Water-Related
Land Use
Inventories

UTAH

Uintah Basin
2012 Inventory

A Water-Related Land Use Inventory Report of the Uintah Basin

Utah Department of Natural Resources
Division of Water Resources

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ACKNOWLEDGMENTS

This report was prepared by Aaron Austin, GIS Analyst. 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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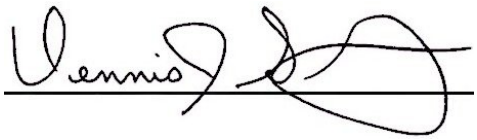

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UINTAH BASIN
WATER-RELATED LAND USE INVENTORY

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).

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 used 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 allowed the division to use multiple technicians for the digitizing process.

Digitizing was done as line and polygon files using ArcView 3.2 with a satellite image, DOQ or NAIP image as a background with other layers added for reference. Boundary files were created in logical groups so that the process of edge-matching along quad lines was eliminated and precision increased. Subsequent inventories were digitized in the ArcMap 9.x software versions.

Present Methodology

Using the latest statewide NAIP Imagery and ArcGIS 10, all boundaries of individual agricultural fields, urban areas, and significant riparian areas are precisely digitized.

Once the process of boundary digitizing is done, the polygons are loaded onto tablet PCs. Field crews are then sent to field check the crop and irrigation type for each agricultural polygon and label the shapefiles accordingly. 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.

Once processed and quality 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.

<u>Wet/open water areas and dry land</u>

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 2.6 million acres of dry and irrigated agricultural land. This represents about 5 percent of the total land area in the state.

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.

UINTAH BASIN
WATER-RELATED LAND USE DATA

Basin Description

The Uintah Basin covers approximately 10,890 square miles of the eastern portion of Utah. This represents about 12.8% of the land area of the state. The Utah/Wyoming state line forms much of the basin's northern and eastern boundary. Portions of the Wasatch Range and the Roan Cliffs comprise the southern and western boundaries of the basin.

The basin spans all or part of nine counties: Carbon, Daggett, Emery, Duchesne, Grand, Summit, Uintah, Utah* and Wasatch.

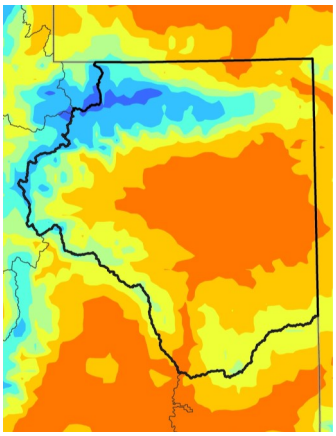
The Uintah Basin consists of a wide variety of valleys and mountains. The basin records a low elevation of 4,040 feet above mean sea level at a point along the Green River and gradually increases throughout several of the valleys into the higher mountain peaks of the Uinta Mountains. Kings Peak stands 13,528 feet above mean sea level. Other peaks along the same ridge include: Mt. Emmons at 13,440 feet, Gilbert Peak at 13,422 and Mt. Lovenia at 13,219 feet above mean sea level. [1]

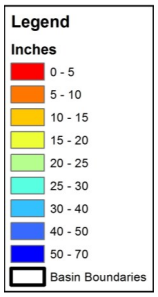
The climate varies widely with the physiography of the basin. Average annual precipitation ranges from approximately 6.5 inches in low lying areas to nearly 48 inches in the mountains.[2] In 2011, annual precipitation values for the Uintah Basin ranged from approximately 7.9 inches in low lying areas to 49.3 inches in the mountains.[2] Figure 1 compares precipitation in 2011 to the average from 1971 to 2000. Precipitation across the entire basin averaged 17.5 inches in 2011 compared to 15.9 inches from 1971 to 2000. [2]

