System of Experts for Intelligent Data Management (SEIDAM)

by the staff of the Advanced Forest Technologies group

1.0 SEIDAM Remote Sensing Data Set Augmented by 1994 NASA Flights

In the summer of 1994, intensive remote sensing flights by NASA aircraft sensors over the SEIDAM test sites of the Greater Victoria Water District and Clayoquot Sound acquired more than 2.2 terabytes of optical and radar data. The 300,000 ha. Clayoquot Sound is a key element in the 400,000 ha Long Beach Model Forest and is part of the North American west coast old growth rain forest. Over 960 kilometres of flight lines were flown for each of the NASA aircraft sensors which included the Airborne Visible Infra-Red Imaging Spectrometer (AVIRIS), Airborne Ocean Color Imager (AOCI) on the NASA ER-2 aircraft, and the AIRSAR system on the NASA DC-8 aircraft over both test sites. These data, in addition to satellite data from platforms such as the ERS-1, JERS-1, LANDSAT, SPOT-1 and SPOT-2 have augmented the available multi- temporal and multi-sensor SEIDAM data sets which go back to 1975.

As in previous years, the 1994 remote sensing program was supported by activities on the ground. These included sensor calibration measurements, acquisition of soil moisture samples, foliage samples for chemical analysis, and mensurational measurements on tree characteristics such as diameter and species in the test plots.

SEIDAM is a NASA project under the Applied Information Systems Research Program for which Dr. Glenn Mucklow is the NASA Program Manager. SEIDAM is also supported by: Natural Resources Canada, Province of British Columbia, Industry Canada, EEC's Joint Research Centre at Ispra, Italy, Sweden's Royal Institute of Technology and private firms such as MacDonald Dettwiler and Associates of Richmond, B.C. Also supporting SEIDAM are the University of Ottawa, the University of Victoria, and the University of British Columbia.

2.0 SEIDAM Partners Assist in Implementing an Asynchronous Transfer Mode Network for Rapid Digital Data Exchange

In September 1994, an Asynchronous Transfer Mode (ATM) Network having a bandwidth of 155 megabits per second was inaugurated at the Pacific Forestry Centre by the federal Minister for Natural Resources Canada, the Honourable Anne McLellan. This high-speed fibre-optic network, a federal-provincial information superhighway test-bed, connects the Pacific Forestry Centre with the British Columbia Ministry of Environment, Lands and Parks in downtown Victoria by utilizing the services of the British Columbia Systems Corporation, a provincial Crown Corporation. The rapid sharing of large volumes of digital information, previously done slowly using tape or optical disk media, is now possible. For example, a 400 megabyte LANDSAT TM image, which would previously have been transferred on a single 8 mm cartridge, can now be exchanged between the two centres in about 25 seconds through this high speed fibre-optic link. ATM links also enable the rapid exchange of data with centres in Canada which are part of CANARIE, the coast-to- coast information superhighway link in Canada. The B.C. board of directors of Rnet, the B.C. connection to CANARIE, have approved the implementation of the extension of the Rnet connection to Victoria. With this connection to Victoria in place, rapid exchanges across the country will be enabled, not only of digital data, but also of expertise from distributed experts as well.

A lower speed (10 Mbits/sec) information highway also links the Pacific Forestry Centre with World Wide Web (WWW), which can be accessed using hypertext methods. The Advanced Forest Technologies Program (AFT) has a home page on WWW which contains detailed information on AFT activities. Other Web servers can also be reached from this home page, both within Natural Resources Canada and elsewhere within B.C. and beyond. The Advanced Forest Technologies Program WWW home page at the Pacific Forestry Centre can be reached at the following address :
http://www.AFT.PFC.FORESTRY.CA/

3.0 Preliminary Analysis of SEIDAM Remotely Sensed Data Yields Diverse Information Content on Forestry-Related Issues

Over the past year, SEIDAM remotely-sensed data have been analyzed using advanced state-of-the-art methodologies. The results show a wealth of information critical to forest resource monitoring.

Shown overside are two examples of imagery acquired during the SEIDAM remote sensing programs in 1993 and 1994. Both of the sample images below were acquired over Sooke Lake, part of the
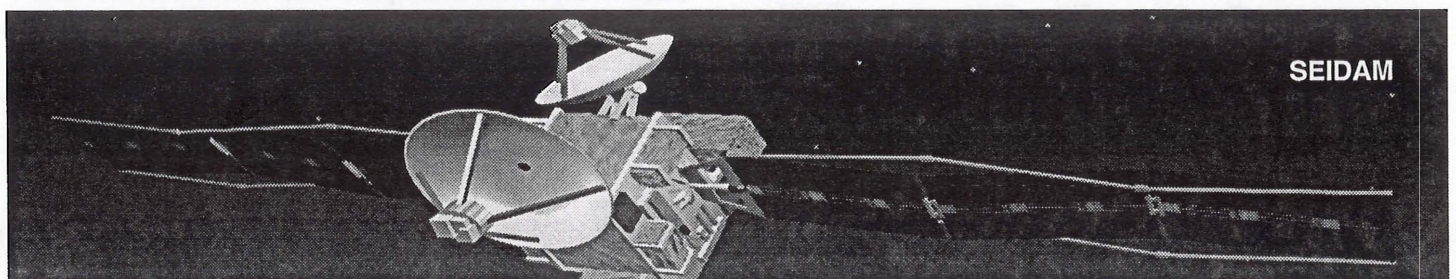
SEIDAM

