URBAN & LAND USE APPLICATIONS   (PARALLEL SESSION)

A   LAND COVER CLASSIFICATION FOR PUGET SOUND 1974 - 1979

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Introduction

The Pacific Northwest was one of the first areas to be involved in
Landsat demonstration projects and in the transfer of digital analysis
capability to users. An overview of land cover classification work in
the Puget Sound region will be presented here, including a description
of the current effort being carried on at the University of Washington
cooperatively with local agencies.

Landsat Applications - Puget Sound

Landsat activity in urban and rural land cover applications began in
the mid 1970's in the Puget Sound Region. In 1975, NASA, USGS and the
Pacific Northwest Regional Commission, began a cooperative Land Resources
Inventory Demonstration Project with the Puget Sound Region identified
as one of the urban test sites. Local agency personnel were involved
in groundtruth collection and digital processing along with NASA and
USGS participants. The classification work was inititated in 1975
using Landsat data from a satellite pass on 13 June 1974. This effort
used 37 spectral classes which yielded 13 land cover classes.

A new land cover classification was undertaken in 1976 by NASA and USGS,
using Landsat data from 23 July 1975, and incorporated 44 spectral
clusters which were stratified and associated into 20 land cover classes.
NASA also demonstrated the feasibility of spectral signature extension
by using the 37 spectral classes from the 1974 Puget Sound work to
classify data in adjoining Landsat scenes from the same date. This
extended the 1974 land cover classification to Vancouver, BC, Canada
and Portland, Oregon. Agency participants received lineprinter and
color-coded map products from the 1974 and 1975 classification effort.

Agency use and acceptance of the Landsat products varied, and often
depended on perceived accuracy of the Landsat data, and conflicts seen
in comparing Landsat data with other land use data. A comprehensive
accuracy verification was never done for the 1974 and 1975 Landsat
products.

New Land Cover Classification Applications

Succeeding years saw several new applications of the 1974 and 1975 land cover classifications. The University of Washington Remote Sensing Applications Laboratory (UW/RSAL), used the 1975 data in a project to test methods for updating land use information in noise and accident zones around Air Force bases. McChord Air Force Base near Tacoma, Washington, served as a test site. In 1978, Washington State Game Department Biologist, Larry Brewer, contacted UW/RSAL personnel for advice on regional grouse habitat data collection. He was directed to NASA and the 1974 Landsat land cover classification. The Game Department used the extended 1974 land cover classification by reassociating spectral clusters into types useful for grouse habitat. The data was tabulated by management units and stratified by the 2000 foot elevation contour to develop habitat acreage totals.

VICAR/IBIS Software Selected

As technology transfer continued in Washington, the VICAR/IBIS image processing software was selected as the state Landsat data processing system and installed at Washington State University in 1978/1979. In 1979, UW/RSAL personnel underwent VICAR/IBIS training and embarked on a project to introduce the Puget Sound agencies to VICAR/IBIS.

All previous Landsat products for the Puget Sound were transferred in digital form to WSU to start a library of Landsat data tapes. This included raw Landsat data, classified data for 1974 and 1975, and Steve Friedman's work at JPL with Puget Sound Landsat data and census tract data. The local agencies used this data library for applications that included mapping impervious surfaces and vacant lands, tabulating agricultural lands and general land cover associations by census tract. Agency personnel became further acquainted with the complexities of . the Landsat land cover data and the problems of accuracy determination.

In 1980, UW/RSAL researchers began a new land cover classification effort for Puget Sound on the VICAR/IBIS system. The best Landsat data available was a scene from 20 July 1979. General goals were to produce land cover classes similar to the 1975 cover classes, to verify the classification statistically, to integrate the 1980 census data with the classification and to attempt general change detection.

Agency personnel from the Puget Sound Region were involved in field checking of training sites. A supervised clustering approach using many of the same training sites from the earlier classification work, was selected. Classification statistics developed from the training

sites were tested and edited using a selection of windows from the Landsat scene. Assignment of 8,949,000 pixels into 71 spectral classes was carried out on the Amdahl 470 V8 at WSU in 23 minutes of CPU time at a cost of $ 867. Because of disk space limitations, the Landsat scene was split vertically into two files during classification and the classified outputs were mosaiced.

The classified output was viewed on the Stanford Technology Corporation System 500 display in Olympia, Washington, for assignment of spectral clusters into 20 projected land cover classes and for location of stratification boundaries. Stratification into urban, rural and mountain regions was accomplished to improve the overall accuracy of the classification and to provide a more useful definition of some of the spectral clusters.

A general verification of the land cover classification is currently being conducted using a random sample of points, photointerpretation of the points and field checking where necessary. A 3 x 3 matrix of pixels will be used for comparison of the Landsat data to the equivalent area in the photointerpreted map file. Local agency personnel will be involved in accuracy determination for areas of interest within their own jurisdictions.

Following the verification of the classification, the 1980 census tract boundaries will be overlaid on the Landsat data using IBIS routines and land cover will be tabulated by census tract. The use of the 1970 census tract boundaries is planned, to develop land cover data which can be compared to the 1975 Landsat land cover tabulations for general change detection. Agencies participating in the project will receive color products and will have access to the classified Landsat data file on tape at WSU to print land cover maps or to reassociate the spectral classes for other uses.

Future Landsat Technology Applications

Through the Landsat land coverp rojects for the Puget Sound Region, agency participants are learning the advantages and limitations of Landsat. The process of education of new users continues, but becomes easier as more college graduates have experience with Landsat data. We continue to encourage the use of Landsat for users faced with new land cover data collection problems, usually in the urban fringe and rural areas. Categories of use include regional overview, reassociation of classes for special purposes and the combination of Landsat with other types of data. Future satellite systems will need testing with respect to urban and land use applications, but new types of data can

be well received if we continue a step-by-step approach, building on the existing user community in each region and addressing user-identified problems for which this technology can provide practical realistic solutions.