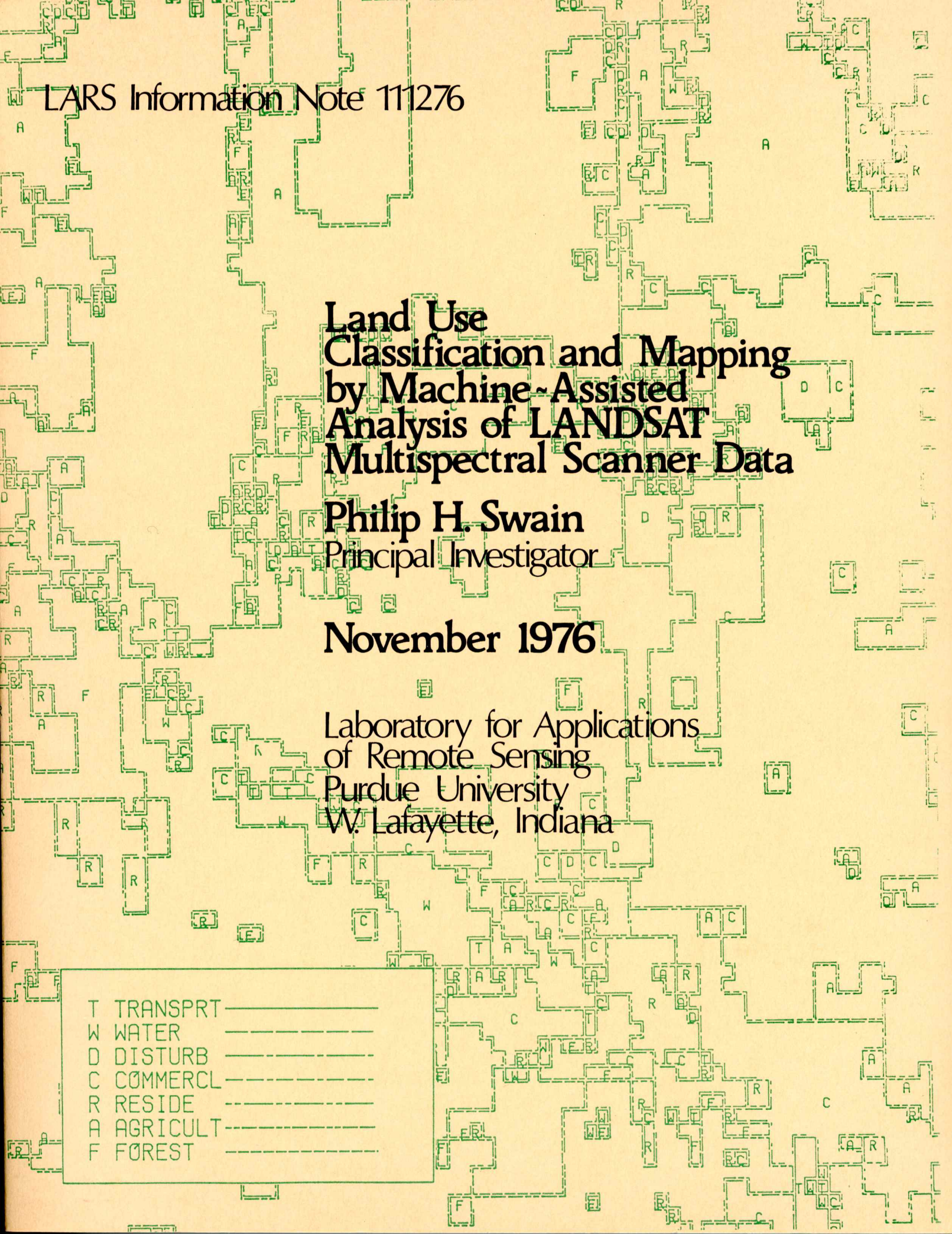
LARS Information Note 111276

Land Use Classification and Mapping by Machine-Assisted Analysis of LANDSAT Multispectral Scanner Data

Philip H. Swain
Principal Investigator

November 1976

Laboratory for Applications of Remote Sensing
Purdue University
W. Lafayette, Indiana



Land Use Classification and Mapping by Machine-Assisted Analysis of Landsat Multispectral Scanner Data

FINAL REPORT

Philip H. Swain
Principal Investigator

Laboratory for Applications of Remote Sensing
Purdue University
West Lafayette, Indiana 47907

September 1976

Sponsored by the
U.S. Geological Survey
Contract No. 14-08-0001-14725
July 1, 1974 - August 31, 1976

Technical Officer: James R. Wray

Acknowledgement

Many people outside the Laboratory for Applications of Remote Sensing contributed substantially to the work reported herein. I would especially like to acknowledge the participation and cooperation of:

Mr. James R. Wray and Mr. Leonard Gaydos, Geographic Applications Program, U.S. Geological Survey,

Dr. Richard Ellefsen, Department of Geography, California State University at San José,

Mr. Robert M. Ray III, Center for Advanced Computation, University of Illinois.

Philip H. Swain
Principal Investigator

CONTENTS

Part I: Overview

Part II: Technical Report

Appendices

LAND USE CLASSIFICATION AND MAPPING BY MACHINE-ASSISTED ANALYSIS OF LANDSAT MULTISPECTRAL SCANNER DATA

Final Report

Part I: Overview

In 1973, a joint study by the Laboratory for Applications of Remote Sensing (LARS) of Purdue University, the Center for Advanced Computation (CAC) of the University of Illinois, and the Geographic Applications Program (GAP) of the U.S. Geological Survey was initiated for the purpose of assessing the applicability of advanced remote sensing systems to land use classification and analysis. Early results of that study, focusing on the use of digital processing methods for the analysis of multispectral data from ERTS (now LANDSAT), were quite promising [1, 2] and funding was subsequently made available to continue and expand the study. Further successes led finally to a two-year research and development project, involving LARS and GAP, which is the subject of this final report. The net outcome of the overall three year effort has been a conclusive demonstration of the feasibility of applying digital analysis of satellite data to land use inventory and mapping. Significant contributions have been made to the remote sensing technology in general, particularly with respect to cartographically oriented applications. And personnel within GAP have learned and transfered to their agency the capability to utilize the remote sensing technology as it applies to their mission.

1.1 Previous Accomplishments

The joint effort prior to this two-year contract had produced significant successes. LARSYS, the multispectral data analysis software developed at Purdue/LARS, had been successfully applied to LANDSAT data to produce land use classifications over large areas, at a large scale, and with a high degree of detail. Some specific accomplishments included:

- Adaptation of general multispectral data analysis techniques to land use mapping at Level II [3] in the San Francisco Bay Area, Phoenix, and Washington, D.C.

- Successful land use mapping under conditions of severely limited "ground truth," through the use of current topographic maps and "unsupervised" multispectral analysis.

- Detection and identification of spectral variations indicative of urban growth.

- Urban/rural discrimination through the use of multi-temporal overlays (multiple satellite passes) characterizing differential seasonal changes.

- Demonstration of a capability to tabulate results on the basis of arbitrarily defined regions, such as census tracts (using, in this case, hand-coded boundaries).

- Improvement of capabilities for geometric rectification of satellite data, registering the satellite data to a 7½ minute quadrangle map to within one or two pixel accuracy.

- Communication of LARSYS algorithms (classification and clustering) to CAC for implementation on the ILLIAC IV.

There were other less tangible but equally significant accomplishments as well. Through this project, GAP was provided an opportunity to evaluate the use of this evolving technology in meeting their needs -- without having to go through an expensive in-house implementation. Working closely with LARS staff, GAP personnel were able to gain considerable insight into the potentials of the technology and to become educated in the use of computer-assisted data analysis techniques. At the same time, LARS benefitted through the opportunity to observe the technology applied by user-oriented specialists. In addition, the particular capabilities which this type of analysis required stimulated and supported development of a broad spectrum of technological advancements, many of which are now finding application to many other remote sensing problems.

The earlier work had a limited scope, involving primarily the application of existing methods to a small number of test sites. Under the expanded effort reported here the scope was broadened to include a wider variety of test areas and to push out the thresholds of the technology in some areas where the potential appeared particularly promising.

1.2 Project Objectives

The two-year project reported here had two relatively distinct phases, each of approximately one-year duration. The objectives of the first phase emphasized applying the previously developed technology to a wider variety of test sites in order to assess its general applicability. A lesser emphasis was placed on advancing the technology. As the research proposal stated, the specific objectives of this phase were to:

1.1 - Effect additional improvements in geometric rectification of ERTS-1 (LANDSAT) data.

1.2 - Reformat and preprocess ERTS-1 (LANDSAT) data for up to five test sites, not to exceed in aggregate 4.5 million data points.

1.3 - For selected test sites (to be specified by USGS) overlay selected bands for two scenes for contrasting seasons; and classify land use and land use change accordingly.

1.4 - Provide tape copies of land use classifications for selected test sites (to be specified by USGS) for production elsewhere of computer prepared map reproducibles.

1.5 - Provide instruction for up to two USGS trainees in the use of LARS data analysis software and the LARS computer terminal.

For the second phase, the objectives shifted slightly away from straightforward application of the existing techniques, providing for development effort in areas where both the need and the potential were apparent. The objectives of this phase were to:

2.1 - Further develop and report procedures for classifying land cover and land cover change by computer-assisted processing of satellite multispectral scanner data in digital format.

2.2 - Rework for publication, using recently developed capabilities, test site analyses previously processed for USGS at LARS; improve procedures for overlaying on the satellite data digitized user jurisdiction or map sector boundaries, and tabulating land cover and land cover change by jurisdiction or sector.

2.3 - Identify and report spatial/textural variations in the data to augment spectral variations; use the spatial/textural variations to refine land cover classification and to aid in the detection of land cover change.

2.4 - Apply digital processing techniques to satellite multispectral scanner data for multidiscipline earth science studies in new areas (to be specified by USGS --probably located in the Chattahootchee River Basin and/or in the Pacific Northwest).

These objectives can be organized logically into three principal task areas:

A. Data Analysis Techniques (objectives 1.2, 1.3, 2.1, 2.3, 2.4) - Develop and demonstrate the utility of digital data processing techniques for classifying land use and land use change.

B. Data Processing Products (objectives 1.1, 1.4, 2.2) - Develop and demonstrate the capability to produce maps and tabular results in various scales, formats, etc. and with sufficient quality to meet the requirements of the user community.

C. Training (objective 1.5) - Communicate to USGS personnel, either through formal training or on-the-job experience, the capability to utilize the digital data analysis technology in an effective and insightful manner.

Organized in this way, the coherence of the overall program is apparent. We shall use this organization to develop the balance of this report.

1.3 Summary of Accomplishments

Data Analysis Techniques. This project saw the "fine tuning" of the basic computer-oriented data analysis techniques developed under the earlier joint effort, application of these techniques to a wide variety of urban areas, and a number of related advancements. With each new set of data analyzed, new features were added to the basic analysis approach in order to demonstrate the versatility of the computer processing in attacking land use analysis problems. Thus, for the Springfield, Missouri analysis, unique aspects included:

- Analysis of a large area (1° x 2° quadrangle) at reduced resolution by systematic sampling of the data.
- Registration of machine-digitized county boundaries for production of county-by-county results tabulation.

- Photographic reproduction of classification results in color-coded form at a variety of scales.

The Indianapolis, Indiana analysis saw the following developments:

- Concatenation of successive (north-south adjacent) frames of LANDSAT data in a geometrically and radiometrically consistent manner in order to achieve contiguous multitemporal coverage not otherwise available.

- Capability to record and transfer digitized county boundaries on magnetic tape.

Analysis of the Washington, D. C. multitemporal data set resulted in:

- Extension of the boundary-handling capability to accommodate census tract boundaries, a more complex problem than county boundaries.

- Transfer of classifier training statistics and geometrically registered multitemporal data from the LARS computer system to the ARPA network.

- Demonstration of Illiac IV capability and speed as applied to 8-channel classification of a relatively large area.

For the purpose of detecting and mapping land use change, advantage was taken of the combination of repetitive satellite coverage, geometric registration of scenes by digital methods, and machine-assisted land cover classification. Although the work in this area was much more limited than originally planned, due to unavailability of USGS personnel expected to participate in this work, a basic capability was demonstrated and related problems were identified for future research.

Two significantly different approaches to the characterization of spatial information were investigated for possible application to land use analysis. One of these, which isolates statistically uniform areas in the data and then classifies all pixels in each area as an aggregate, was shown superior to the other approach, which involves determination of local texture. The former method, dubbed ECHO (Extraction and Classification of Homogeneous Objects), was extensively investigated to learn how it can best be applied in the context of land use analysis. It was shown capable of improving classification results over those obtained by the usual pointwise classification methods, at competitive cost in terms of computation required.

Data Processing Products. Progress was made in exploring the possibilities for improved output products, both of a map-like and tabular nature.

It was demonstrated that commercially available film-writing systems can produce image versions of the land use classification results, and a number of these were obtained, both by LARS and by USGS, for evaluation. The general characteristics as well as cost and quality of the products differ substantially. Still other variables are the availability of the service if the products are to be obtained from a contractor, and the availability of the hardware if it is desirable to obtain an in-house capability.