Greater Victoria Watershed District SEIDAM test site. The AVIRIS image was acquired at a wavelength of 0.660 micrometres and was selected from 224 available channels. The AIRSAR image is a C- band, total power image, one of 18 available configurations from this NASA synthetic aperture radar sensor. Both images, when used in conjunction with each other, contain a wealth of information such as canopy chemistry and stand density.

Other state-of-the-art techniques being used for the analysis of SEIDAM remotely sensed data include spectral endmember analysis, band-moment analysis and principal component analysis using as many as 170 channels per scene from the AVIRIS data.

## 4.0 SEIDAM Expert Systems Address User-Queries Using GIS and Remote Sensing Data

Major strides have been made in the evolution of SEIDAM expert systems. Using PCI, ENVI and LDIAS image analysis software; ESRI ARC/Ingres, AVS Pamap, and GRASS for GIS; AVS for visualization; and Ingres for relational data, SEIDAM expert systems can now

address a set of user-queries for forestry applications. All of these software packages are seamlessly controlled by an expert system shell built using PROLOG. Other innovations which make SEIDAM expert systems more user-friendly include :

-graphical user interfaces (GUIs) which have been built using Tcl/Tk. Tcl/Tk is a public domain GUI scripting language and toolkit which enables rapid GUI development and prototyping. GUI development for SEIDAM is also designed to support distributed processing across the ATM network.

- a SEIDAM metadata database for image and GIS data.

- a new context-sensitive help system. This help system is based on distributed hypermedia capability available in MOSAIC.

- enhanced natural language interface which allows user to specify queries in natural English language format.

These developments make SEIDAM a user-friendly systems application for forestry information.

(a) AVIRIS Image
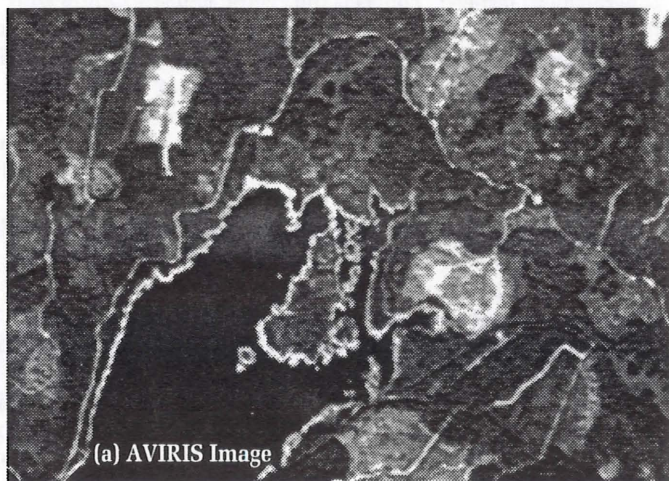
(b) AIRSAR Image

Processed AVIRIS (a) and AIRSAR (b) imagery acquired over Sooke Lake in 1993. The AVIRIS image was acquired at a wavelength of 0.660 micrometres. The AIRSAR image was acquired at a wavelength of 5.7 centimetres (total power). Note the clearly
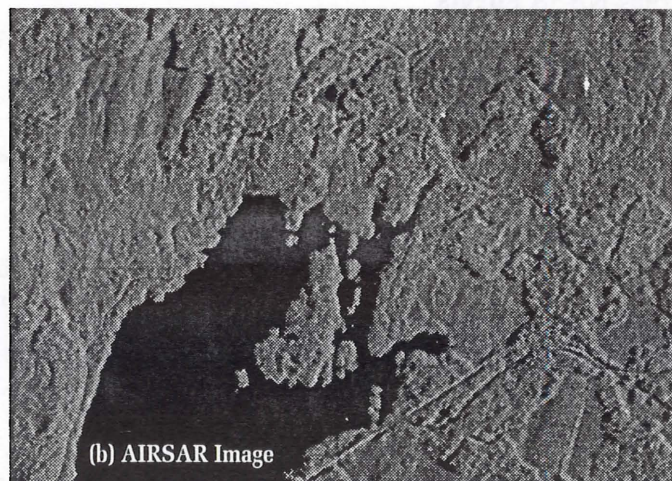
discernible features within clearcuts and regeneration areas in the AVIRIS image. The AIRSAR image shows similar information, but at a dramatically different perspective.

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