys near the water courses of the basin.

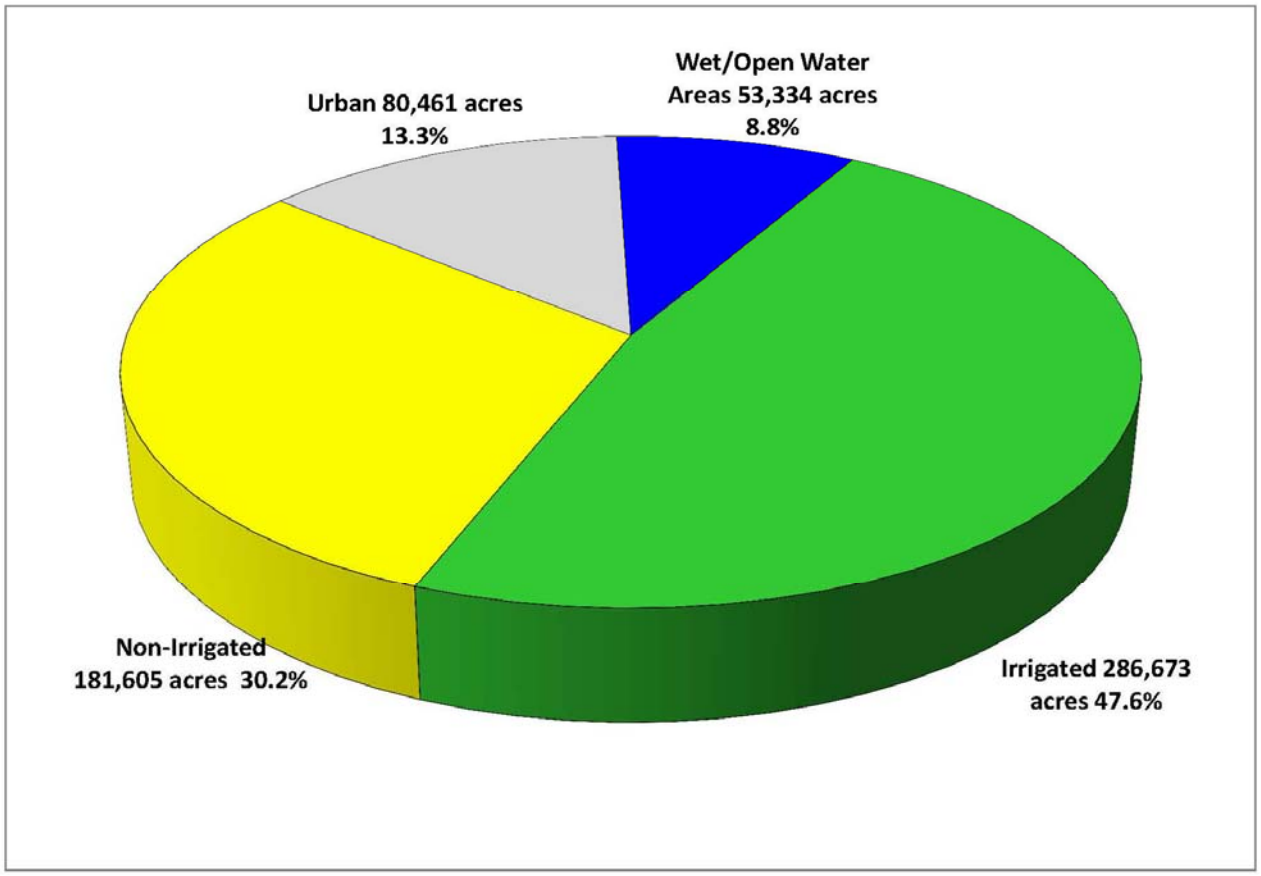
Data Summary

Figure 3 delineates four categories of water-related land use by percentage and acreage.

Of the 468,000 agricultural acres inventoried in 2010, 286,673 acres were irrigated lands (including land that was sub-irrigated), and 181,605 were non-irrigated

*The data collected in 1983 are available in book form at the Utah Division of Water Resources

Figure 3 Delineation of Water-Related Land Use Categories within the Sevier River Basin in 2010.



(including land that was fallow and idle). Other categories that were inventoried include: 53,334 of wet/open water areas (including reservoirs and mountain lakes), and 80,461 were residential, commercial, and industrial areas (including farmsteads and rural housing).

The division has further classified the water-related land use within the basin. Figure 4 represents data from the surface irrigated and sub-irrigated cropland categories. The data are broken down into 15 different subcategories.

