

WATER-RELATED LAND USE INVENTORY

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 phreatophytes¹, 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 planimetered¹¹ 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 Uinta 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 9.2 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.

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.