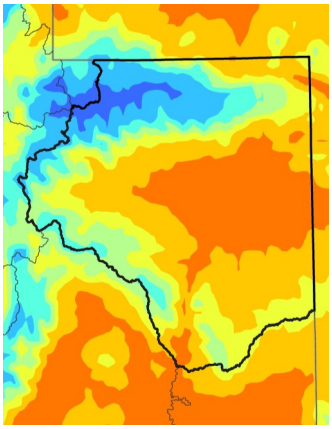
* Only a very small portion of Utah County resides in the Uintah Basin

Figure 1

Annual Precipitation For 2011

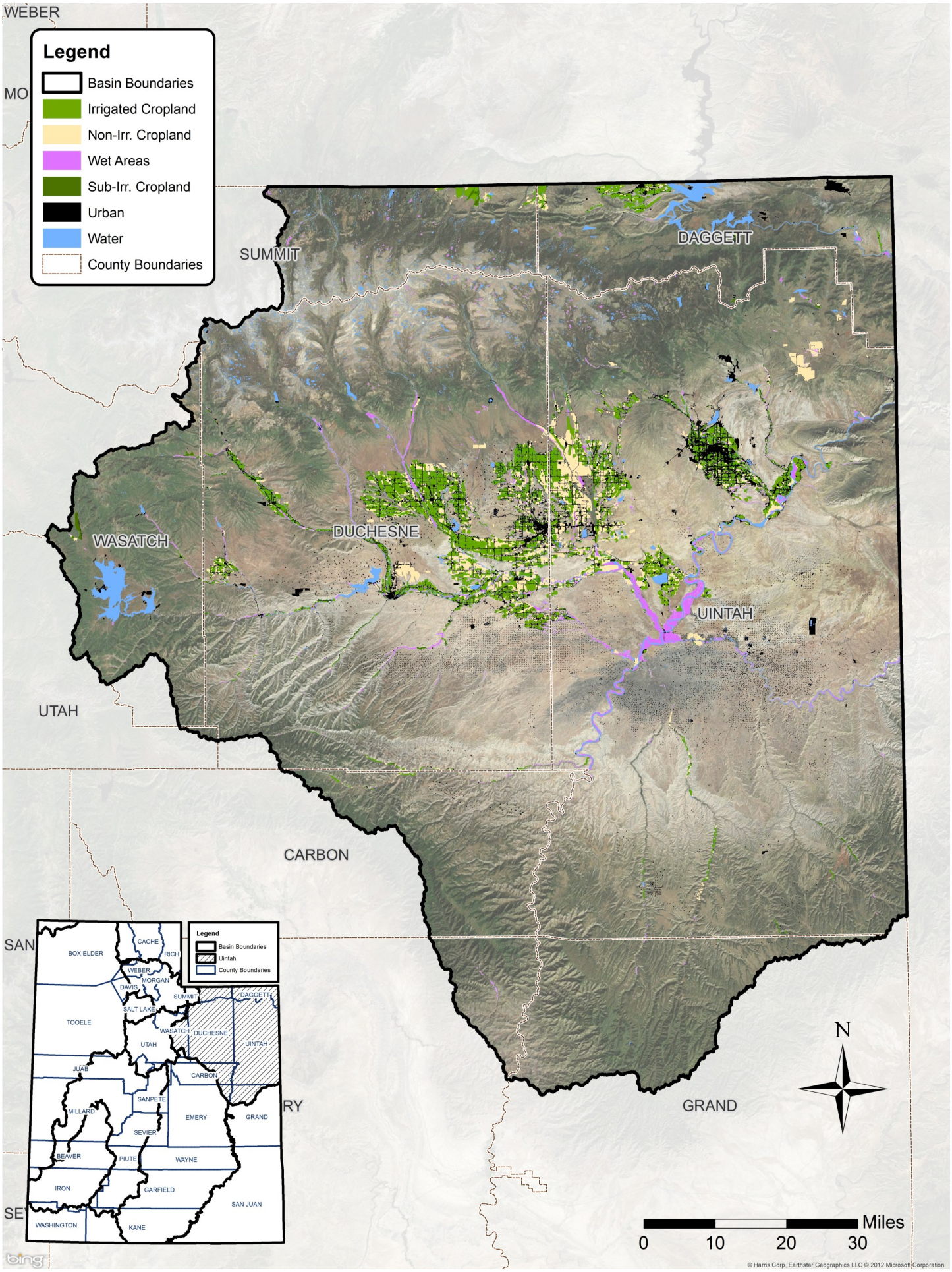






Average Annual Precipitation 1971 to 2000

Figure 2 Mapped Water-Related Land Use in 2012 and Basin Location



Normal January temperatures range from near zero degrees Fahrenheit to near 30 while normal July temperatures range from the low 40s to the low 90s. The basin experiences short, mild warm summers and long, cold winters at the higher elevations. At lower elevations, temperatures and seasons are more moderate and less varied.

Figure 2 locates the Uintah Basin with respect to the Utah state and county borders and illustrates the water-related land use of the basin. It also indicates that agriculture within the basin occurs mainly in the valley in and around Duchesne, Roosevelt and Vernal. Additionally, considerable acreage along the Duchesne, Green, Strawberry and White rivers is regularly farmed. The figure also depicts the county lines within the basin.