In addition to map-like (image) reproductions of the land use classifications, various forms of tabular presentations were explored. It was demonstrated that the results could be tabulated on a rectangular cell basis; e.g., the number of pixels (or acres or hectares) of each cover type within any given UTM grid cell (1m, 5m, etc., on a side) could be tabulated. Of greater significance, it was demonstrated that arbitrary political or jurisdictional boundaries could be digitized from existing maps, registered to the LANDSAT imagery and the classification results, and the results could then be aggregated on the basis of these units. As noted earlier, aggregations by county were obtained for Springfield and Indianapolis, and by census tract for Washington, D. C.

Training. USGS did not elect to send personnel to LARS for a period of formal training in residence. (Such training is available at LARS and Purdue University through a broad spectrum of short courses, full-credit university courses, and a Visiting Scientist program.) However, a variety of USGS personnel were exposed to the machine-assisted analysis/remote sensing technology. In the course of the overall 3-year effort, Mr. Leonard Gaydos, of USGS, spent many weeks working closely with LARS researchers and developed a considerable expertise in the application of the technology which he has since made extensive use of in other USGS activities.

1.4 Conclusions

This project has demonstrated that the synoptic view from satellite altitude together with the modern sensor and computer processing technologies have much to offer those who need accurate and timely land use information. Even with relatively limited "ground truth" or reference data, computer analysis of digital multispectral data has yielded accurate classification of a wide range of ground cover types. It has also been demonstrated that once the data has been classified, further

data processing operations can produce imagery or tabular summaries from the classifications, the products needed for a variety of land use mapping and inventory applications.

Most notable has been the success with which the evolving technology has been transferred from the university research laboratory to the potential user agency. The "user-in-residence" approach has been effective in two respects. By becoming well acquainted with the technology on a first-hand basis, the agency representative has had the opportunity to gain an insightful appreciation for how the technology can meet his needs. Equally important, he has been able to assess those areas in which the current technology falls short of meeting his needs and to point the direction for further development.

The possibilities have by no means been exhausted. Data analysis techniques evolving through research continue to hold promise for improving the applicability of remote sensing to land use mapping and inventory problems. A prime example is the use of computer-derived contextual clues which can be used to convert land cover classes into true land use classes. Still to be explored to any significant depth are the benefits to be derived from registration of multiple data types (e.g., demographic data or soil type data, registered with satellite data) for the purpose of studying how land-use variations impact the environment in which we live.

New sensor systems to be orbited in the foreseeable future will open up still further possibilities for deriving more accurate and detailed land-use information.

Part II. Technical Report

2.1 Classification and Aggregation

As noted in Part I of this report, the early joint study had seen the successful adaptation of the basic multispectral remote sensing data analysis techniques to the highly complex land use mapping application. By early in this project, a procedure had been arrived at, consisting of a mixture of unsupervised (clustering) analysis and supervised (training sample selection) analysis, which was felt to be optimal for the sets of LANDSAT data which had already been examined (San Francisco Bay Area, Phoenix, and Washington, D.C.). Subsequent work with the Springfield, Indianapolis, and multitemporal Washington, D.C. data sets produced no significant changes in the basic procedures.

Figure 2.1, adapted from a diagram by James R. Wray, shows the essential steps in the analysis procedure. Further detailed descriptions of the specific procedures applied to the various data sets may be found in the references (see especially [4]). The computer programs themselves and the numerical algorithms which they embody are thoroughly documented in [5].

Virtually all of the data analyses performed in connection with this project was carried out using geometrically registered multitemporal data, since results of the early joint study indicated that multitemporal data provided a marked improvement in rural-urban separation over single-date data [4]. Although the basic analysis procedure remained essentially unchanged from one urban area to the next, the data processing associated with each of the LANDSAT data sets for this project had its novel aspects. We shall, therefore, take a brief look at them individually.

Springfield. This analysis had many unique aspects. Covering almost the entire area of a 1° x 2° quadrangle map, it was the largest area to which the analysis procedures had yet been applied. Data from two LANDSAT passes, October 4, 1972 and January 20, 1973, were registered and geometrically corrected. It was decided that the full resolution data would not really be needed for an area this size and the cost of the preprocessing operations could be reduced significantly by reducing the volume of data. Thus, in the registration process, only every other line and every other column in the data set were extracted, effectively reducing the linear resolution by a factor of 2. This meant, for example, that line printer output would have a scale of 1:48,000.

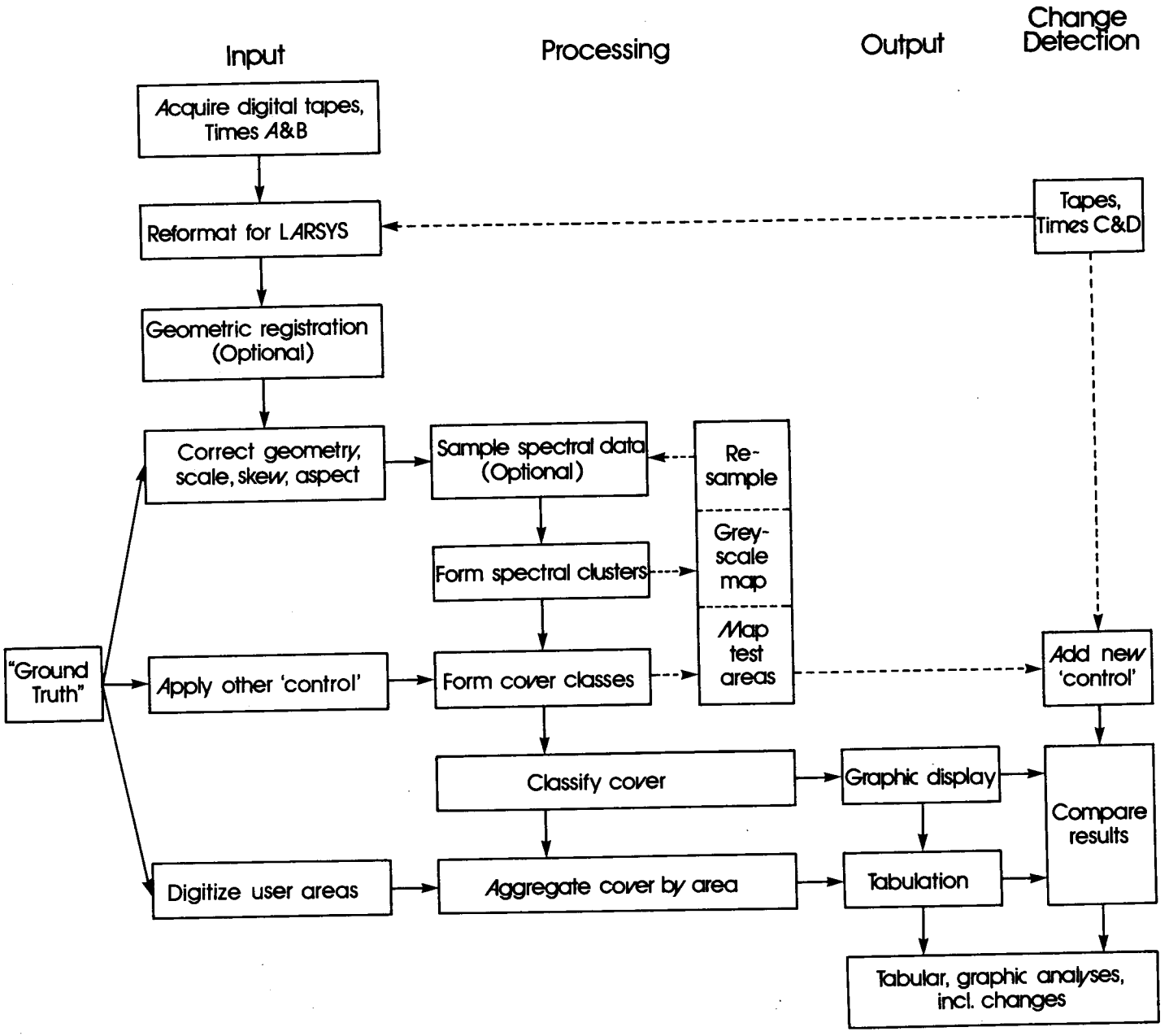


Figure 2.1 Procedures for Computer-Aided Classification of Land Cover from LANDSAT Multispectral Scanner Data (James R. Wray, U.S. Geological Survey, August 1974).

This was the first data set for which machine-digitized boundaries were made available for tabular aggregation of the analysis results. A simple demonstration of the aggregation process had been performed earlier by hand-encoding the census tract boundaries for the San José area. A modified version of the LARSYS PRINTRESULTS processor was used to tabulate the classification results based on these boundaries. But it was clear that encoding boundaries by hand was not a practical approach. Therefore, USGS personnel utilized mechanical digitizing equipment to produce a coded description of the county boundaries in the Springfield area, and this was supplied to LARS in punched card form. Procedures were then developed by LARS to register the boundaries with the LANDSAT data and to recode the boundaries in the form needed for the aggregation process. A full description of these procedures is presented in a later section of this report.

The Springfield classification results were utilized in many forms in addition to the county-by-county tabulation of results. Imagery showing color-coded versions of the classification were produced in many scales and formats, including a spectacular color print at a scale of 1:250,000 (examples are shown in Section 2.4). This marked the beginning of a long series of experiments aimed at producing high quality color displays of the results which might be recast almost directly as map products.

Indianapolis. The Indianapolis analysis, like Springfield, involved the area covered by a 1° x 2° quadrangle. Again, two seasonally contrasting LANDSAT acquisitions were used (January 16, 1973 and September 7, 1973) but this time the full resolution data set was prepared because it was intended to look at several smaller areas within the quadrangle in greater detail.

It was discovered that the available and cloud-free LANDSAT frames did not completely cover the desired area in the north-south direction. However, two successive frames covering the area were available, so the LARS reformatting group developed a procedure for concatenating successive frames. Care was required to assure both geometric alignment and radiometric consistency. The latter is not automatically guaranteed from frame to frame due to the nature of the data processing performed by NASA in the "framing" operation.

It was again desired to aggregate the classification results by county. The boundaries were again supplied by USGS, this time on magnetic tape--one more step toward practical handling of the considerable volume of data involved.

The results of this analysis have been published both formally and informally within USGS. Intensive studies of many sub-areas of the Indianapolis quadrangle have provided a basis for evaluating many of the data processing and analysis techniques developed in connection with the project.

Washington, D. C. The capital area had been analyzed earlier in connection with the initial joint study. However, it was desired to try for more accurate classification results using multitemporal data and to tabulate the classification results by census tract.

The LANDSAT frames registered at LARS for this analysis were from October 11, 1972 and April 9, 1973. In order to make maximal use of both the multitemporal and multispectral information contained in the resulting data set and to experiment with the use of a powerful new computational facility, it was decided to run a full 8-channel classification of the entire area, encompassing approximately 2.5 million pixels, on the Illiac IV computer accessed via the ARPA Network. To take advantage of the interactive facilities needed to best design the classifier, the classifier training phase and a smaller scale test classification were carried out at LARS. The resulting statistics and the 8-channel multispectral/multitemporal data were then transmitted to CAC at the University of Illinois for the Illiac IV processing.

Eight minutes of Illiac IV processing time were required to complete the classification--which would have required on the order of thirty hours on the LARS system. This reflects the potential power available for this type of processing through special purpose hardware. Although considerable additional time and expense are required today to set up such a job and retrieve the results from the Illiac IV and ARPA Network, it is anticipated that future systems designed expressly for large scale image processing will make this sort of computational power more generally and conveniently available.

The Washington, D. C. census tract boundaries were machine-digitized at USGS and registered at LARS to the Illiac IV classification results. The very large number of census tracts, far larger than the number of aggregation units dealt with previously, made further software development imperative. The tabulations produced appear as an appendix to this report.

2.2 Change Detection

The availability of data from multiple satellite passes over a given site plus the technology to precisely register the data has proved valuable in many respects. As noted above, the multitemporal information can be used to increase the classification accuracy. But the dynamics of land use are of interest in themselves, and detection and mapping of land use change were specific objectives of this project.

Anuta and Bauer at LARS [6] had investigated a number of approaches to urban change detection. In analyzing LANDSAT data from the Phoenix area, Ellefsen et al. [4] reported detection of spectral classes indicative of change.

To further pursue this matter, a data set was prepared for which several anniversary passes (i.e., separated by a year or multiples of a year) were available together with supporting reference data. The specific objective of this investigation was to determine if land use changes could be detected by comparison of two classifications of data collected approximately three years apart. The specific land use change of interest was urban encrochment on agricultural land. The data used was collected over the vicinity of Clermont, Indiana, by the LANDSAT satellite in September of 1972 and in October of 1975. The basic approach used was to classify each date separately and compare the classifications in such a manner that green or vegetative cover in 1972 which had changed to non-green cover in 1975 would presumably indicate change to urban land use. The data sets were overlaid and precision corrected to a line-printer scale of 1:24,000. (A third date from September of 1973 was included in the data set but was not used in the classifications because little land use change had taken place in the one year time interval.) The area was classified with both the standard LARSYS pointwise classifier and the experimental sample classifier (ECHO: see Section 2.2.3). The classifications were compared with photography available to the dates of data collection and in each case the photography and data were separated in time by less than a year.

