District Management System Program

Website: http://dms.tamu.edu

Abstract

The District Management System (DMS) program involves research and development of GIS-based tools for total irrigation district management and optimization. Initially, the program primary focus was to provide training to irrigation districts on the benefits of GIS and to help districts develop in-house GIS capabilities. Research components are centered on integration of irrigation scheduling, crop growth, and distribution network simulation models into the GIS.

Since 1996, we have been working with irrigation districts in Texas to implement the system. Implementation of the DMS in irrigation districts has been a slow and laborious process. Success is achieved only by changing the way a district thinks and uses information to make decisions. GIS-based tools are now being used to look at water and irrigation use patterns, and to manage and plan maintenance activities. These tools also provide a new perspective for considering possible distribution network improvements through interactive mapping and district database integration. This paper summarizes our experience in working with districts and details what has and has not worked in DMS implementation. The paper also discusses ways in which districts are using the DMS in their day-to-day operations.

In 2000, the USCID formed a committee on GIS applications in irrigation projects to foster communications and cooperation among various groups involved in this type of work. Short-term goals set included assembling a list of current users of GIS, and to summarize their efforts in getting a GIS program started. A web site has been created to document and publicize this work. Long-term goals include the development of standards and create collaborative programs and projects. This paper summarizes GIS activities currently underway nationally and internationally.

The focus of the DMS program is changing due to the input and needs of participating districts and the regional and international aspects of water, particularly in the Lower Rio Grande Valley (LRGV) of Texas. Irrigated agriculture has played a large roll in defining many aspects of life in the LRGV. But in recent years, drought and population growth have raised real concerns about the viability of the limited water supply of the Rio Grande River. The Rio Grande is also an international river whose water supply is shared with the rapidly growing and industrializing border region of Mexico. Rio Grande Basin problems must not only be solved on a localized scale, but on a regional or basin wide scale. The DMS is now being called upon to help with accounting for and understanding the relationships of the water problems at the regional and international levels.

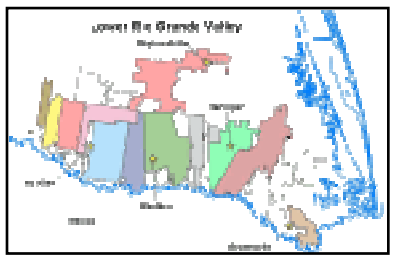

Figure 1. Irrigation Districts of the Rio Grande Valley of Texas

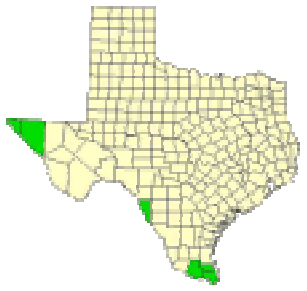

Figure 2. The counties in green represent the major irrigated areas along the Rio Grande River.

Introduction

The Lower Rio Grande Valley (Valley) is located at the Southeast tip of Texas and contains 28 irrigation districts (Fig. 1). The Region has approximately 740,000 irrigated acres and uses 1 to 1.4 million ac-ft of water a year to grow a wide range of fruit, vegetable and field crops. Just across the border in Mexico is a similar irrigated region containing about 1 million ac. All the water used in the region comes from the Rio Grande River which is divided between Texas and Mexico as stipulated by international treaty.

The region is also one of the fastest growing areas in Texas, and the water demand of municipalities and industries is also rapidly increasing. Water to meet the increasing demand must come from agriculture which holds 90% of all the water rights in the basin. A state-mandated regional water resources planning effort is currently underway which includes a detailed analysis of the current conveyance efficiencies of the districts. Planners are attempting to determine how much water could be freed up for other users through improvements in the districts and with on-farm irrigation.

The region has suffered reduced water supplies since 1995 due, in part, to a drought in the Lower Rio Grande Watershed of West Texas and Northwest Mexico and severe regional droughts in 1996 and 1998. Irrigation districts are beginning to recognize the need to restructure their distribution systems, management decisions, and operating methods in order to improve efficiency.

In 1996, Harlingen Irrigation District and the Texas Agricultural Extension Service (TAEX) began an effort to develop visual system using GIS (geographical information system) that would allow the district to visually display and analyze all data used in daily district management. After evaluating several GIS options, *ArcView* was chosen as the GIS-tool for this effort. In 1998, Harlingen and 7 other irrigation districts began GIS implementation with technical support provided by TAEX and the DMS (District Management System) Team in the Agricultural Engineering Department of Texas A&M University. A description of this program is provided by Fipps and Pope (1998).