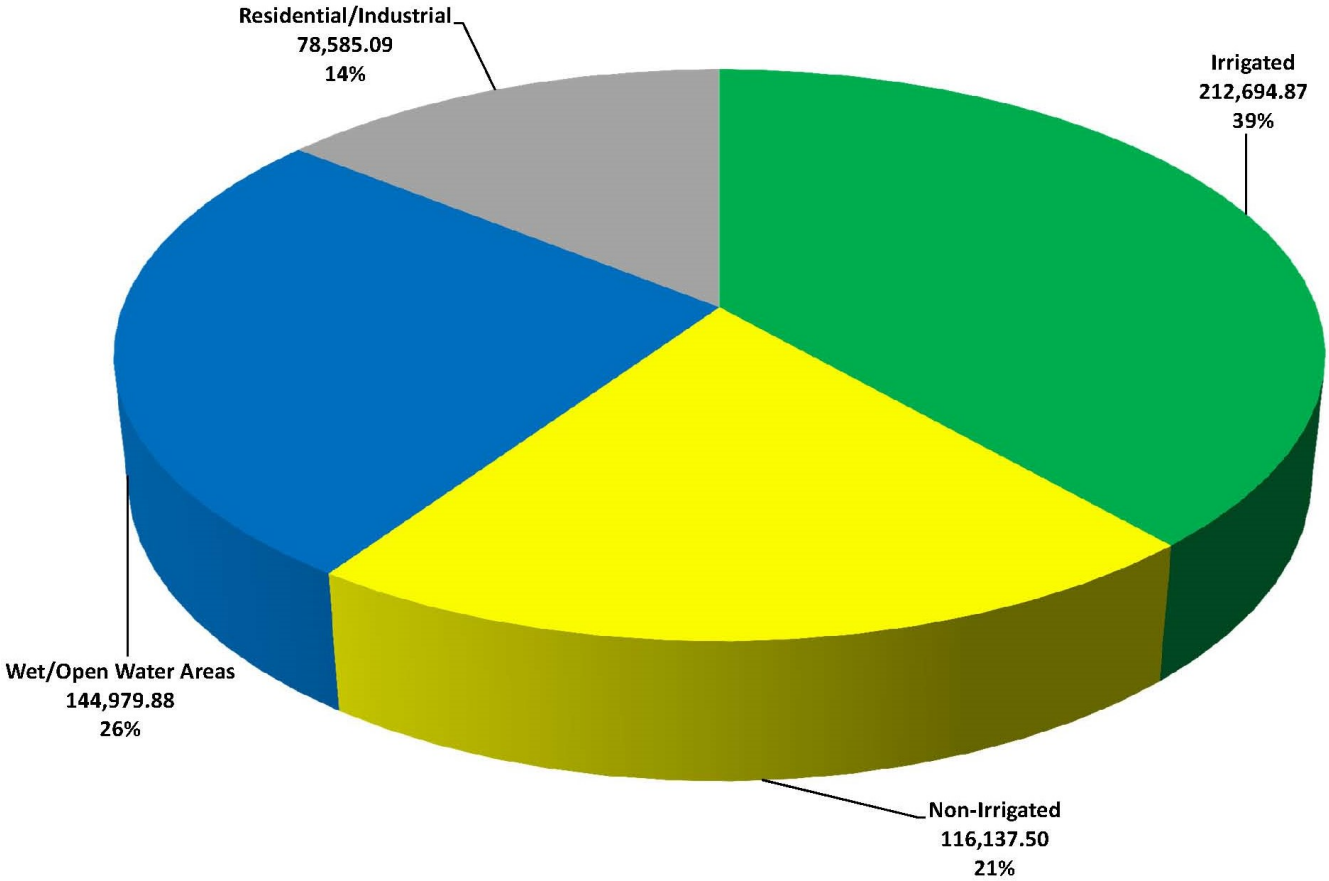
Data Collection

The Division inventoried water-related land use in the Uintah Basin during the summer of 2012. Previous inventories were done in 1971*, 1992, 2000 and 2006.

In 2012, the division inventoried nearly 590,000 acres of land in the Uintah Basin. This represents roughly 8.5 percent of the total land area in the entire basin.

* The data collected in 1971 are available in book form at the Utah Division of Water Resources

Figure 3 Delineation of Water-Related Land Use Categories within the Uintah Basin in 2012.



Data Summary

Of the nearly 590,000 acres inventoried in 2012, 212,695 were irrigated lands (including land that was sub-irrigated), 116,138 were non-irrigated (including land that was fallow and idle), 144,980 were wet/open water areas (including reservoirs and mountain lakes), and 78,585 were residential/industrial areas (including farmsteads and rural housing).

Figure 3 delineates the four categories of water-related land use listed above by percentage.

Figure 4 represents data from the surface irrigated and sub-irrigated cropland categories. The data are broken down into 16 different subcategories.

Table 1 presents the total basin acreage for irrigated lands, non-irrigated lands, wet/open water areas, and residential/industrial lands and Table 2 provides a comparison of acreage totals by survey year.

Figure 5 shows a comparison of surface irrigated lands through the subsequent land use inventories.

Figure 4 Breakdown of Irrigated Cropland within the Uintah Basin in 2012.