Preparation of the Reference Data. Although there was no photography taken at the time of data collection, we had available high altitude (18,000 m [60,000 ft]) 23 cm x 23 cm (9" x 9") color infrared photography taken in 1971, approximately one year prior to collection of the 1972 LANDSAT data. Also, in May 1976, we were able to collect color infrared photography over the test site with the LARS 70mm photography system, eight months after collection of the 1975 LANDSAT data. While this reference data was not ideal, it was the best available and provided a good idea of urban encroachment into agricultural areas during the three year time period. There are two small areas in the 1976 photography which appear to be very new residential areas but may not have been in residential land use at the time the 1975 LANDSAT data was taken. A zoom transfer scope was used to overlay the photography onto a 1:24,000 USGS quadrangle map and the residential areas from the 1971 photography were transferred to the quadrangle map to update it to 1971. A similar procedure was followed using the 1976 photography to add urban and residential areas which appeared on the new photography but was not present on the 1971 photography. These were added to the quadrangle map in a different color. This map was then used as ground truth to check the classifications by overlaying 1:24,000-scale line-printer classification maps directly on the quadrangle map.

Analysis of Single Date Data. The following procedures were used in the analysis of each individual date. Training areas were selected from known urban areas and from known

agricultural areas and the clustering algorithm was employed to define sets of spectral classes which would represent each general land use, i.e., urban or agricultural. The agricultural areas could not be identified as to specific crop since no concurrent photography was available on either date, but this did not effect the analysis procedure since the goal was only to identify the areas in agricultural land use, essentially covered by green vegetation. The forest category and permanent pasture were also identified and row crops (soybeans and corn) were identified as a single group. In addition, several classes of water were identified in Eagle Creek Reservoir. After the cluster classes were identified in each individual area they were compared statistically and reduced in number as appropriate. The final number of spectral classes used was 12 for the 1972 data and 13 for the 1975 data.

In selecting the data sets, an attempt was made to pick times at which the ground cover would be relatively similar. The ideal situation would be to have data on dates in each growing season such that agricultural crops would be at similar growth stages and agricultural fields would be completely covered with vegetation; forest areas would be covered with green tree canopies and the urban areas would be under similar lighting and spectral response conditions. As is often the case when attempting to do classifications or urban and agricultural areas within the same single-date data set, there were numerous problems of confused classifications between urban and agricultural classes. Since the purpose of this analysis was to detect change from green or agricultural use to non-green or urban use, the training sets were deliberately biased somewhat in favor of identifying green classes at the expense of some misclassification within the urban areas, particularly in older residential areas with large areas of green lawns and tree canopies. Although this error would be serious in a single-date classification, the misclassification of an old urban area as agricultural would not be a problem in the comparison between the two dates, since only changes from green to urban would be examined.

Unfortunately, the 1975 data was not collected at an ideal time, since it was collected in late October, and some difficulty resulted in defining agricultural land uses. Much of the row crops (corn and soybeans) had already been harvested, so that agricultural land use was represented primarily by stubble fields or probably, in some cases, bare soil where fields had been plowed after harvesting. This situation accentuated the problem of misclassification between urban and agricultural land use, but with careful selection of training fields a satisfactory classification was obtained for comparison of the 1972 and 1975 situations.

Once the training sets for each date had been defined, classifications were made of identical areas using both the standard LARSYS pointwise classifier and the experimental ECHO sample classifier [7]. The ECHO classifier was used with a cell size of two, which provided the highest resolution for classification. The other parameters were selected to favor cell splitting or pointwise classification so that local variations could be seen while still taking advantage of the property of the ECHO classifier which tends to reduce random incorrect classifications of individual points. Since the data sets had been geometrically registered, identical 2 x 2 cells were classified on each date with the ECHO classifier. After some experimentation, the annexation parameter was adjusted to eliminate all annexation of cells (region growing), since there was a tendency to produce excessive errors when fields were incorrectly annexed.

Comparison of Classifications. After each date had been classified individually the classifications were then compared pixel by pixel by another computer program called CHANGE which allows the user to specify groups of classes which he wishes to have considered. The program generates a new results tape which can be used with the PRINTRESULTS processor in LARSYS to generate output of the change detection results in any LARSYS format the user desires. In this case, the program was instructed to find pixels of urban, residential, commercial, forest, agricultural and water land uses which had NOT changed classification between the two dates. These classes were then assigned appropriate symbols allowing the overlay on the 1:24,000 map to be done with precision since the lake and forest classes provide easily located check points. Those classes which had changed from agricultural land use to urban land use were also specified as separate classes and assigned distinct symbols. All other changes were assigned to a "general change" class, since these were not significant for this investigation. The 1972 classification, 1975 classification and the change maps, as seen on the LARS digital display system, are shown in Figures 2.2 to 2.7.

Areas of Change. Comparing the pointwise classifications, two distinct areas of change are seen in Figure 2.6. One of these, toward the southwest, is in fact an addition to a trailer park; the other is a new residential area in the northwest portion of the quadrangle. There are several small areas of change which are associated with very small residential additions. Some of the singleton points are errors in classification, which are of little significance and could be "filtered out" of the results. There is a new residential area apparent in the photography which was not picked up by the change analysis, apparently because the area was built under a partial tree canopy and with wide separations between houses.

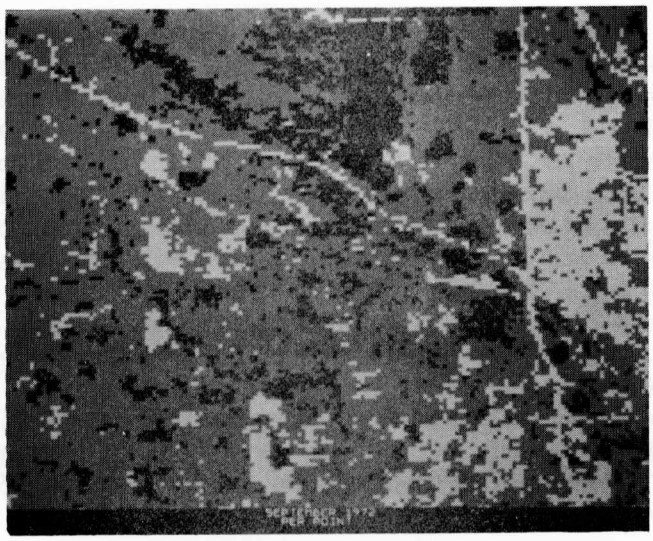


Figure 2.2 September 1972. Pointwise classification. Black, forest and water; Gray, agriculture; White, urban.

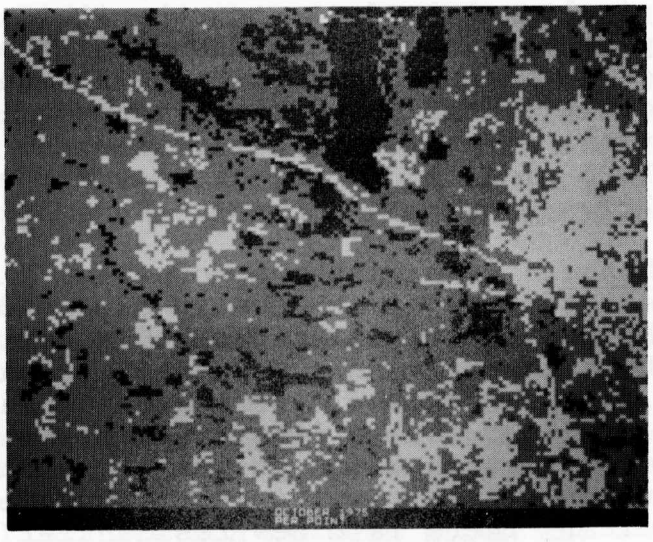


Figure 2.3 October 1975. Pointwise classification. Black, forest and water; Gray, agriculture; White, urban.

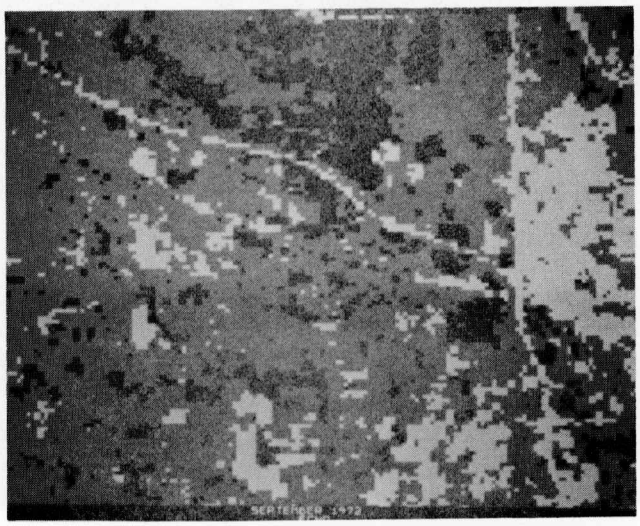


Figure 2.4 September 1972. ECHO Classification. Black, forest and water; Gray, agriculture; White, urban.

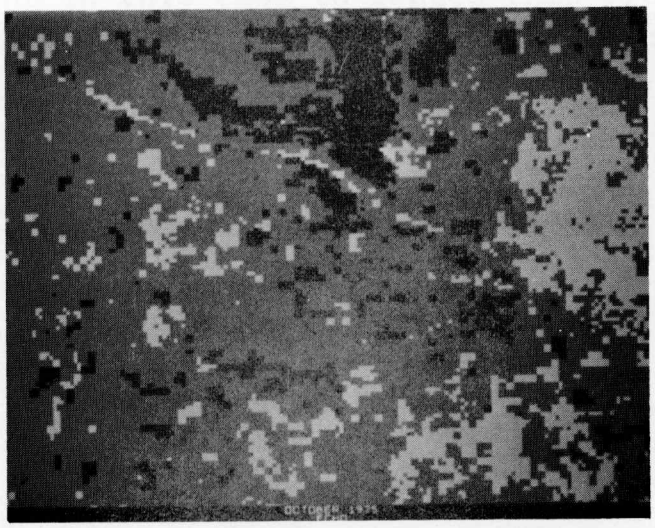


Figure 2.5 October 1975. ECHO Classification. Black, forest and water; Gray, agriculture; White, urban.

Figure 2.6 Change Classification. Black, water; White, agriculture-to-urban change; Gray, agriculture and forest. Clump at top right is new residential and group at lower left is addition to mobile home park.

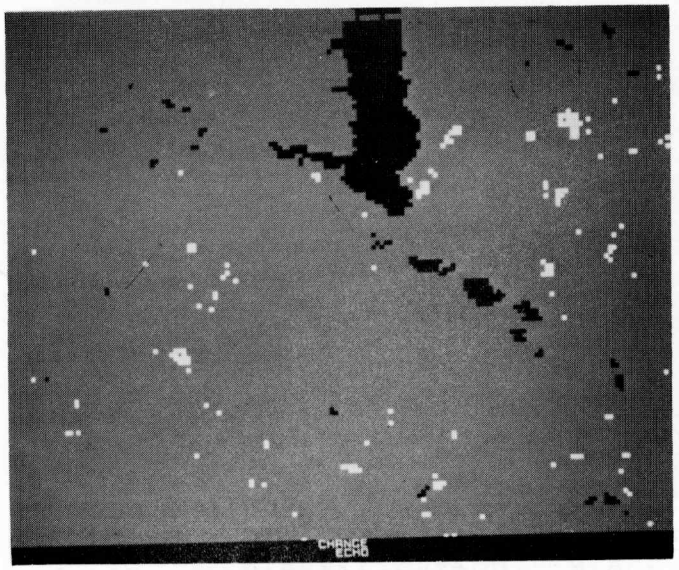


Figure 2.7 Change Classification. ECHO. Black, water; White, agriculture-to-urban change; Gray, agriculture and forest. Clump at top right is new residential and group at lower left is addition to mobile home park.

The areas of change actually appear to be slightly smaller than the area shown in the second classification. This is probably due to the very small registration error between the two data sets resulting from the fact that the scanner would rarely, if ever, track over exactly the same point on the ground. Therefore, there may always be up to one-half pixel misregistration between dates, and this may show as a variety of classes, probably different from the actual ground cover. The singleton errors probably result from the same circumstances, especially at the boundary between urban and agricultural cover. Many of the singleton errors are associated with interstate highways and an oil storage tank farm just north of the mobile home park. In addition, there are two bands of water change around the lake (not shown) due to this misregistration and to the additional effects of variation in water level in the lake between the two dates.

Comparison of ECHO and Pointwise Classifications. The ECHO sample classifier has the capability of reducing "noise" in the classification. It is also dependent on the setting of several parameters to give appropriate results. In this case, it was found that a parameter setting using the smallest cell size, i.e., 2 x 2, and allowing more than the usual amount of cell splitting gave the best results. (Setting parameters in ECHO is discussed at length in the next section.) The effect is to "clean" the classifications to some extent by reducing the number of individual points scattered about the classification which are evident in the pointwise results. Care had to be taken, however, in selecting the parameters due to the possibility of misclassification in areas of very abrupt change on the ground. It appears that the level of cell splitting used was sufficient in this case to reduce this problem while still cleaning up the classification. Comparison of Figures 2.6 and 2.7 shows that in the ECHO results the scattering of individual change points has been reduced.

The results of this investigation indicate that urban encroachment of agricultural areas can be detected through classification of multitemporal data. However, the size of the change areas must be large relative to the resolution of the sensor, and the classifications must be done with relatively high accuracy with respect to the classes which will show the change. In the part of the midwest from which the data for this investigation were taken, there is almost complete utilization of land for agriculture during the growing season and change becomes relatively easy to find. The analysis has only to detect change from green cover to non-green cover provided the dates have been selected in the part of the growing season when full ground cover is still assured. Land use changes which did not disturb forest cover, such as residential housing underneath partially forested areas, were not detectable using this approach.

