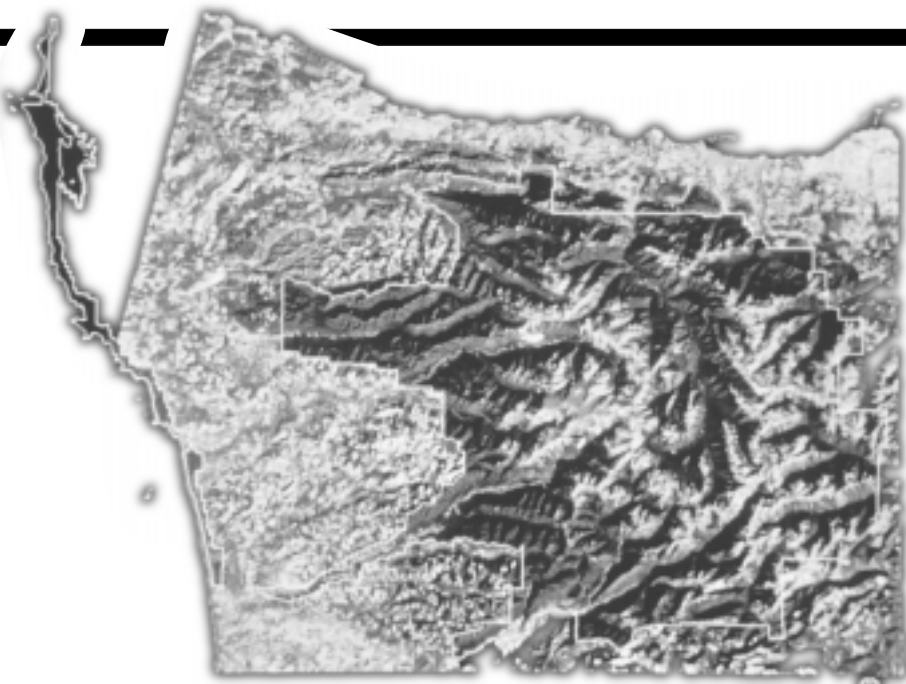




Figures 1 (left) and 2 (right). The database development process uses Thematic Mapper satellite images, such as these of Olympic (left) and Mount Rainier (right) National Parks, Washington. The images reveal tree size and forest structure, species composition, forest crown cover, and geomorphic characteristics of the land. Clear cuts outside the parks show as white patches.

VEGETATION AND LANDFORM DATABASE DEVELOPMENT

Satellite imagery eases updates, applicability in Pacific Northwest parks

By JEFF CAMPBELL AND DAVID PETERSON

AN IMPORTANT NEW DATABASE WAS recently developed for national parks in the Pacific Northwest that will aid resource managers and scientists interested in a wide variety of natural resource issues. In 1992, the Natural Resource Preservation Program of the National Park Service provided funding for a contract with Pacific Meridian Resources, Portland, Oregon, to develop and produce a comprehensive GIS vegetation land cover and geomorphologic landform database for four national parks in the Columbia-Cascades Cluster: Olympic, North Cascades, and Mount Rainier National Parks, Washington, and Crater Lake National Park, Oregon. The study was designed to develop a comprehensive, consistent inventory and mapping of the vegetation and landform characteristics for the four parks using digital Landsat Thematic Mapper (TM) satellite imagery (figures 1 and 2) and field collected data as the primary information bases.

Using satellite imagery as the primary information base for developing a comprehensive, consistent vegetation landcover database has four advantages:

1. Substantially less time and cost is needed to produce the GIS layers as compared to aerial photo interpretation
2. Much more useful data can be produced; image raster data can be intersected with GIS polygon (vector) coverages providing information about the diversity of vegetation cover within each polygon
3. Analyses across ownership boundaries can be performed. The great economies of scale provided by digital image processing make it relatively inexpensive to map large expanses of land
4. Landsat TM satellite data are captured over the same area every 16 days. Thus, fast and inexpensive database updating is possible. Landsat TM data and extensive field-based observations were used as base data for the study. Computer classification was an iterative process. Aerial photographs, ancillary GIS layers, field and office reviews, and NPS personnel input were used to refine the maps through modeling and manual editing

PRODUCTS

Final products resulting from the study are three separate raster GIS data layers of tree size and forest structure, forest spe-

cies, and forest crown cover. Image-based raster map acreage totals for these layers are included in the final report for the project. In addition, a spatially related database of vegetation characteristics was developed from the compilation and analysis of an extensive vegetation inventory completed for each park as part of this study. Also, a digital map of geomorphologic landforms was produced through the analysis and interpretation of digital elevation data, aerial photography, and digital satellite imagery.

The accuracy of the image classifications was assessed and difference matrices are provided for the study. Accuracies in excess of 85% were achieved for all image-based data layers. More extensive field data collection, draft map review, and editing would further improve the quality and accuracy of the map data. The map data should be viewed as a dynamic, evolving database that should be consistently updated, evaluated, and improved.

DATABASES IMPROVED

The powerful, comprehensive databases developed through this study have several distinguishing characteristics: these databases provide the National Park Service with comprehensive baseline data

for each park in the Pacific Northwest. This data set can serve the basis for various long-term ecological research and monitoring efforts. The hierarchical data structures for the databases allow for landscape characterization and analysis at multiple scales. Future studies and analy-

site specific spatial assessments (i.e., habitat conditions, connectivity, biological indicators, etc.)

The data classification schemes allow for seamless analysis of ecosystems across the landscape regardless of ownership. Obviously, since the ecological world does not end at the boundaries of national parks, comparison and analysis of ecosystems across adjacent ownerships is critical.

The databases are easily updated, revised, and enhanced. Since the landcover classification process employed easily repeatable image classification methods utilizing Landsat TM imagery, change detection analysis and map updating procedures can result in a very cost-effective and fast approach for keeping the data sets current. Also, the standardized field data collection procedures allow for

the enhancement and expansion of the field-based vegetation inventory database during future field studies.

Finally, as accurate, comprehensive, and powerful as the databases developed from this study are, they will only gain true legitimacy and the confidence of the user through extensive use and review. The potential utility and application of the data sets is limited only by the imagination of the user. While these databases certainly do not represent the end-all data sets needed for the region, they do provide a powerful state-of-the-art launching pad for further study, analysis, and ecosystem management for the parks of the Pacific Northwest.

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ses can utilize these data sets for project- or watershed-specific areas or for more broad-based, regional and landscape-scale analysis by utilizing the full detail of the data or by aggregating the data into broader categories of information.

The raster data sets provide a more realistic depiction of diversity and variation of landcover across the landscape than do polygonal, usually photo-interpreted, data sets providing a single landcover label for often large (several acres) land areas that many times possess tremendous biodiversity.

DATA USES EXPANDED

The integration of spatial and tabular data provide greatly expanded applications for both data sets. Field-based measurements not measurable from remotely sensed data can provide much greater site-specific descriptions of cover types produced from satellite imagery. The spatial cover type data provide the means to consistently stratify field-based measurements and apply them across a park. The result is a powerful data set that can be used not only for general, regional summary statistical measurements, but also for

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