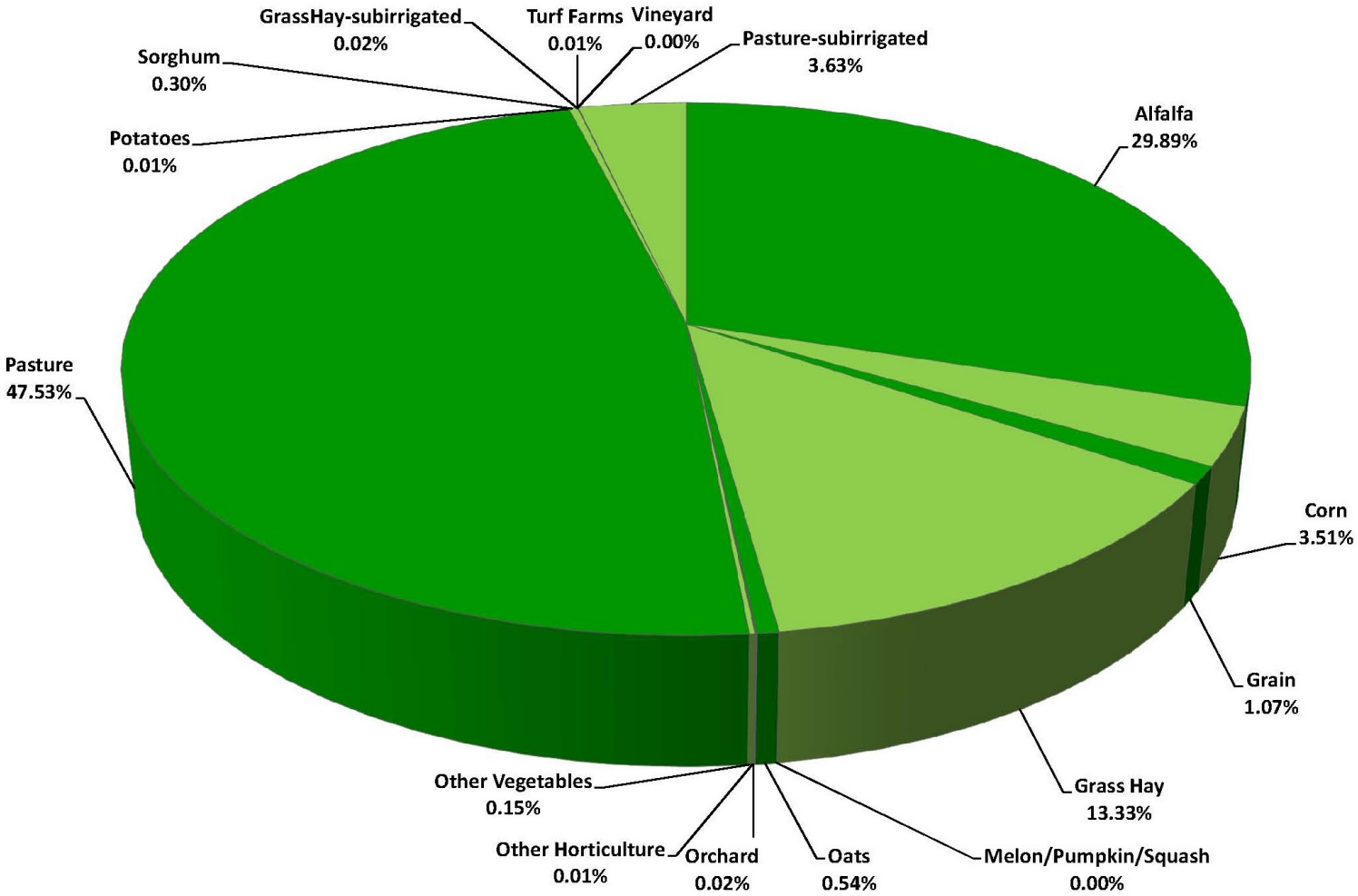


Table 1 Uintah Basin Land Use Summary of Land Cover by County for 2012

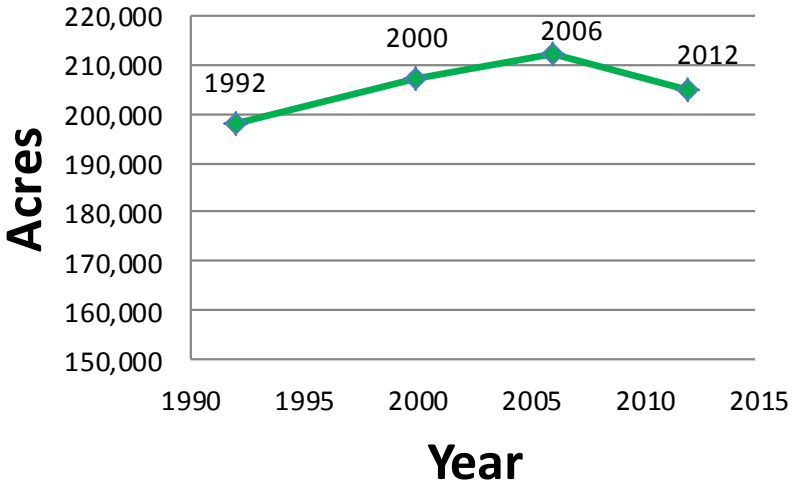
UINTAH BASIN LAND USE 2012 (Acres)										
Category	**Cover**	**CARBON**	**DAGGETT**	**DUCHESNE**	**EMERY**	**GRAND**	**SUMMIT**	**UINTAH**	**WASATCH**	**Total**
Surface-Irrigated										
	Alfalfa	52	1,446	31,042	0	0	0	31,001	26	**63,567**
	Corn	0	0	4,274	0	0	0	3,187	0	**7,461**
	Grain	0	0	426	0	0	0	1,840	0	**2,266**
	Grass Hay	0	8,095	17,200	0	0	492	2,507	56	**28,349**
	Melon/Pumpkin/Squash	0	0	1	0	0	0	0	0	**1**
	Oats	0	0	786	0	0	0	350	6	**1,142**
	Orchard	0	0	11	0	0	0	35	0	**46**
	Other Horticulture	0	0	10	0	0	0	20	0	**30**
	Other Vegetables	0	0	6	0	0	0	303	0	**308**
	Pasture	601	1,944	57,784	0	0	3,070	37,600	98	**101,097**
	Potatoes	1	0	0	0	0	0	14	0	**15**
	Sorghum	0	0	69	0	0	0	561	0	**630**
	Turf Farms	0	0	21	0	0	0	0	0	**21**
	Vineyard	0	0	0	0	0	0	0	0	**0**
	Irrigation Method									
	Flood	653	5,613	46,400	0	0	3,562	33,043	109	**89,381**
	Sprinkle	1	5,872	65,227	0	0	0	44,375	77	**115,553**
	Subtotal	654	11,485	111,628	0	0	3,562	77,418	187	**204,933**
Sub-Irrigated										
	GrassHay-subirrigated	0	0	41	0	0	0	0	0	**41**
	Pasture-subirrigated	0	305	3,430	0	31	874	1,566	1,515	**7,721**
