

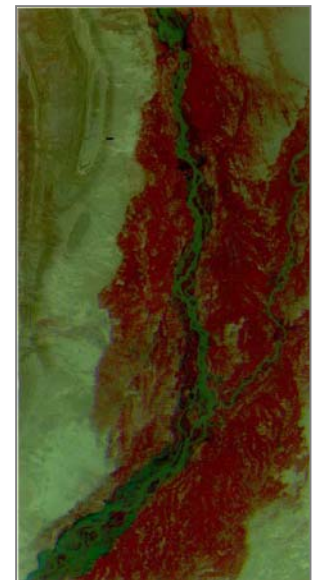
Case Study of Use of GIS by AAI

Part 2 - Case Study from Pakistan

We have run GIS related stories from time to time in AAI News. In the series on analysis of remote sensing images, we introduced ways to obtain, analyze and utilize satellite images. In addition, in the mini-series on databases, we introduced GIS as a tool for thinking. In this series we will introduce various examples of GIS use in the field, and will focus on examples in Pakistan in this issue.

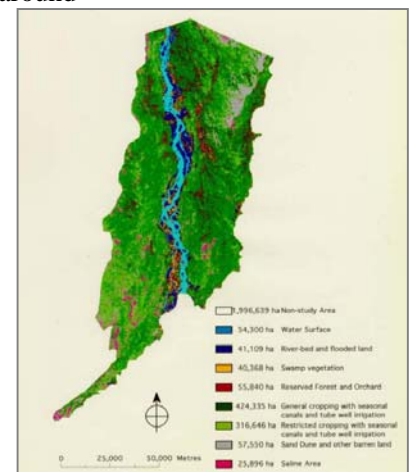
The majority of the land in Pakistan is arid or semi-arid, which necessitate irrigation facilities for agricultural production. In the Punjab Region, which is the center of the country's agricultural industry, there has been a rapid decrease in the effectiveness of irrigation due to the aging of the facilities. The improvement of such irrigation facilities has been strongly sought. One of the 16 such facilities nationwide is the Taunsa Barrage which has deteriorated badly. In 1997, a feasibility study was conducted to formulate the "Taunsa barrage irrigation system rehabilitation plan". There are major obstacles for regional agricultural development; soil erosion and floods caused by surface water from the Sulayman Mountain Ranges on the right hand bank of the target area, and shifting dunes penetrating into the region on the left bank. In irrigated areas, water logging and salinization are causing major damage. These facts prompted development of a present land use map using satellite images and the results of physical investigations on the ground. The map clearly shows the location of shifting dunes, areas where salt is accumulating, as well as distribution of wetlands and natural woodlands.

Data search was commissioned to the Remote Sensing Technology Center, designating conditions such as the types of satellite, sensors, target areas, and observation years. We chose necessary data from search results. For this particular development survey, we purchased two scenes of LANDSAT/TM data that jointly cover the whole target area. We partially overlaid the two scenes to make one scene and we cut off excess areas. Then, using red, green and blue for bands 4,3 and 2 respectively, we created false color images. In these images, areas with high vegetation are shown in red, and one can see, in the map on the right hand side the way irrigated fields spread along the banks of the river. As a method for analyzing land cover categories, we first tried to use the maximum likelihood estimate as a classification method. This method chooses certain points that represent each category of land cover, and classifies areas by choosing pixels with similar characteristics. However, with this method, the result showed too much forest cover and unrealistic salt accumulating areas. Given this, we conducted detailed ground truth field work, carrying with us the false color images and GPS. We repeated the activity of confirming the difference between the various colors on false color images, as well as the difference between actual land cover through physical investigation. Based on this investigation method, a very realistic present land use map was created using the level slice method.



False colour image of the study area

What we learned through this work was the importance of tenaciously walking around actual areas with maps and a GPS in hand. Initially we could not easily distinguish forest vegetation from wetland vegetation on the maps. Therefore, we visited all the forests existing in the study area and marked on the false color images. Then, we determined the distribution of forest vegetation, through repeated trial and error. In the same way, we also determined sand dunes and salt accumulated areas. This trial and error process taught us that both field work and analysis on computer should really be done by the same person. The major point of satellite image analysis is to express the information obtained in the field work accurately on the screen. In addition, by taking out irrigated areas from the image of the study area, we made it possible to instantly analyze area sizes per category from the number of pixels, using MF Works software. This in turn enables us to verify the map from other information such as existing area size statistics indicated in a land use map and forest distribution map. In other words, if a map is created which is realistic in terms of distribution but not accurate in terms of area size, we now have the option to make further adjustments.



Actual land cover classification map created and based on the results of field work