Since it is not simple change per se which is being detected but rather its multispectral manifestations, the strategy needed to detect and map land use change is likely to vary with the region involved.

The use of sample classification for analysis of data sets between which change is to be detected is recommended, since it tends to eliminate random classification errors and can generally raise the accuracy level toward that needed for reliable detection of land use change.

2.3 Spatial/Textural Features for Classification Improvement

During the first decade of research and development in applying digital analysis techniques to multispectral remote sensing data, emphasis has been concentrated on extracting information from the spectral domain. In other words, the methods applied have in the main been those which analyze the spectral measurements on a pixel-by-pixel basis. Some work has been done to utilize temporal information through registration and analysis of multiple sensor passes over the same scene. Far less work has been directed at extracting spatial information based on shape, context, texture and other forms of spatial relationships--even though we know from our experience with manual interpretation of multispectral remote sensing data that the spatial information content is significant.

There were a number of compelling reasons for looking into the use of spatial features as part of this study. To begin with, we believed that spatial information could be used to improve on the level of classification accuracy attainable using the spectral data alone. Also, while the spectral data is well suited to identifying land cover, the real goal of this study is identification of land use. Thus, while spectral data can be used to classify "asphalt," spatial data might lead us to classifications such as "highway," "roof top," and so on. Of particular interest as we began to consider using spatial information was improving the distinction between urban cover types and spectrally similar non-urban cover types.

Spatial/textural feature extraction has been under study during the last year of the contract. Specifically, we have looked at two approaches: sample classification with automatic object finding, and use of texture as a characterizing feature.

2.3.1 Sample Classification

Simultaneous analysis and classification of a group of pixels all assumed to be drawn from the same class has been shown to be a powerful method for incorporating simple spatial information (adjacency) into the analysis process [7]. If a

means is available for automatically determining the pixel groups, called "samples," in the data, sample classification can improve both the accuracy and the efficiency of the data analysis. An approach combining both sample location and sample classification has been developed at LARS and is referred to as Extraction and Classification of Homogeneous Objects, or simply ECHO.

The ECHO processor became available on the LARSYS experimental library at LARS during the past year but very little work had been done to determine how best to use the flexibility of this new analysis tool. Early results from the processor had indicated that varying the processor parameters could produce significant differences in the classification results, but the relationships between the parameters were not well understood. The processor was also felt to be inherently data and problem dependent. Therefore, a series of tests were formulated to study the effects of parameter variation, to determine optimal parameter values, and to observe how the parameters interact. A relatively small area in a LANDSAT frame was selected so that exactly the same set of data points could be used for each test classification in order to reduce the data dependency effects. The area selected for the test was the south-east quarter of the USGS 7.5 minute Clermont, Indiana, quadrangle. This area includes a zone of transition from urban to agricultural land use and also contains water, forest, and disturbed areas which are now being converted from agricultural to urban land use. The area is therefore spectrally complex and provided an interesting test for the ECHO processor.

The supervised ECHO sample classifier used for the test is a two-part processor which requires three user-specified parameters. These parameters will be described here briefly and the observed interactions and recommended values will be discussed. The training set (i.e., classes and channels) used for the test was the set developed for the original classification of the Clermont quadrangle by Mr. Leonard Gaydos of USGS.

The CELL WIDTH parameter (CELW) controls the size of the cell or smallest block of data which will be considered as a candidate "field" by the processor. The value of CELW establishes the size of a square of data pixels. Values of CELW used in the test were two, three, and four, corresponding to cells of 4, 9, and 16 pixels, respectively.

The CELL SPLITTING parameter (SEL1) allows the user to specify how homogeneous a cell must be to be allowed to stand as a unit. The value of SEL1 sets a threshold on the data variance within each cell of size defined by CELW. Depending upon the threshold level, the processor will decide if the cell is sufficiently homogeneous to be accepted as a unit. If it is not, the cell is broken up into individual pixels which are then classified by the pointwise classifier. In general, as SEL1 increases, the processor allows cells of greater

variability to stand, but the effect of changing SEL1 is observed to interact with changes in CELW: a given SEL1 value will usually produce differing results at different CELW values.

The third parameter is the ANNEXATION parameter (ANN1) which affects how cells which are similar may be grouped together to form larger aggregate fields to be sample classified. The ANN1 value controls a threshold used to decide if a boundary exists between candidate fields. If so, the fields will not be merged into a single sample. Fields which have "failed" the cell-splitting test and thus have been split for pointwise classification cannot be annexed, and as a result, small values of SEL1 will inhibit the degree of overall annexation by breaking the spatial continuity required to add cells to an existing field--another case of parameter interaction. In the tests performed in this study, no annexation was allowed (ANN1 = 0) in order to evaluate more easily the effects of varying CELW and SEL1. The effects of varying ANN1 will be the subject of later, ongoing studies of the ECHO processor.

The parameter evaluation tests consisted of a series of classifications of the test site in which the CELW value was held constant at a number of levels while at each level SEL1 was varied to determine its effect and range of useful values. CELW of 2 was used first. Visual examination of the classification maps indicated that SEL1 values of 160 or greater produced virtually no cell splitting whereas SEL1 values of 20 or less resulted in very nearly pointwise classifications. For CELW = 3, the corresponding extremes of SEL1 were 50 and 400; for CELW = 4, they were 100 and 700. Thus, for CELW = 2, 3, or 4, these values bracket the useful range of SEL1. This is the range of CELW values most commonly used for analysis of LANDSAT data.

Figures 2.8 and 2.9 show a more quantitative characterization of the effects of varying the parameters CELW and SEL1. In a sense, the most desirable parameter settings might be considered to be those giving the most efficient (fastest) classification and the most homogeneous results. For a given value of CELW, this type of performance corresponds to a very large value of SEL1. Therefore, we used as bases for comparison three classifications obtained with (CELW = 2, SEL = 200), (CELW = 3, SEL1 = 500), and (CELW = 4, SEL1 = 700). We refer to these as "perfield" results since each cell is retained as a small "field." For a range of values of SEL1 (at each setting of CELW), we tabulated the number of points which were classified differently from the basis classification (the same value of CELW) and these results are shown in Figure 2.8. The computer time required for each case is shown in Figure 2.9. In Figure 2.9, "Phase 1" is the time required for finding the homogeneous areas or samples and "Phase 2" is the time required to classify the samples. Clearly the former is the dominating factor.

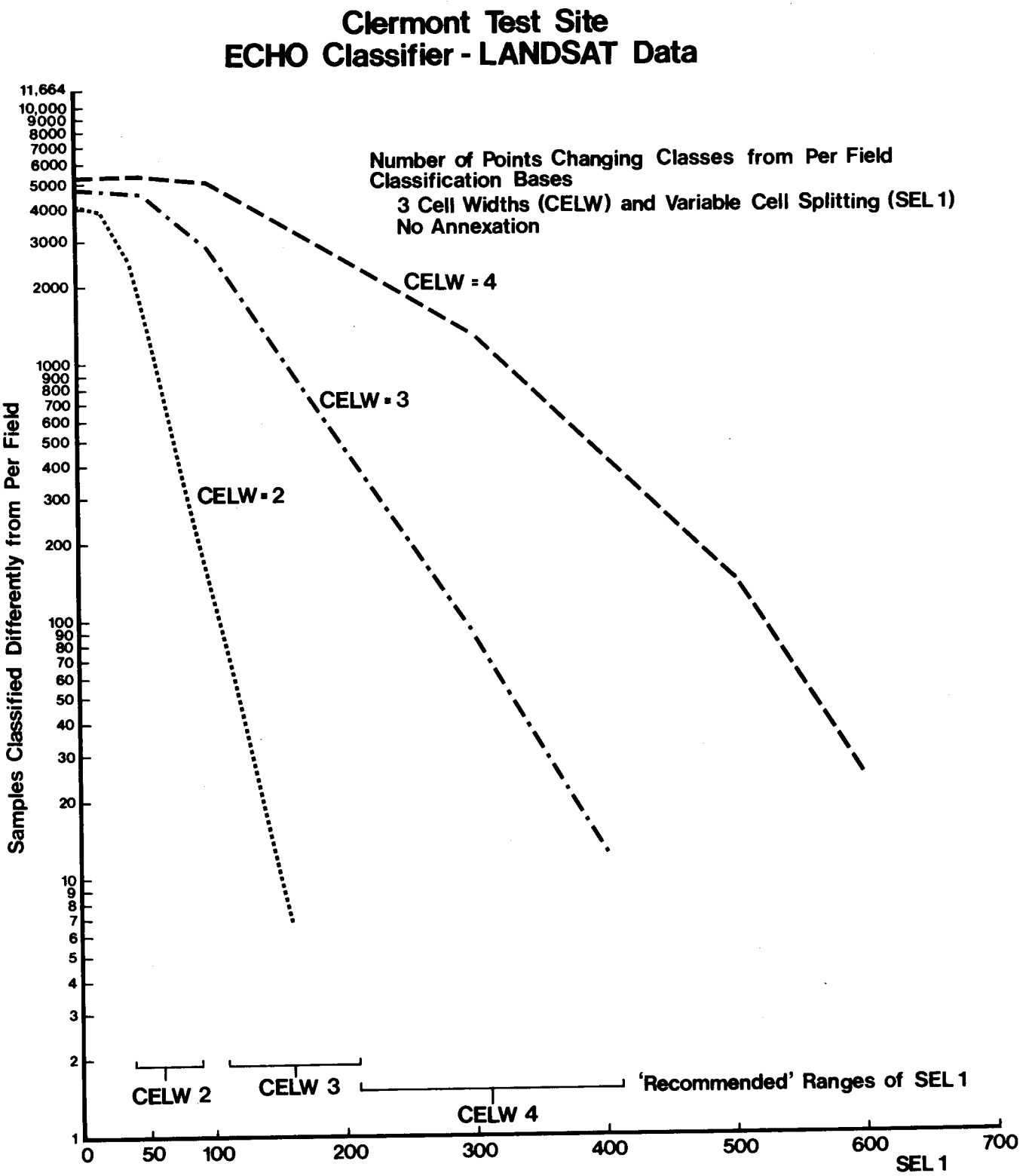


Figure 2.8 ECHO Classifier Behavior as a Function of Parameters CELW and SEL1.

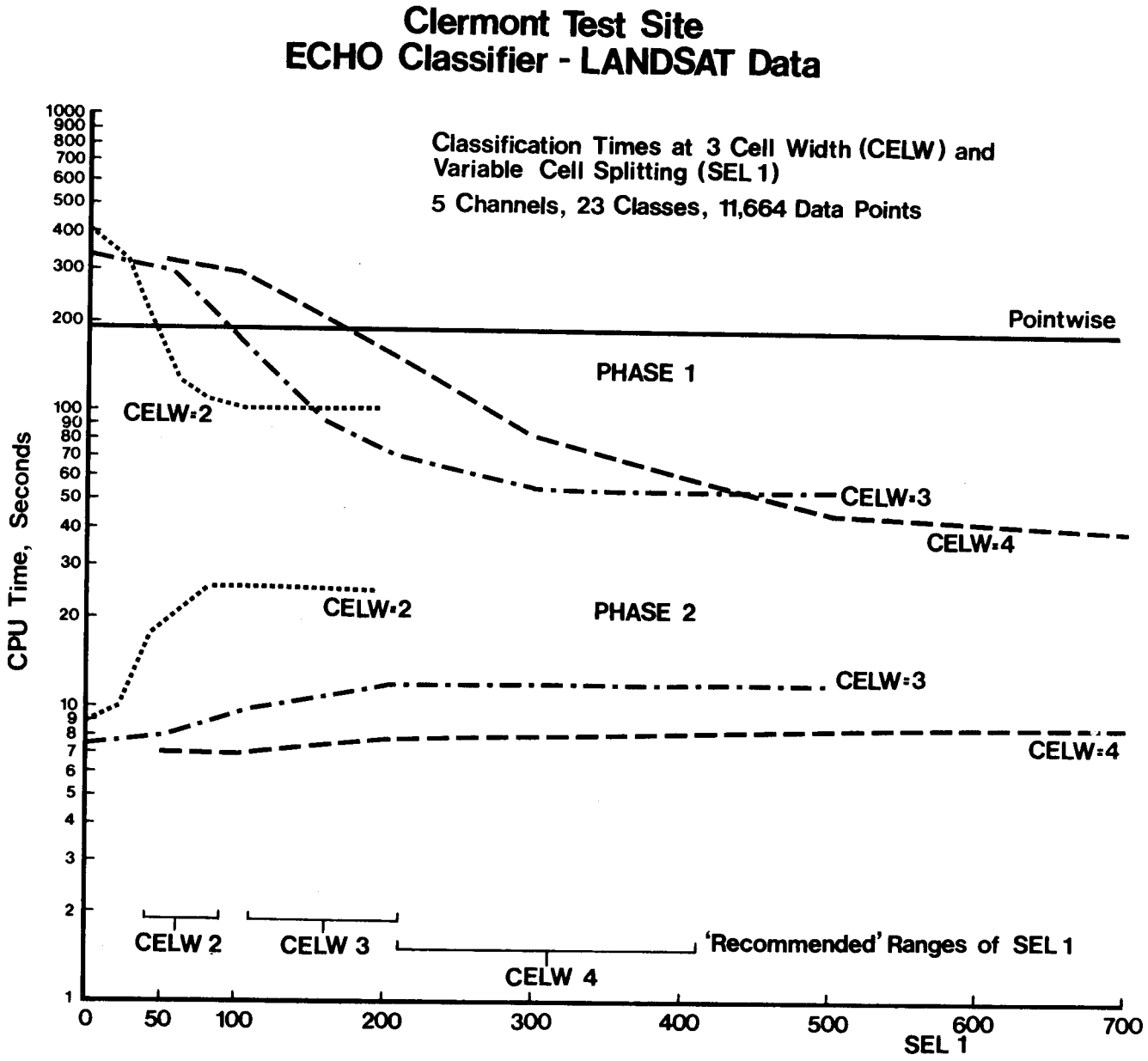


Figure 2.9 The Effect of Parameter Variation on ECHO Classification Time.