	Subtotal	0	305	3,471	0	31	874	1,566	1,515	**7,762**
Non-Irrigated										
	Dry Grain/Seeds	0	0	6	0	0	0	0	0	**6**
	Dry Idle	0	0	293	0	12	0	728	0	**1,034**
	Dry Pasture	0	560	1,453	0	0	83	4,095	0	**6,190**
	Fallow-Irrigated Land	0	0	377	0	0	0	597	0	**973**
	Idle-Irrigated Land	140	858	33,073	0	7	812	39,294	15	**74,201**
	Subtotal	140	1,418	35,202	0	19	895	44,714	15	**82,404**
Other Non-Irrigated										
	Range Pasture	47	898	13,629	0	0	0	19,004	154	**33,733**
Wet/Open Water Areas										
	Evaporation Pond	0	2	13	0	0	0	300	0	**316**
	Lakes & Ponds	9	539	5,748	0	13	2,204	1,172	267	**9,951**
	Reservoirs	4	14,157	8,742	0	24	842	9,011	16,974	**49,754**
	Riparian	570	901	19,880	279	134	1,620	40,410	941	**64,736**
	Sewage Lagoon	0	57	136	0	0	0	404	0	**597**
	Streams	1,197	914	2,794	638	614	119	13,336	13	**19,625**
	Subtotal	1,780	16,570	37,312	917	785	4,786	64,634	18,195	**144,980**
Residential/Industrial										
	Urban	366	4,826	29,914	4	83	96	41,300	1,211	**77,800**
	Urban Grass/Parks	0	7	326	0	0	0	452	0	**785**
	Subtotal	366	4,834	30,240	4	83	96	41,751	1,211	**78,585**
Total Land Use/Land Cover		**2,987**	**35,510**	**231,482**	**921**	**919**	**10,214**	**249,087**	**21,276**	**552,397**