Total basin acreage for irrigated lands, non-irrigated lands, wet/open water areas, and residential/industrial are presented in Table 1 by county. Table 2 provides a comparison of basin acreage totals by survey year.

Due to changes in methodology, improvements in imagery, and upgrades in software and hardware, increasingly more refined inventories have been made in each succeeding year of the Water-Related Land Use Inventory. While this improves the data we report, it also makes comparisons to past years difficult. Making comparisons between datasets is still useful; however, **increases or decreases in acres reported should not be construed to represent definite trends or total amounts of change up or down.** To estimate such trends or change, more analysis is required.

Figure 4 Breakdown of Irrigated Cropland within the Sevier River Basin in 2010.

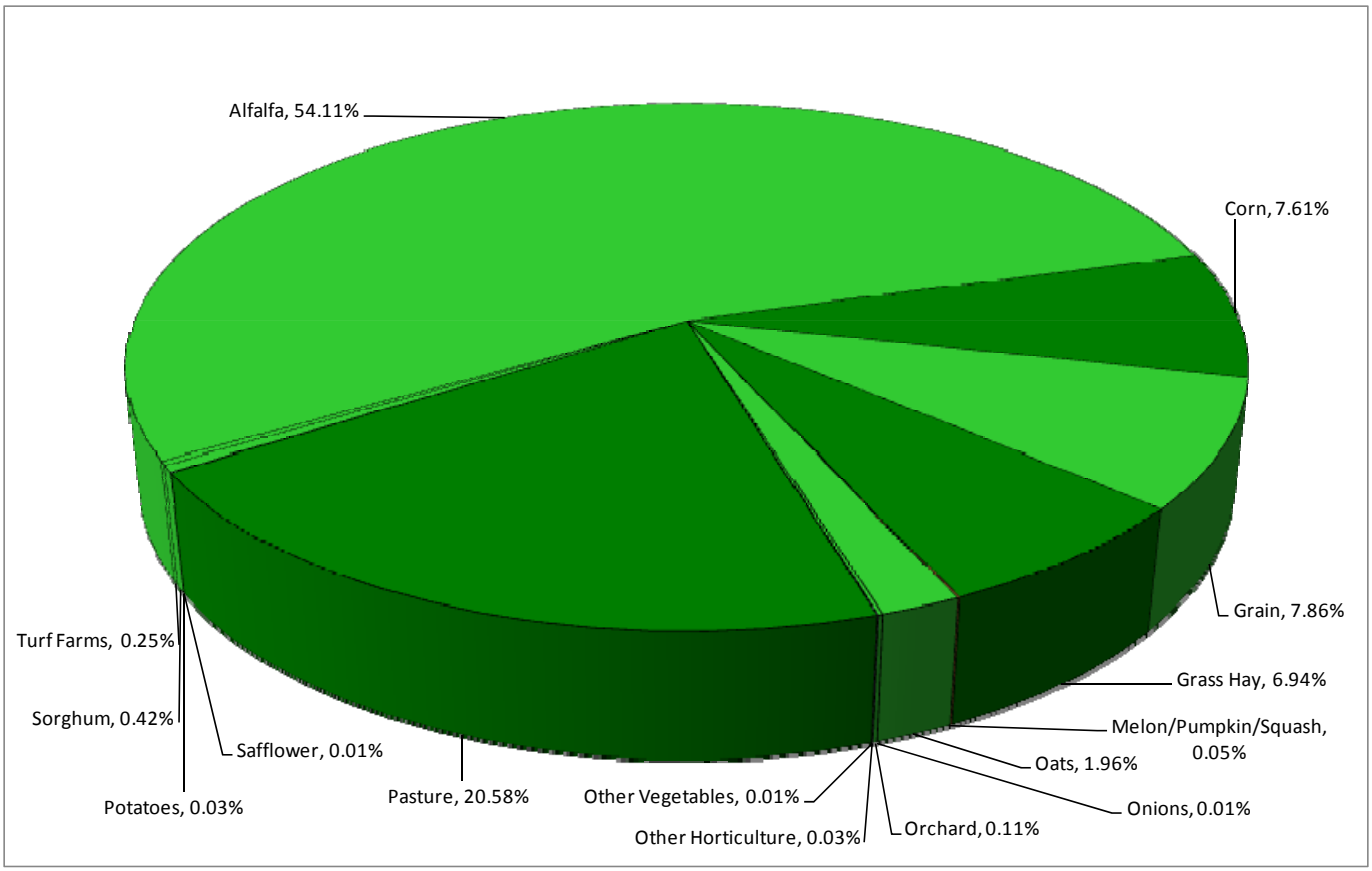


Table 1 Sevier River Basin Land Use Summary of Land Cover by County for 2010.