These curves do not tell us the "best" values of the parameters to use. Rather, they indicate the relative costs associated with various parameter combinations. In general, as we increase SEL1, the classifier will for a time get more and more efficient, but there is a point beyond which the improvement is no longer significant. Meanwhile, the results get less and less homogeneous, which, depending on the application, may or may not be desirable.

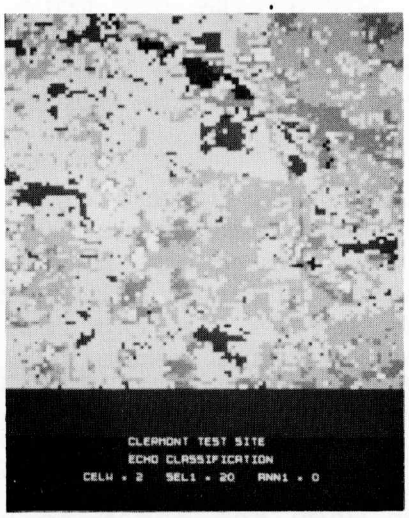
Qualitatively, the effects of CELW and SEL1 parameter changes are apparent when the results are examined visually. Examples are shown in Figures 2.10 to 2.13. These are photos of the classification test area with classes grouped into six informational classes represented by gray levels ranging from black to white and corresponding to water, forest, commerical, residential, agricultural, and distrubed land uses, respectively. An actual pointwise classification from the regular LARSYS classifier is shown in Figure 2.13 together with a CELW = 3, SEL1 = 50) ECHO classification to show how closely the ECHO result resembles pointwise classification when the parameters are set to that extreme end of the range.

For general use the following parameter values are recommended for ECHO analysis of LANDSAT data:

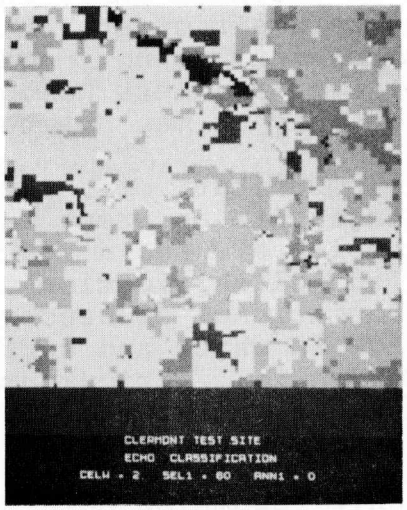
Cell Size (CELW)	Cell Splitting (SEL1)
2	40 - 90
3	100 - 210
4	210 - 410

In urban areas, and other spectrally complex scenes, CELW = 2 appears to give best results with SEL1 = 60 and annexation (ANN1) between 0.0 and 1.0. In less complex areas such as rangeland or agricultural land with large fields, for example, cell widths of three or four, cell splitting parameters set toward the high end and annexation values of 1.0 to 2.0 should be used. This also takes advantage of reduced computation times.

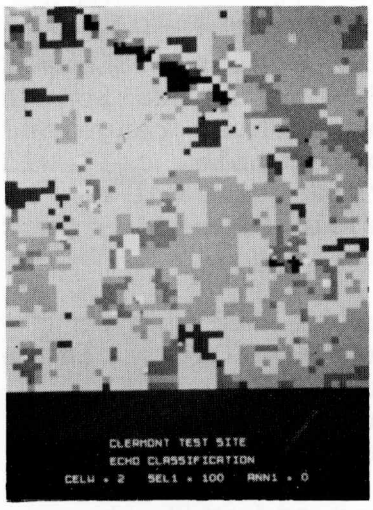
The test results demonstrate the range of different results which can be obtained with ECHO when the data, classes, and channels are held constant and only the CELW and SEL1 parameters are varied. The user, based on his analysis objectives, must choose the parameter values to give the desired results. That choice requires an understanding of how the parameters interact with one another and with the data. The results obtained in this study provide an indication of the nature of these interactions and some guidelines for parameter settings.



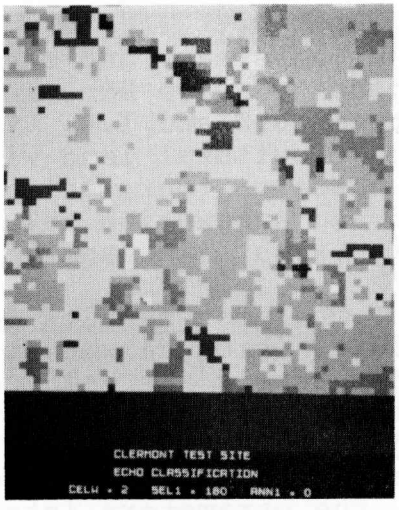
ECHO Classification
CELW=2 SEL1=20 ANN1=0



ECHO Classification
CELW=2 SEL1=60 ANN1=0

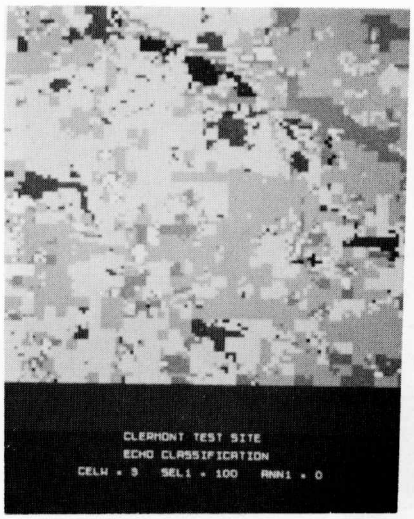


ECHO Classification
CELW=2 SEL1=100 ANN1=0

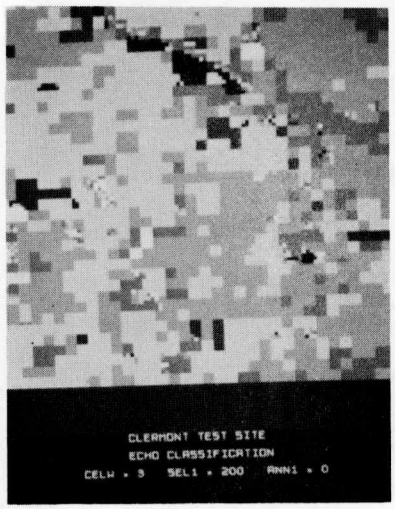


ECHO Classification
CELW=2 SEL1=180 ANN1=0

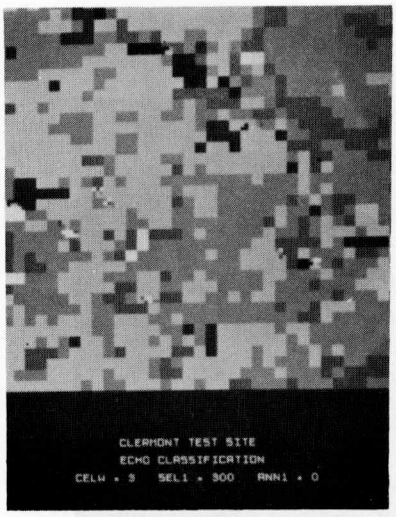
Figure 2.10 ECHO Results for CELW=2.



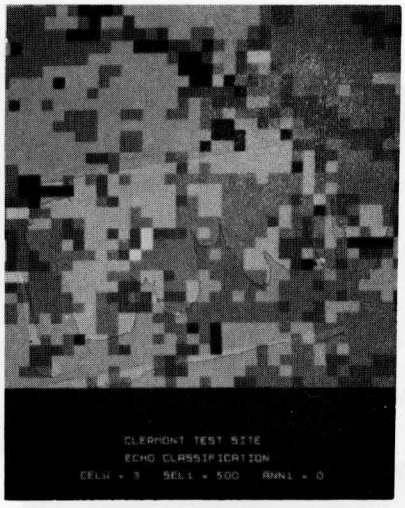
ECHO Classification
ECLW=3 SEL1=100 ANN1=0



ECHO Classification
CELW=3 SEL1=200 ANN1=0

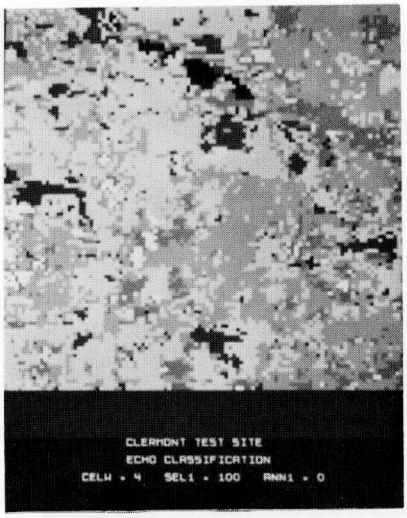


ECHO Classification
CELW=3 SEL1=300 ANN1=0

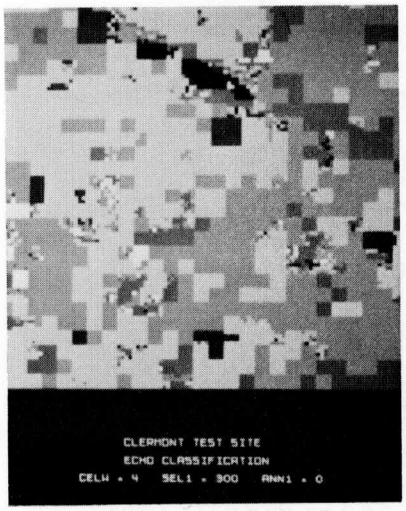


ECHO Classification
CELW=3 SEL1=500 ANNL=0

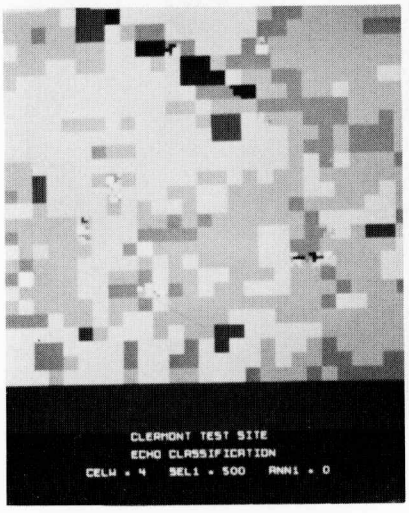
Figure 2.11 ECHO Results for CELW=3.



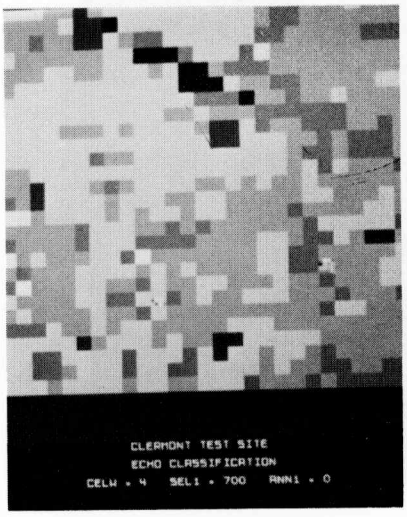
ECHO Classification
CELW=4 SEL1=100 ANN1=0



ECHO Classification
CELW=4 SEL1=300 ANN1=0

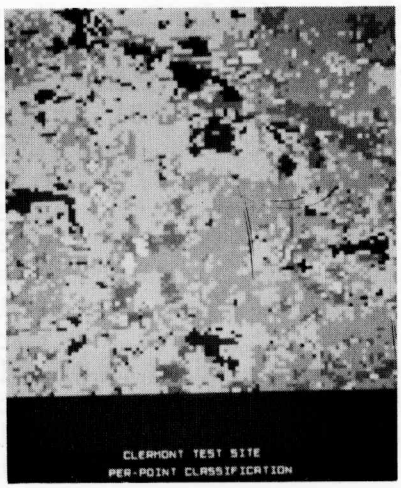


ECHO Classification
CELW=4 SEL1=500 ANN1=0

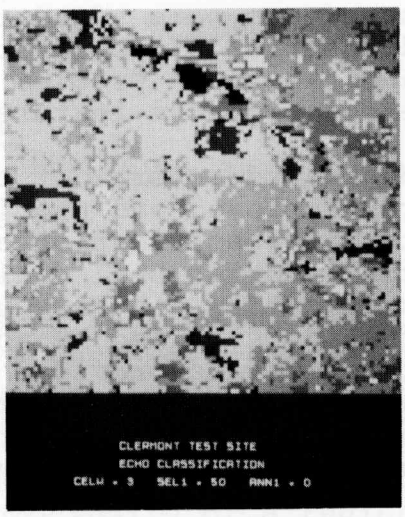


ECHO Classification
CELW=4 SEL1=700 ANN1=0

Figure 2.12 ECHO Results for CELW=4.



Pointwise Classification



ECHO Classification
CELW=3 SEL1=50 ANN1=0

Figure 2.13 ECHO Result Similar to Pointwise Classification.