Table 2 Comparison of Land Cover Totals by Inventory Year*

UINTAH BASIN LAND USE (Acres)	Carbon	Daggett	Duchesne	Emery	Grand	Summit	Uintah	Wasatch	Basin
1992 Land Use Summary									
Surface-Irrigated	697	10,529	106,403	108	0	2,330	78,029	188	198,284
Sub-Irrigated	0	729	77	0	0	62	1,999	0	2,867
Non-Irrigated	29	41	5,182	96	0	0	10,755	0	16,104
Other Non-Irrigated	0	0	0	0	0	0	0	0	0
Wet/Open Water Areas	1,353	15,824	25,258	620	480	2,299	35,378	13,235	94,446
Residential/Industrial	8	1,006	7,378	5	0	15	9,955	7	18,375
Total Land Use/Land Cover	**2,088**	**28,129**	**144,298**	**829**	**480**	**4,706**	**136,115**	**13,430**	**330,075**
2000 Land Use Summary									
Surface-Irrigated	591	10,978	106,384	205	0	3,064	86,109	157	207,488
Sub-Irrigated	0	0	5	0	0	0	0	0	5
Non-Irrigated	251	967	17,214	35	0	0	20,747	61	39,275
Other Non-Irrigated	0	0	0	0	0	0	0	0	0
Wet/Open Water Areas	928	16,790	15,243	492	518	2,963	16,845	13,378	67,157
Residential/Industrial	4	874	6,818	0	0	11	7,507	7	15,221
Total Land Use/Land Cover	**1,774**	**29,609**	**145,664**	**732**	**518**	**6,038**	**131,208**	**13,603**	**329,146**
2006 Land Use Summary									
Surface-Irrigated	535	10,770	121,191	0	0	1,345	78,492	207	212,539
Sub-Irrigated	0	37	2,601	0	0	2,298	2,411	0	7,374
Non-Irrigated	35	2,679	14,105	0	0	277	26,548	245	43,888
Other Non-Irrigated	0	838	7,957	0	0	34	14,162	0	22,991
Wet/Open Water Areas	1,354	16,714	30,503	780	558	3,003	46,908	15,690	115,510
Residential/Industrial	30	5,483	12,619	1	0	25	18,497	307	36,961
Total Land Use/Land Cover	**1,954**	**36,521**	**188,975**	**781**	**558**	**6,982**	**187,018**	**16,475**	**439,264**
2012 Land Use Summary									
Surface-Irrigated	654	11,485	111,628	0	0	3,562	77,418	187	204,933
Sub-Irrigated	0	305	3,471	0	31	874	1,566	1,515	7,762
Non-Irrigated	140	1,418	35,202	0	19	895	44,714	15	82,404
Other Non-Irrigated	47	898	13,629	0	0	0	19,004	154	33,733
Wet/Open Water Areas	1,780	16,570	37,312	917	785	4,786	64,634	18,195	144,980
Residential/Industrial	366	4,834	30,240	4	83	96	41,751	1,211	78,585
Total Land Use/Land Cover	**2,987**	**35,510**	**231,482**	**921**	**919**	**10,214**	**249,087**	**21,276**	**552,397**

* Please refer to the word of caution on page 3 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:

gis.utah.gov/data/planning/water-related-land/

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

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

Past Land Use Reports for this area and a PDF of this report can be found at

www.water.utah.gov/planning/landuse/publ.htm

Metadata is available at

www.water.utah.gov/planning/landuse/gisdata.htm

Additional Uintah Basin reports as well as many other reports can be found at

www.water.utah.gov/planning

REFERENCES

1. Utah State Water Plan, Uintah Basin,
Utah Board of Water Resources, June 1999.

2. Prism Group, Oregon State University, prism.oregonstate.edu/
Maximum, Minimum and Mean precipitation calculated using Zonal Statistics tool with ESRI ArcInfo license

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.