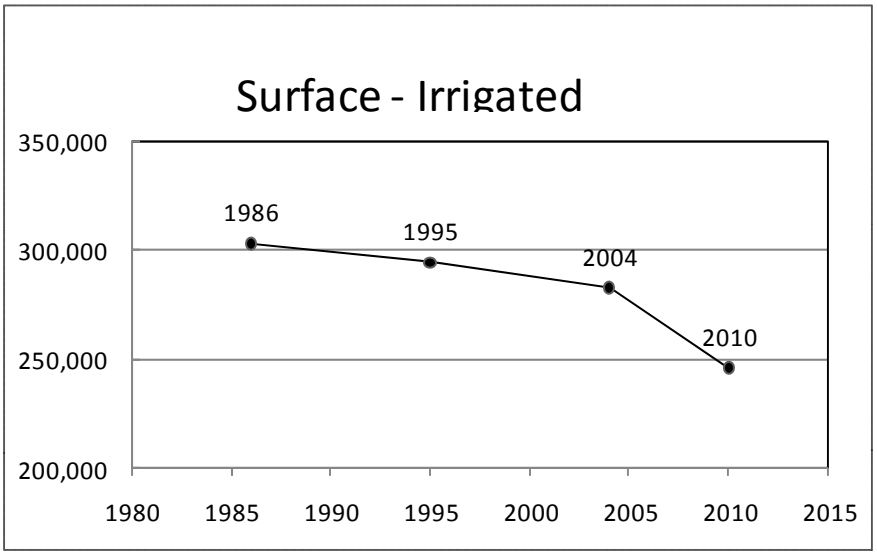
SEVIER RIVER BASIN LAND USE 2010 (Acres)											
Category	**Cover**	**Beaver**	**Garfield**	**Iron**	**Juab**	**Kane**	**Millard**	**Piute**	**Sanpete**	**Sevier**	**Total**
Surface-Irrigated											
	Alfalfa	227	5,747	0	4,191	0	58,515	7,030	34,072	23,213	132,995
	Beans	0	0	0	0	0	8	0	0	0	8
	Corn	0	0	0	544	0	9,639	139	3,713	4,679	18,714
	Grain	0	138	0	2,064	0	11,508	762	3,501	1,356	19,330
	Grass Hay	0	2,203	0	0	0	762	2,676	9,595	1,831	17,068
	Melon/Pumpkin/Squash	0	0	0	0	0	0	2	119	2	122
	Oats	0	988	0	0	0	1,164	56	2,142	477	4,826
	Onions	0	0	0	0	0	0	0	0	19	19
	Orchard	0	0	0	246	0	10	0	5	13	275
	Other Horticulture	0	0	0	0	0	0	0	56	13	69
	Other Vegetables	0	1	0	0	0	4	0	11	3	19
	Pasture	37	6,785	302	163	0	4,987	4,857	18,709	14,753	50,593
	Potatoes	0	50	0	0	0	0	25	3	1	79
	Safflower	0	0	0	0	0	0	0	23	0	23
	Sorghum	0	0	0	593	0	331	0	58	50	1,033
	Turf Farms	0	0	0	299	0	0	0	0	313	612
	Irrigation Method										
	Flood	0	6,592	302	988	0	55,503	9,276	23,310	33,837	129,808
	Sprinkle	264	9,320	0	7,113	0	31,425	6,271	48,698	12,887	115,978
	Subtotal	**264**	**15,912**	**302**	**8,100**	**0**	**86,928**	**15,547**	**72,008**	**46,724**	**245,786**
Sub-Irrigated											
	GrassHay-subirrigated	0	0	0	0	0	50	468	2,881	0	3,398
	Pasture-subirrigated	0	6,160	282	1,115	603	970	3,743	20,042	4,574	37,489
	Subtotal	**0**	**6,160**	**282**	**1,115**	**603**	**1,020**	**4,210**	**22,922**	**4,574**	**40,887**
	Irr. Total (Surface & Sub)	**264**	**22,072**	**584**	**9,216**	**603**	**87,947**	**19,757**	**94,930**	**51,298**	**286,673**
Non-Irrigated											
	Dry Alfalfa	0	0	0	359	0	105	0	834	7	1,305
	Dry Beans	0	0	0	51	0	0	0	59	0	111
	Dry Fallow	0	0	0	1,832	0	355	0	76	0	2,263
	Dry Grain/Seeds	0	0	0	11,479	0	1,411	15	1,772	0	14,676
	Dry Idle	0	418	0	5,805	0	29,181	319	4,211	176	40,111
	Dry Oats	0	0	0	0	0	0	0	57	0	57
	Dry Pasture	0	2,936	0	18,798	0	30,612	1,483	14,600	1,358	69,789
	Dry Safflower	0	0	0	0	0	40	0	16	0	57
	Fallow-Irrigated Land	0	6	0	1,444	0	3,528	384	659	266	6,287
	Idle-Irrigated Land	104	1,450	0	1,108	0	26,324	2,354	7,017	8,593	46,950
	Subtotal	**104**	**4,811**	**0**	**40,877**	**0**	**91,555**	**4,555**	**29,302**	**10,399**	**181,605**
Other Non-Irrigated											
	Range Pasture	0	12,214	308	21,003	28	34,195	3,232	28,687	3,336	103,003
Wet/Open Water Areas											
	Riparian	13	2,672	1,140	1,861	1,142	8,881	938	7,694	3,978	28,353
	Streams	0	893	0	571	7	2,739	908	707	1,140	6,965
	Reservoirs	1	1,498	12	2,635	31	2,615	4,541	2,395	1,181	14,910
	Lakes & Ponds	5	102	56	41	582	716	1	142	192	1,840
	Sewage Lagoon	0	60	0	0	3	233	0	216	370	882
	Evaporation Pond	0	0	0	0	0	254	1	130	0	385
	Subtotal	**19**	**5,225**	**1,208**	**5,108**	**1,765**	**15,437**	**6,390**	**11,285**	**6,861**	**53,334**
Residential/Industrial											
	Urban	50	5,626	257	2,429	4,019	28,096	3,083	19,710	15,420	78,691
	Urban Grass/Parks	0	133	0	24	0	624	41	549	400	1,770
	Subtotal	**50**	**5,758**	**257**	**2,453**	**4,019**	**28,720**	**3,124**	**20,259**	**15,819**	**80,461**
Total Land Use/Land Cover		**438**	**50,080**	**2,358**	**78,658**	**6,416**	**257,854**	**37,058**	**184,462**	**87,714**	**705,076**