2.3.2 Texture

By taking account of the context of a pixel (variations in the data over a neighborhood about the pixel), various characterizations of textural information can be derived and used to augment the pointwise spectral information. Two texture measures which have shown some promise for improving classification performance are the Gray-Tone Angular Spatial Dependence (GTASD) features [8] and Power Spectrum (PS) features [9, 10]. However, these had been used only in block classification schemes (classification of square blocks of pixels), and there are many situations where, because of the severe loss of resolution which results, classification into 32 x 32 or 64 x 64 pixel blocks is inappropriate. For instance, mappings of agricultural fields of small or irregular size, irregular stands of various types of forest cover, or interspersed rural areas and small towns are all situations requiring high classification resolution. The research described here attempted to determine the utility of the GTASD and PS features for improving high resolution mappings. To this end, one fairly complex ground cover area, the Clermont Quadrangle, was studied since the fields are irregularly shaped and sized. A second region, the vicinity of Bloomington, Indiana, was used to investigate the efficacy of the features in aiding high resolution mappings of large homogeneous ground features with irregular boundaries. The two texture features sets were added to the spectral data already available and a series of comparative classifications were performed. In addition, the problem of urban-nonurban delineation was addressed from the textural standpoint.

The results demonstrated several of the characteristics of the texture measures employed and provided an evaluation of their relative effects on classification accuracy. Briefly, it was determined that the informational quality of the GTASD features, from a classification accuracy standpoint, was superior to the information supplied by the PS features. However, neither texture measure provided sufficient information for successful urban-nonurban discrimination. It was found that the ECHO processor described previously was able to improve classification accuracies over any combination of the spectral and textural features employed. Since, in addition, the ECHO process does not require a separate data transformation phase as is required by the GTASD and PS features, it therefore has definite advantages over the GTASD and PS features for incorporating a measure of context as additional useful information for classification.

The Texture Features. The Gray Tone Angular Spatial Dependence (GTASD) features [8] are computed from a set of gray tone spatial dependence matrices. The element p_{ij} of the matrix P_σ is the frequency with which a pixel with "gray tone" i is adjacent to a pixel with "gray tone" j in an angular direction σ over a specified subimage or neighborhood

of the reference pixel. In this study, angular directions σ of 0°, 45°, 90° and 135° were used; and the subimage size used was 15 x 15 pixels. The "gray tones" were defined by first quantifying the data range (0-128) into eight equally occurring levels.

Four GTASD features were calculated for each matrix:

$$f_1 = \sum_{i=1}^{n} \sum_{j=1}^{n} (p_{ij}/R)^2$$

$$f_2 = \sum_{k=0}^{n-1} (k)^2 \left(\sum_{|i-j|=k} p_{ij}/R \right)$$

$$f_3 = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} ij\ (p_{ij}/R) - \mu_x \mu_y}{\sigma_x \sigma_y}$$

$$f_4 = \sum_{i=1}^{n} \sum_{j=1}^{n} [(p_{ij}/R)\ \ln\ (p_{ij}/R)]$$

In these features, R represents the total number of neighbors of each gray tone spatial dependence matrix (8 for this study) and μ_x, μ_y, σ_x, σ_y are the means and standard deviations of the marginal distributions of the elements p_{ij}.

Feature f_1 is called the Angular Second Moment (ASM) and is a measure of the homogeneity of a region. Regions with few dominant gray tone transitions will yield higher ASM values than those with a great number of dominant transitions. Feature f_2 is called the Contrast (CON) and is a measure of local variations in a scene, increasing in areas of rapid local changes. The Correlation feature (COR) is f_3 and it is a measure of gray tone linear dependencies in a region. This feature's value diminishes with diminishing linear structure in a region. Finally, f_4 is the Entropy (ENT) and is a measure of the randomness of a scene and behaves in a manner roughly opposite to the ASM.

These features were computed for each gray-tone angular spatial dependence matrix. Then the features were averaged over the various angles to yield one ASM, one CON, one COR and one ENT feature for the pixel at the center of the neighborhood for which the matrices were computed.

The basic equation for the generation of the discrete Power Spectrum (PS) is the discrete two-dimensional Fourier transform:

$$G(u,v)=(1/N)\sum_{x}\sum_{y} f(x,y)\exp\{-j2\pi/N[(u-N/2)x + (v-N/2)y]\}$$

where N is the width in pixels of the square block of pixels being transformed (16 x 16 pixels in this study), f(x,y) is the spectral response at the point (x,y), and u and v are the orthogonal frequency components of the spectrum. Because G(u,v) is a complex number, the power spectrum is used: $|G(u,v)|^2$ is the value of the spectrum at frequency (u,v). The spatial frequencies u and v occur at discrete intervals defined by:

$$u = i \cdot f_o \quad \text{where } f_o = \frac{1}{N\Delta X}$$

$$i=1,....,N-1$$

where ΔX is the pixel size (for LANDSAT data, approximately 80 meters). Due to the nature of the discrete two-dimensional Fourier transform for a finite area, the transform is origin symmetric and mirrors itself after (N/2)-1 frequency gradations per axis.

The features were generated by ring sampling in the u-v space [10]. For this research, seven rings were used. The feature values were obtained by determining the average power spectrum value in each ring and scaling this value so that all values were in the 0-255 range. This effectively gives the average power of the spectral response in 7 different frequency ranges.

All channel numbers and designations used in this report on texture are given in Table 2.1.

Preliminary Investigations. Due to the amount of CPU time required to transform a quadrangle-size data set (40 CPU min for PS features, 45 CPU min for GTASD features), it was necessary to select an optimal data channel for use as a source for the computation of the texture features, since the use of each additional channel as a source would substantially increase the CPU cost without a commensurate increase in information.

Table 2.1 Channel Designations for Spectral/Spatial Feature Tapes

CHANNEL DESCRIPTIONS

CHANNEL BLMTN[1]	CHANNEL CLER[1]	TYPE	DESCRIPTION
1	5	Spectral[2]	.5-.6 μm.
2	6	Spectral	.6-.7 μm.
3	7	Spectral	.7-.8 μm.
4	8	Spectral	.8-1.1 μm.
---	---	---	---
5	9	GTASD	ASM
7	11	GTASD	CON
9	13	GTASD	COR
11	15	GTASD	ENT
---	---	---	---
5	9	PS	1280 m.
6	10	PS	640 m.
7	11	PS	427 m.
8	12	PS	320 m.
9	13	PS	256 m.
10	14	PS	213 m.
11	15	PS	182 m.

[1]Data set designator: BLMTN = Bloomington, CLER = Clermont

[2]MSS Data

In order to select an optimal channel, small areas (14 x 14 pixels) of urban and agricultural fields were transformed to yield the additional PS features (the initial project was primarily concerned with the PS features). The transformation was performed using each of the available LANDSAT bands as a source channel. After reviewing the generated statistics via histograms, an average pairwise probability of error figure was obtained for those features displaying roughly gaussian distributions in the two regions. The average probability of error was computed for spatial channels 12, 13, 14, and 15 over Clermont and 8, 9, 10, and 11 over Bloomington. The results indicated LANDSAT MSS channel 5 as the Clermont source and LANDSAT MSS channel 2 as the Bloomington source.

After the selection of the source channels, the data sets were transformed to generate both the PS and GTASD features. The transformation procedure effectively involved moving a square aperture across the data set from left to right and top to bottom. The aperture was stopped at every second pixel in its left to right movement and the PS or GTASD features were calculated and assigned to the 2 x 2 cell in the center of the aperture. When each line was completed, the aperture was reset to the left and moved down two lines, and the procedure was then repeated. For the GTASD features the aperture dimensions were 15 x 15 (pixels) and 16 x 16 for the PS features. The 16 x 16 pixel PS aperture was chosen as a compromise between the number of PS features obtained and the CPU time required to obtain them. The next largest aperture size of 32 x 32 (the sizes are restricted by the Fast Fourier Transform Computation scheme) would have required over 2.5 times as much CPU time. This magnitude of expense was not observed to be offset by a corresponding increase in information available, and this magnitude of CPU time would have required a reduction in the amount of data analyzed. The 15 x 15 GTASD aperture was the closest conveniently available aperture size to the PS aperture, and was therefore chosen for the comparative studies. The difference in aperture sizes is not felt to be significant. Computation times averaged 87msec/pixel for the PS and 102msec/pixel for the GTASD.

Due to the aperture nature of the PS and GTASD features, the context or neighborhood of a point is much more important to the value of the features than the actual pixel over which the frame is centered. Determining the ramifications of these neighborhood dependencies with respect to data smoothing, especially at boundaries, was the main objective of one preliminary investigation. The study dealt with the Clermont data set, the first data set studied.

The LARSYS LINEGRAPH function was used to generate profiles or graphs of the PS and GTASD features for several lines of data. Three such profiles are shown in Figures 2.14 to 2.16. These profiles depict the major results obtained in this investigation.

