Overview

Remote Sensing (RS) and Geographic Information System (GIS), known as geomatic technology, involve the acquisition, digital processing and interpretation of airborne and spaceborne images, and other spatial data. This geomatic technology (RS/GIS) is used for global, regional and local resource and natural-hazard management, environmental protection, transportation, retail, and strategic military purposes. The rapidly growing geomatic technology is providing electronic management and scientific information that is worth billions of dollars. The proliferation of RS and GIS systems, interpretations, and applications along with related mapping and remote sensing techniques, have emphasized the need for voluntary consensus-type standard methods, practices, guides, specifications, and terminology to ensure high quality and interchangeable products for these techniques. In addition, technology transfer becomes essential for information about new standards activities and needs, and new applications of remote sensing and GIS to reach the largest possible audience.

Recent techniques and application of RS/GIS were presented and discussed at the *International Symposium on Remote Sensing and GIS for Site Characterization—Application and Standards* at San Francisco, in January 1994. This symposium brings together an interdisciplinary and international group of scientists and engineers to (1) provide a forum for exchange of experiences, and for learning from both successful and unsuccessful case histories; (2) arrive at the needs and available methods for remote sensing and GIS to develop information on the priority and potential for standardization of some elements of each; (3) promote technology transfer between producers and users from the various disciplines and countries represented; (4) and provide an educational resource for those attendees who may be new to the use of, or into new uses of remote sensing and GIS.

This symposium was convened and sponsored by ASTM, D-18 committee on Soil and Rock, and its subcommittee on Surface and Subsurface Characterization and the U.S. Geological Survey. The ASTM D-18 committees on the Remote Sensing and GIS are aimed at developing consensus-type standard methods, some of which are included in this publication. Other co-operating organizations include the American Congress of Surveying and Mapping; American Society of Photogrammetry and Remote Sensing; AM/FM International; American Water Resources Association; Association of American Geographers; Canada Centre for Remote Sensing; International Association of Hydrological Sciences; International Association of Hydrogeologists; International Society for Photogrammetry and Remote Sensing, Commission V11/7 on Hazardous Waste and Environmental Pollution; Urban and Regional Information Systems Association; and United Nations Educational, Scientific and Cultural Organization.

This special technical publication (STP) is divided into five sections with several appendices. Section one provides two Keynote papers that discuss remote sensing and GIS guidelines for geological and environmental site characterization, environmental monitoring and management. Singhroy provides useful image enhancement guidelines through case studies that will facilitate geological mapping and environmental monitoring in vegetated areas. Emphasis is placed on combining radar, optical and magnetic images to provide standard image products for geological interpretation. The operational use of high spatial and spectral airborne multispectral images for local environmental site characterization and monitoring is a significant development in environmental protection. Ehlers discusses the role of this rapidly emerging geomatic technology in the resources management decision processes. Since RS/GIS are crossing the boundaries of many traditional disciplines designing geomatic training programs in environmental monitoring is a challenge.

Section two on Remote Sensing Applications discusses a number of systems and image processing and data integration techniques that have been used for geological mapping and environmental monitoring. Three case studies are included. Wester and Lunden merged Landsat thematic mapper (TM) with digital terrain data for visual geological and geomorphological interpretation. This study emphasized the use of principal component decorrelation and Crosta techniques for lithological mapping, and the combined TM and DTM for topographically expressed structures. Rango and Baumgartner discuss the integration method of using NOAA-AVHRR, climatic, hydrologic, and topographic data in ASCAS, to provide information on snow distribution and runoff that are useful for hydropower companies. DiMaio and Setzer describe a methodology to locate new deforestation in the Brazilian Amazon using multi-temporal NOAA-AVHRR images and GIS. This method should be useful for small scale deforestation monitoring studies.

Section three on GIS discusses several case studies as well as training programs. Albers et al. discuss the role of geomatics for environmental restoration within the U.S. Department of Energy (DOE). The significance here is that the problems of environmental clean up within the DOE requires a number of strategies. Remote sensing and GIS are useful techniques used to characterize and monitor clean up and revegetation success at hazardous waste sites. Hansen and Sebhat provide another case study on the use of GIS to identify irrigated lands, water rights and water allocation areas for the U.S. Bureau of Reclamation. In addition, GIS are being used extensively in ground water exploration and management. Hall reviews these methods and discusses the differences in data requirements for the older manual method of processing data and new GIS methods. Training and certification of GIS professionals are discussed by Bixby with particular reference to the program at St. Cloud State University. Finally, the case study by Asabere on mineral transport activities in Ghana; shows the increasing uses of GIS in developing countries.

Section four discusses the use of geomatics techniques for environmental Site Characterization. Shaffer et al. locate potential sources of surface and ground water contamination and correlate the sites with environmental stressed vegetation. Kuhn and Horig provide a detail case study on the use of high resolution remote sensing techniques to characterize military training sites in Ger-

many. This study emphasizes the use of ground spectral techniques to assist in the interpretation airborne and spaceborne images. Finally, Deckers discusses the use of object oriented principles applied to GIS for the characterization of hydrogeological sites.

Section five provides examples of Standards under development, and their uses. Nebert discusses the development of a spatial metadata content standard. This standard, which is under review by ASTM, will be particularly useful to users of spatial data and processing systems. Kolm presents an integrated, multidisciplinary, step approach for the characterization of ground water systems using GIS. Hansen discusses an extension of the U.S. Spatial Data Standard to laboratory data. This additional data element within the metadata standards ensures that additional information is available to the GIS user. Finally, Light describes how the U.S. National Aerial Photographic Program consisting of black and white and color infrared photography at scales of 1 : 40 000. is an ideal standard as input to GIS engaged in site characterization.

As shown in this publication, the use of remote sensing and GIS in environmental site characterization and monitoring is rapidly increasing. ASTM recognizes the potential of these technologies and the importance of promoting standards through the methods used in case studies. It is hoped that this publication will increase the dialogue by those who develop and use RS and GIS techniques for site characterization. The editors would like to thank all the authors, reviewers, and the ASTM publication staff for producing such a high quality publication.

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