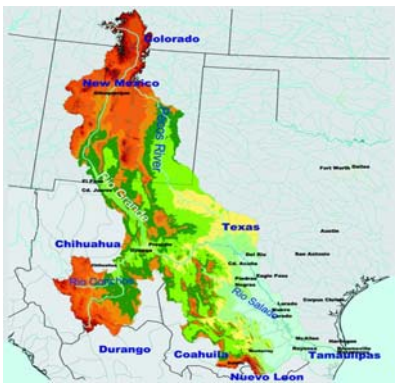

Figure 3. Rio Grande Basin, covers the states of Colorado, New Mexico, and Texas in the United States, and the states of Chihuahua, Durango, Coahuila, Nuevo Leon, and Tamaumpas in Mexico.

GIS Implementation in Districts

We have developed a program that encourages GIS development and implementation in districts through a step-by-step process. Keys to our success have been focusing the following:

•demonstrating ways in which GIS management systems can be a benefit and an important asset to the district,

•teaching the practical applications of *ArcView* and making suggestions as to what steps should be taken in what order to build GIS-based maps and databases, and

•providing continuous support in the process at each level, from the initial introduction to the software, to the confident use of *ArcView* as a daily management tool.

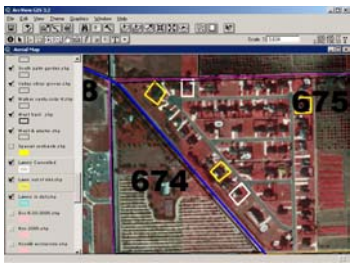

Figure 4. Lawn water accounts mapped, helps the district determine who is authorized to irrigate.

Figure 5. Maintenance location recorded and description picture hot linked.

Common Uses For GIS in Districts

To encourage continuing progress in GIS development by districts, we focus on aspects that are the most beneficial based on their current stage of GIS development. These include the following.

•Maintenance Tracking – After the completion of a job, records to indicate exact locations often forgotten. GIS allows the district to pin-point job sites and to attach descriptions, pictures, and other records that may be vital for future work (Figure 5).

•Map Making – Accurate and up to date maps are vital for daily operations.

•Boundary Disputes – Reclaiming encroached upon areas and settling property disputes with accurate GPS/GIS maps coupled with recent aerial photographs are uniquely suited to such tasks.

•Determining Net Acreage – Water assessed fees based on the account acreage or the amount of land actually in production. The difference between total acreage and net acreage under production may be significant.

•Projecting Water Usage Patterns – Irrigation districts can use GIS to visually represent the distribution of water use in any or all fields over the past week, month, year, or period of record. This process can be taken a step further by overlaying two or more consecutive years to find patterns in water usage. Differences in water use may directly or indirectly occur due to crop rotation, weather, irrigation methods, tillage practices, etc.

Regional GIS Uses and Activities

Water Saving Strategies

Currently, we are working with districts and the region to determine water savings from rehabilitation projects and the amount of water that could potentially be freed up from improvements in distribution networks and on-farm irrigation for transfer to other users. This is a major expansion of the efforts conducted in the Phase II Project (see Fipps and Pope, 1998). An intense effort is underway to assemble detailed information on operational methods and physical features of the districts' distribution systems. Canal rider surveys were conducted in all or parts of 6 districts to identify:

•the condition of canal segments, including physical dimensions and lining materials

•on-farm irrigation methods and technologies in use on a field by field basis,

•water supply or loss problems identified by canal segment and individual fields, and

•locations of turnout valves, check gates, pipeline control valves, and operational spill drains

In addition, the DMS team is conducting seepage loss tests across the Valley on variety of canals segments, monitoring operational spill sites and recovery projects, and documenting water savings from metering programs. After these surveys and studies are complete, the results will be entered into the appropriate GIS databases for analysis.

USCID Working Committee GIS Applications for Irrigation Projects

In 2000, the USCID formed a committee on GIS applications in irrigation projects to create and expand national and international collaborative efforts, and open future funding opportunities for the advancement of GIS technology and management with in irrigation schemes. The goals of the committee include creating GIS user groups, demonstrating the uses of GIS, and work with collaborators to develop standard and new GIS techniques for irrigation projects. The following is a list of outreach activities:

Washington, US – The USBR – Upper Columbia Area, GIS Workshop for Irrigation Districts was held in Yakima, Washington, June 2001. This program invited local irrigation districts to hear presentations from GIS professionals that shared their experiences and examples to show them benefits to GIS management. Afternoon tours took place at the Yakima County GIS Office (Yakima, WA) and Reclamation District GIS Operations (Ellensburg, WA).

Hawaii, US – Toured and presented a presentation to Hawaii Commercial & Sugar (Maui) to look at potential strategies to use GIS applications for large irrigated farming schemes.

Jamaica, West Indies – The DMS team started collaborative efforts with the NIC (National Irrigation Commission Limited) to look at improving their GIS capabilities through more detailed mapping, database integration, and providing training programs for the district supervisors. The NIC is the public sector agency responsible for the management and operation of public irrigation schemes in Jamaica. They operate 6 irrigation and 1 drainage scheme.

Chairman: Guy Fipps

Send questions and comments to the DMS Website Project Team
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