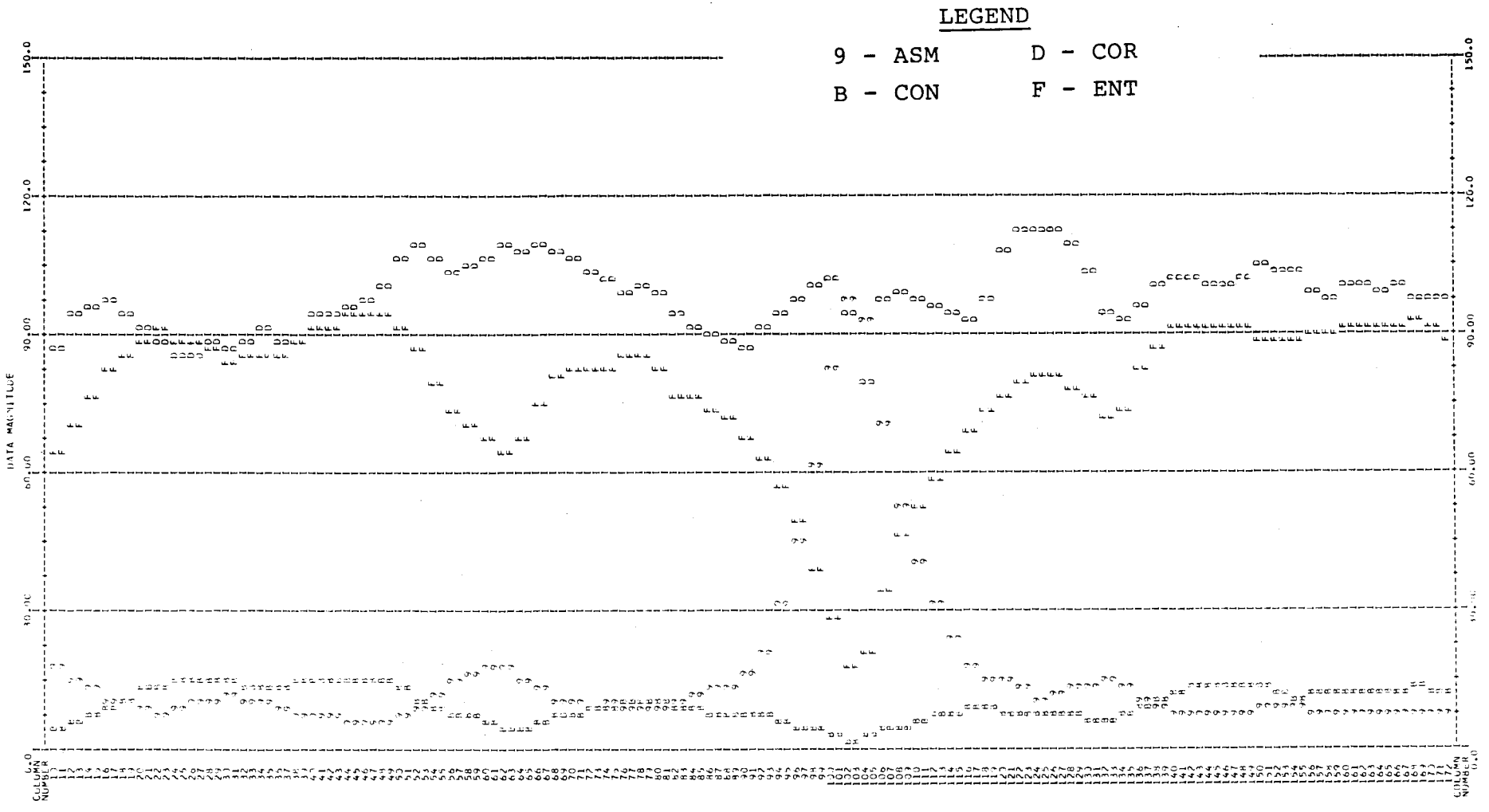


Figure 2.14 GTASD Response to Abrupt Boundaries

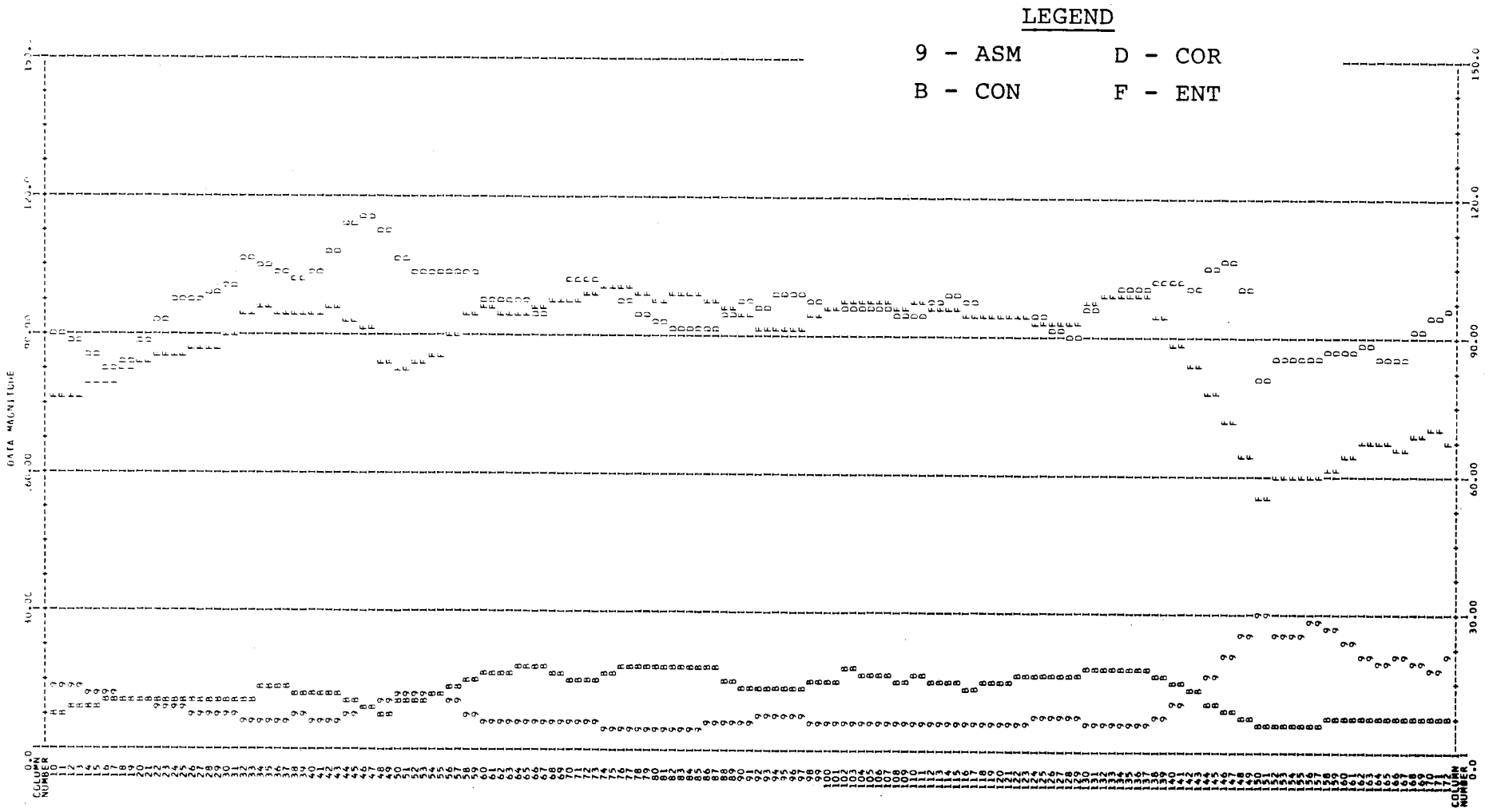


Figure 2.15 GTASD Response Over a Relatively Homogeneous Area

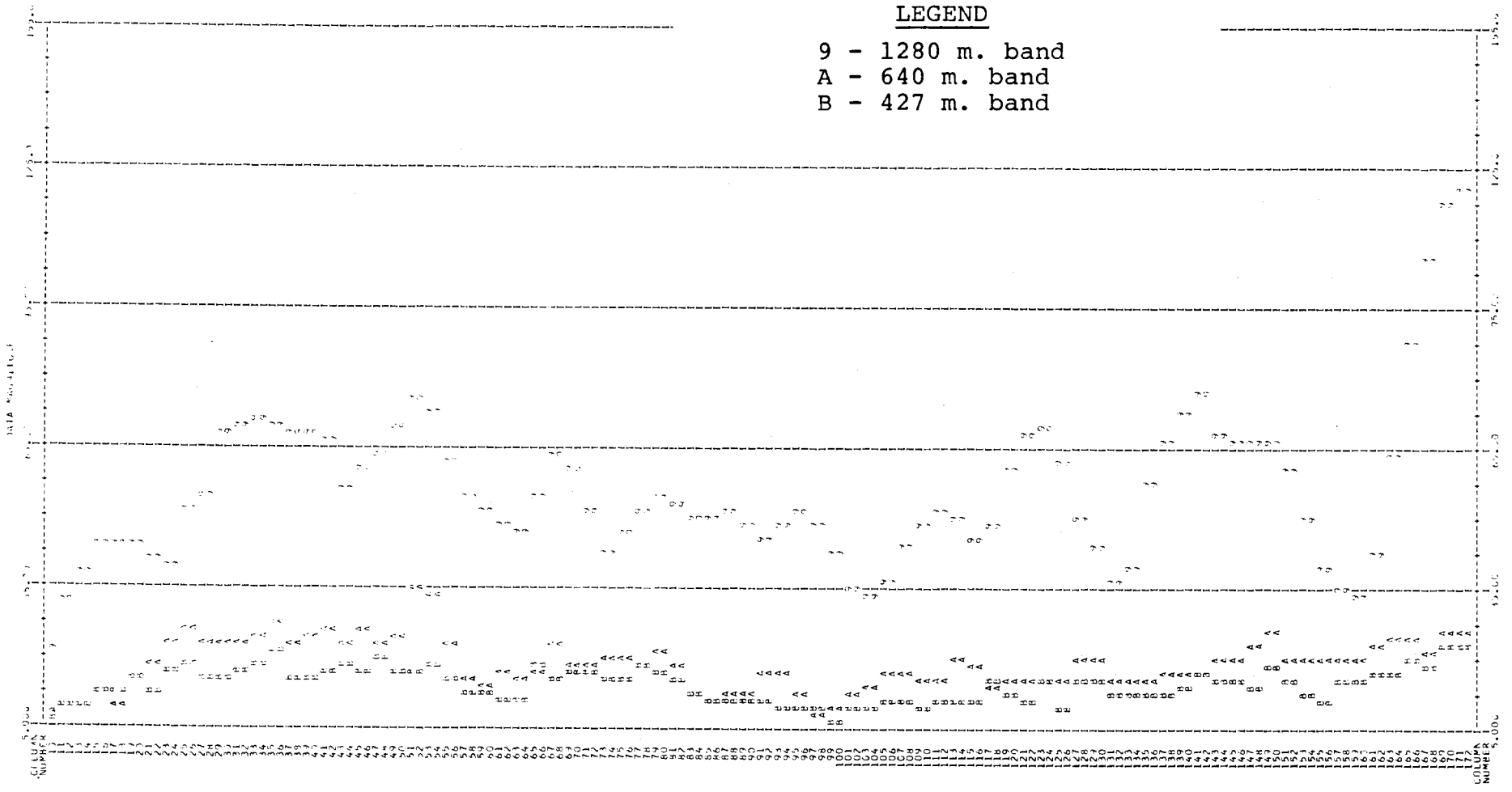


Figure 2.16 PS Response Over a Relatively Homogeneous Area

Figure 2.14 shows the response of the four GTASD features to a series of abrupt boundaries. Columns 59-69 represent a narrow stand of trees surrounded by agricultural fields and columns 97-110 is Eagle Creek Reservoir. All four features respond to these regions but the changes are not abrupt. As can be seen from the response of the ASM feature (9), the reservoir begins to affect the features while the aperture is over column 82, the response peaks around column 102 and returns to its original level near column 123. This response indicates that a response to a boundary begins as soon as the boundary appears in the calculation aperture.

Figures 2.15 and 2.16 show the response of the four GTASD features and three of the PS features to a fairly uniform line of data. All columns are in rural areas with exception of columns 45-71 and 134-172. These areas are urban. In addition to the previously demonstrated boundary response, these profiles show feature response to relatively homogeneous areas. A comparison of the two profiles reveals a marked difference between the PS and GTASD features in homogeneous areas (areas containing the same cover class, columns 72-133). The values of the GTASD features exhibit relatively minor fluctuations whereas the PS features show much more variation in these regions. Our classification results have led us to believe that this tendency of the GTASD to remain stable in homogeneous regions may account for their superior performance which we shall discuss subsequently.

Classification Studies. The principal study investigated the relative merits of the two sets of textural feature measures based on classification performance. Each data set was evaluated independently, and, for convenience, each is presented separately.

Clermont "Small Field" Study. Four major land cover types were defined for the Clermont site (Figure 2.17). These were urban (primarily residential and light commercial areas), forest, water, and rural (agricultural fields, unused land, etc.). To provide a basis for comparison, the first step in the Clermont study was to perform a classification using the spectral data alone. Training areas were chosen in each of the four cover areas and utilized roughly 5% of the total analysis area. As far as possible, these areas were isolated from information class boundaries and spectral class boundaries owing to the results obtained in the preliminary investigation concerning the instability of the texture measures near boundaries. In the case of the Clermont study, it was not possible to provide much isolation for the training areas in the water and forest classes because of the shape of the "fields." The actual training was accomplished by the Modified Supervised Technique [11]. All four LANDSAT MSS bands were used in the classification.

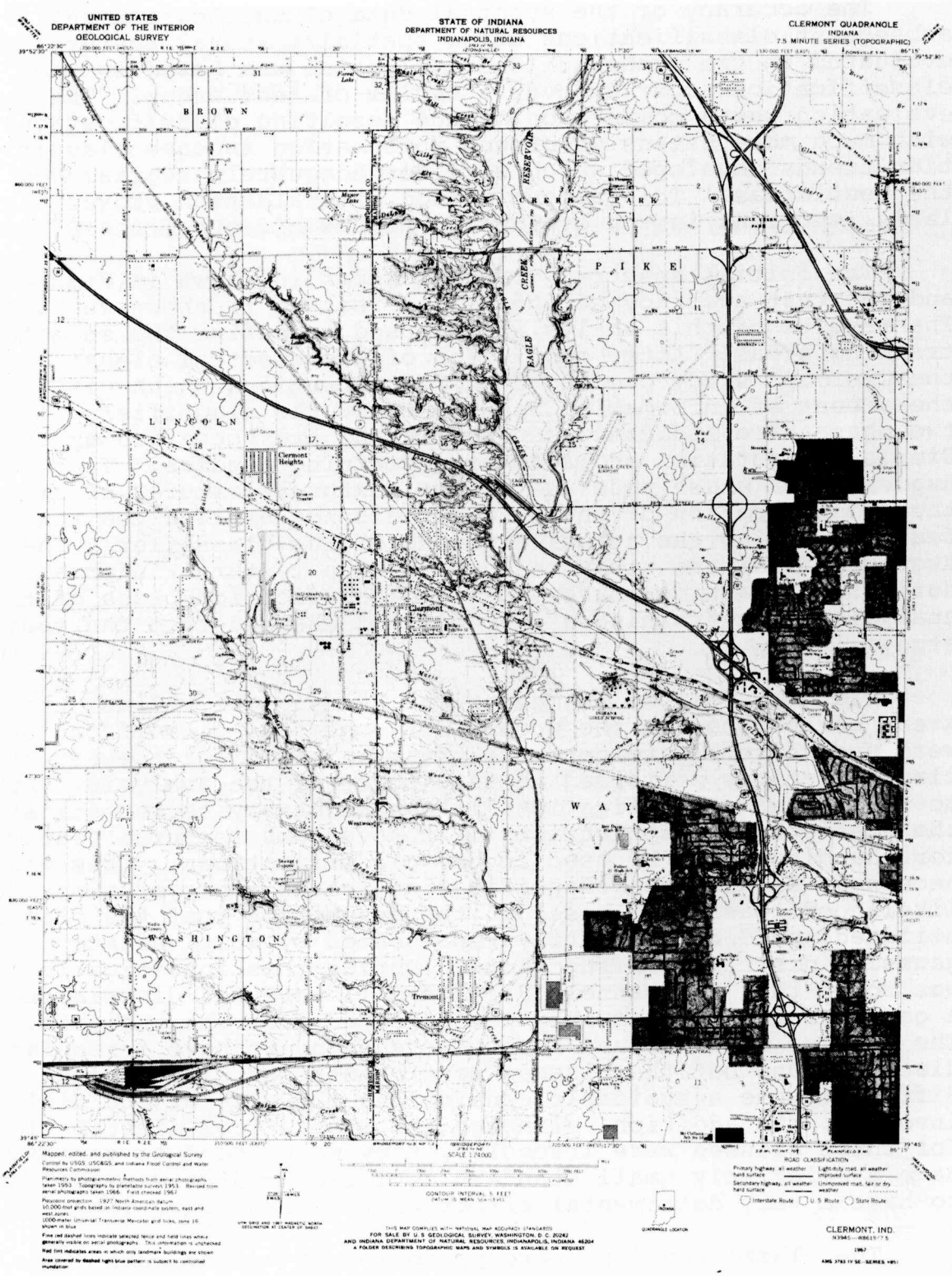


Figure 2.17 Clermont Study Site.

The accuracy of the spectral data classification and subsequent classifications using spatial/textural features were evaluated in two manners. One evaluation was based on the classification accuracy over a series of test areas. The second evaluation was a comparison of the resulting classifications with much more extensive ground information in case classification trends developed which were not adequately represented by the test areas. This second method of evaluation proved particularly important in the evaluation of the effect of the PS features.