Table 2 Comparison of Land Cover Totals by Inventory Year*

SEVIER RIVER BASIN LAND USE (Acres)	
Year/Catgory	Basin Total
1986 SEVIER RIVER BASIN LAND USE	
Surface-Irrigated	303,007
Sub-Irrigated	30,923
Non-Irrigated	107,102
Wet/Open Water Areas	49,922
Residential/Industrial	31,253
Total Land Use / Land Cover	522,207
1995 SEVIER RIVER BASIN LAND USE	
Surface-Irrigated	294,271
Sub-Irrigated	18,170
Non-Irrigated	79,537
Wet/Open Water Areas	72,793
Residential/Industrial	38,333
Total Land Use / Land Cover	503,104
2004 SEVIER RIVER BASIN LAND USE	
Surface-Irrigated	282,634
Sub-Irrigated	41,761
Non-Irrigated	292,270
Wet/Open Water Areas	187,660
Residential/Industrial	58,298
Total Land Use / Land Cover	862,622
2010 SEVIER RIVER BASIN LAND USE	
Surface-Irrigated	245,786
Sub-Irrigated	40,887
Non-Irrigated	181,605
Other Non-Irrigated	103,003
Wet/Open Water Areas	53,334
Residential/Industrial	80,461
Total Land Use / Land Cover	705,076

* Please refer to the word of caution on page 6 regarding comparisons between datasets.

Figure 5 Surface Irrigated Land Use Comparison Graph



Data Access

GIS data used in this summary may be downloaded from the Utah AGRC. Current land use datasets are available as a statewide layer or by county and are offered in shapefile and geodatabase formats. To download the most recent dataset, Go to:

http://www.water.utah.gov/Planning/landuse/index.htm

For past GIS datasets, Please contact Technical Services at the Division of Water Resources

Past Land Use Reports for this area and a PDF of this report can be found at
http://www.water.utah.gov/planning/landuse/publ.htm
Metadata is available at
http://www.water.utah.gov/planning/landuse/gisdata.htm
Additional Bear River Basin reports as well as many other reports can be found at
http://www.water.utah.gov/planning

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ftp://prism.oregonstate.edu//pub/prism/us/grids/ppt/2000-2009/us_ppt_2010.14.gz

GLOSSARY

I. Phreatophyte - A deep-rooted plant that obtains water from a permanent ground supply or from the water table.

II. Planimetered or dot-counted - process to determine acreage by assigning an acreage value to a “dot” based on map scale and then counting the number of “dots” within a specific boundary.

III. Heads-up digitizing - Manual digitization by tracing a mouse over features displayed on a computer monitor, used as a method of vectorizing raster data.