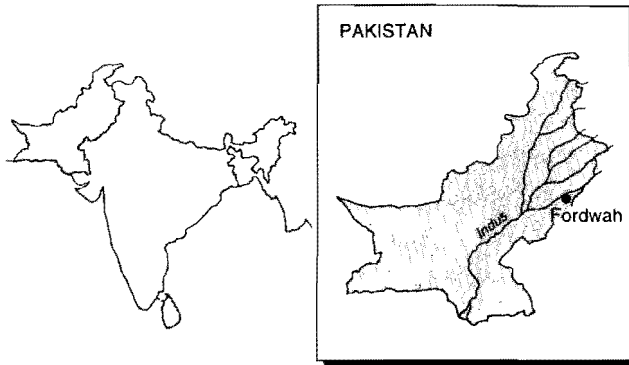


ITIS in the Field: User Perspectives

PAKISTAN



Using GIS and RS to Monitor and Evaluate Irrigation and Drainage Projects: Example from IIMI Pakistan National Program

BACKGROUND

Irrigation system performance has received increasing attention during the last decade as a result of poor performance of projects and policy interventions. In large-scale irrigation and drainage projects in Pakistan, assessing performance requires a large amount of information that is currently scarce and whose accuracy is, often, less or unknown. In this context, Remote Sensing (RS) and Geographical Information Systems (GIS) offer a high potential for obtaining and structuring information to improve monitoring and evaluation of irrigation and drainage projects and related policy decisions. To address these issues, the International Irrigation Management Institute (IIMI), Pakistan National Program, started a research program in 1994, in collaboration with Cemagref, a French research institute for agricultural and environmental engineering, and the Watercourse Monitoring &

Evaluation Directorate (WMED), Water and Power Development Authority, Pakistan.

OBJECTIVES

The main objectives of this collaborative research are:

- to assess the potential for GIS and RS to monitor and evaluate irrigation and drainage projects in Pakistan
- to identify appropriate methodologies to estimate selected performance indicators using RS

Based on research results, the final goal is to operationalize GIS and RS as part of the regular monitoring and evaluation activities of WMED or other potential partners. To assess performance requires a clear identification of the performance indicators, the scale at which performance is to be assessed, and the level of accuracy required by the potential users of this information. In terms of the use of satellite imagery, it is important to identify the appropriate combination of the number of satellite images, resolution, dates, bands, and ground truth information required to obtain a given indicator at the right scale and with the right accuracy. This article concentrates on the estimate of crop-related indicators such as area under different crops and cropping intensity.

INITIAL ACTIVITIES

Activities on the use of satellite imagery for estimating area under different crops and cropping intensity started in April 1994 in the context of the collaboration between IIMI and Cemagref. SPOT images from October 1994 and March 1995 were acquired for the Chishtian Subdivision (67,000 ha) that is part of the Fordwah/Eastern Sadiqia irrigation system, South Punjab. Supervised classification was performed independently for both images to obtain cropping pattern and cropping intensity for the *kharif* (summer)

1994 and the *rabi* (winter) 1994–95 seasons. An overall accuracy of around 95 percent was obtained for land use (i.e., cropped area versus other areas), but confusion remained between different crops (overall accuracy of 80-85% only).

METHODOLOGY

Based on the lessons from these initial activities, a collaborative research effort between WMED and IIMI with support from Cemagref was developed. This research is focused on the development of appropriate methodologies to identify crops and estimate cropping intensity and cropping pattern in irrigation systems in Pakistan. The sensitivity of classification results to specific elements that are part of the methodology development is being tested.

These elements include:

- different sample sizes for ground truth information, from 1 to 7 percent of the total command area
- different sampling methods, using square segments or tertiary unit command area as sampling units
- different combinations of dates, resolution, and number of bands of satellite images
- different intensity of ground truth data collection, from rapid surveys to more detailed monitoring of sample areas

The research effort is undertaken in the command area of the 3-R secondary canal of the Fordwah/ Eastern Sadiqia irrigation system with a command area of 28,000 ha.

PROGRESS AND EXPECTED RESULTS

Activities started in May 1997 for the kharif 1997 season. Initial output will include the production of primary agricultural statistics for the command area of the distributary. The comparison between these statistics and statistics obtained by WMED using their traditional sampling plans will lead to the identification of improvements in these sampling plans. The next step will be the production of secondary statistics using classification results and satellite imagery. A sensitivity analysis will be undertaken on the elements

described above. Costs will be estimated for each option to identify the appropriate methodology required to assess the cropping pattern or cropping intensity at various scales of the irrigation system using various accuracy levels. Appropriate methodologies will then be implemented by WMED on a regular basis in various monitoring and evaluation projects.

FOLLOW-UP ACTIVITIES

The direct follow-up activity that will involve WMED and IIMI will consider the full area of the Fordwah/ Eastern Sadiqia (South) irrigation and drainage project. The operationalization of the methodologies identified will lead to the production of crop-related information that will be used in the preparation of the second phase of this irrigation and drainage project. Other follow-up activities will investigate other performance indicators such as actual evapotranspiration (using NOAA-AVHRR satellite) or crop yields. Such activities will start in October 1997.

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Announcement

Update on the World Water and Climate Atlas

Version 1 of the World Water and Climate Atlas developed by IIMI and covering Asia was released in March, 1997 and is available on CD Rom or through the Internet. This initial version of the atlas was released for illustration purposes and for seeking recommendations and suggestions for its improvement. A second version of the Atlas for Asia with improved maps and software will be available during the first part of 1998. The remainder of the World Water and Climate Atlas is due to be completed thereafter. To obtain the atlas, visit the Internet address <http://atlas.usu.edu/>. For further questions, contact Atlas@cgnet.com