The initial spectral classification is shown in Figure 2.18 and the test accuracy of the classification is shown in Table 2.2. The results of this analysis were used to refine the selected training areas. After completion of the spectral classification, the Clermont study proceeded in two directions which differed by the amount of information used to train the classifier. These two phases are indicated separately and are specified as the Simple Augmentation and Augmented Training studies. The Simple Augmentation phase made use of the textural features as aids in the classification of the area but did not utilize the textural features during the actual training of the classifier. The Augmented Training study made use of the textural information during the training phase and the classification phase of the analysis. The training areas were not changed from the spectral study.

Clermont "Simple Augmentation" Study. The refined training areas established in the preliminary spectral classification were used directly to generate the statistics for the set of classifications performed in this phase of the analysis. Prior to the actual classifications it was necessary to investigate the statistical distributions of the various textural features for the classes to be used in the classifications. This was necessary because the classification scheme employed a maximum likelihood classifier based on the assumption that the classes utilized would be accurately represented by multivariate gaussian distribution functions. During this investigation it was found that PS channels 9, 10 and 11 were not distributed in a gaussian fashion and they were dropped from the analysis. The classes of water and forest were found to have irregular distributions but the classes were maintained since this difficulty was unavoidable considering the size of the fields involved. In addition, although the statistical distributions for these classes were irregular, they were found to generally have a relatively small standard deviation and so were unlikely to have a very detrimental effect on the classifications.

The classifications were performed by adding each gaussianly distributed textural channel to the original LANDSAT channels in turn during the classification phase of the analysis. The results are shown in Table 2.2. The best augmented classification occurred when GTASD channel 9 (the ASM feature) was added. The classification map generated by this classification is

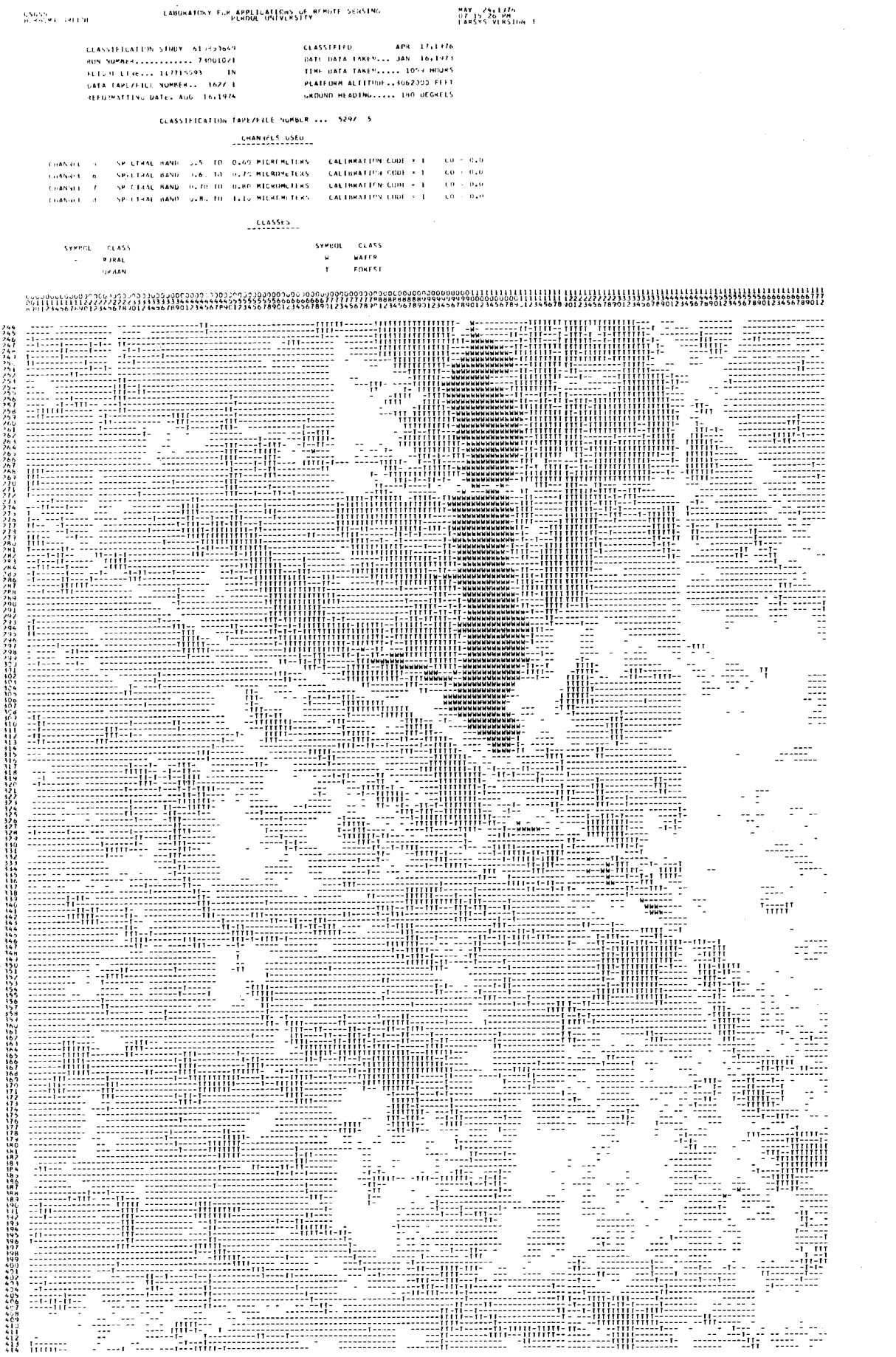


Figure 2.18 Clermont Classified with Spectral Data Only.

Table 2.2 Clermont Spectral and "Simple Augmentation" Results

Class	Spectral	PS12	PS13	PS14	PS15	ASM	CON	COR	ENT
Rural(1075)	88.2%	88.0%	79.6%	82.6%	76.7%	92.2%	86.0%	86.7%	89.8%
Urban(581)	81.8%	83.8%	87.6%	86.1%	86.4%	81.2%	85.4%	81.6%	83.0%
Water(110)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Forest(279)	78.5%	63.4%	64.5%	45.5%	58.4%	78.7%	79.6%	77.1%	68.8%
Overall(2045)	85.7%	84.1%	80.9%	79.5%	78.2%	87.8%	85.7%	84.8%	85.5%

Table 2.3 Clermont Spectral and "Augmented Training" Results

Class	Spectral	GTASD: Best-4	GTASD: Best-5	PS: Best-4	PS: Best-5
Rural(1075)	88.2%	91.0%	91.3%	67.9%	67.9%
Urban(581)	81.8%	80.7%	80.9%	90.7%	89.8%
Water(110)	100.0%	100.0%	100.0%	100.0%	100.0%
Forest(279)	78.5%	61.7%	72.0%	18.3%	18.6%
Overall(2045)	85.7%	84.7%	86.3%	69.3%	69.1%

shown in Figure 2.19, and the map reveals a generally 'cleaner' classification than that obtained using spectral features alone. However, the overall effect of this feature addition produced only a 2.1% accuracy increase. The remaining GTASD additions similarly produced only very slight variations in accuracy from the original spectral results. The best-performing PS addition (Table 2.2) was channel 12. That is, it was the least detrimental channel in the PS series! Generally, the accuracy decreased with increasing spatial frequency, but this trend was not well defined since the incremental percentage changes were not large.

Clermont "Augmented Training" Study. In this case, the original spectral training areas were again used; however, the training algorithm took into account the PS data or the GTASD data as appropriate. In each case the Modified Supervised training was again employed to develop the training statistics. Due to the large number of possible channel combinations which could be employed, the LARSYS Separability processor was used to determine the best possible combination of 4 and 5 channels for both the PS and GTASD classifications. Since both the classifier and the separability processor operate under the multivariate gaussian assumptions, it was again necessary to eliminate some of the features owing to their highly non-gaussian distributions. PS channels 9 and 10 were eliminated.

In the case of the PS phase of the study, the best four channels included two spectral bands (6 and 7) and two PS bands (11 and 15), and the best five channels were channels 6 and 8 (spectral) and channels 11, 13, and 15 (spatial). The accuracies of these classifications are specified in Table 2.3 and it is shown that the overall accuracies are inferior to the original spectral basis classification. The general reason for the poorer accuracies is the urban fringing (classification of non-urban pixels in the vicinity of urban areas into the urban class) shown in Figure 2.20. This fringing was equally pronounced in the best five channel classification.

The GTASD features performed much better than the PS features, but they did not significantly deviate from the previous performance of the spectral classification. The best five channel classification (Figure 2.21) shows some areas of cleaner classification, as in the urban region to the east and some areas of less accurate performance such as to the southwest of the reservoir. Generally speaking, the GTASD phase did not produce any superior classifications, but the PS features were definitely inferior to the GTASD features.

Bloomington "Large Field" Study. As in the Clermont study, a classification using only the four LANDSAT bands was established as a comparative base for the subsequent classifications. Like Clermont, the Bloomington area (Figure 2.22) was found to have four major ground cover types: urban, forest, water, and agricultural. The water class, however, was not used due to the constricted nature of the training areas and the small

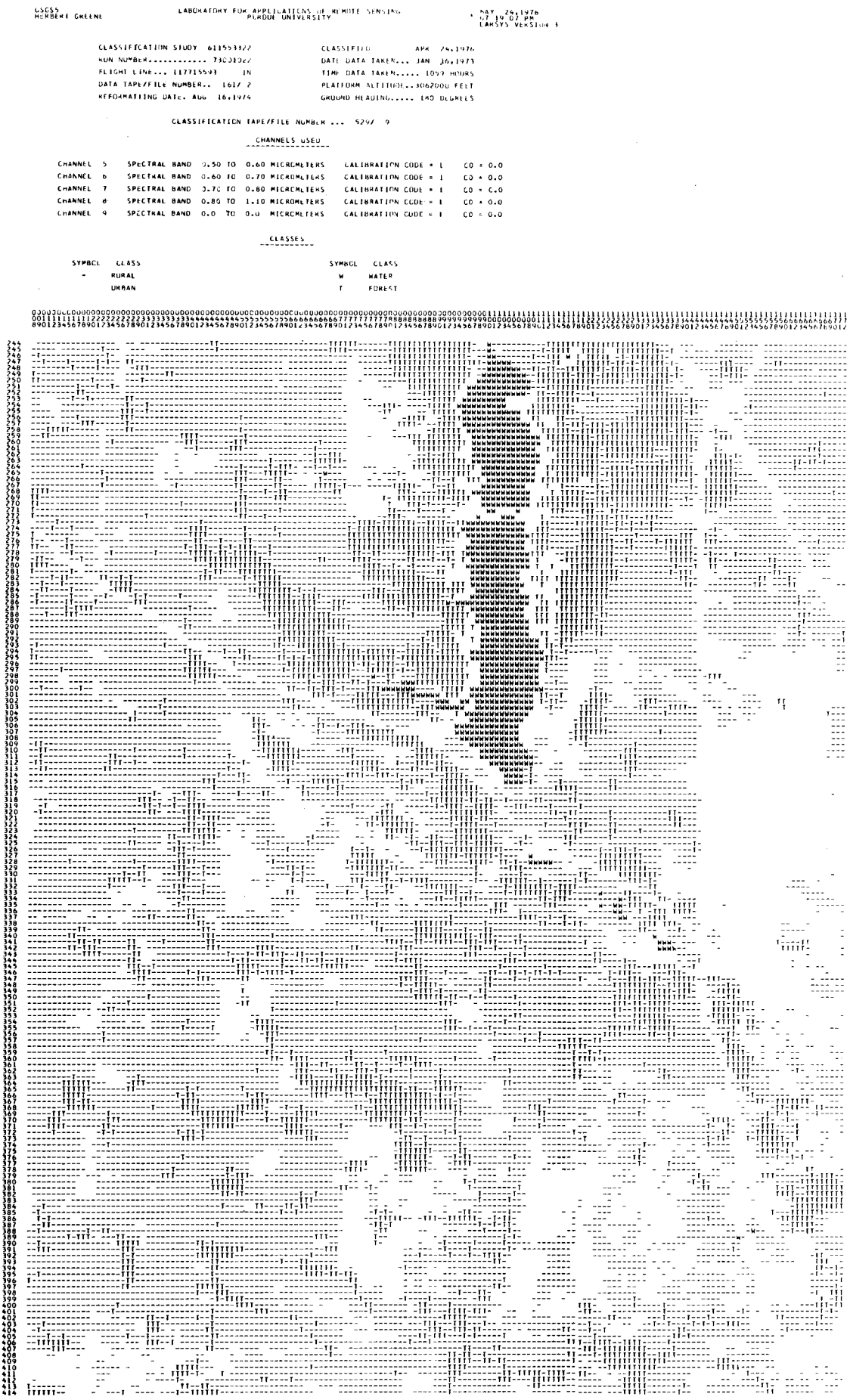


Figure 2.19 Clermont Classified with Spectral Data Plus ASM Feature.

USGSS
HERBERT GREENE

LABORATORY FOR APPLICATIONS OF REMOTE SENSING
PURDUE UNIVERSITY

MAY 26,1976
07 24 29 PM
LARSYS VERSION 3

CLASSIFICATION STUDY ALI13A806
RUN NUMBER..... 73001021
FLIGHT LINE... 11/7715593 IN
DATA TAPE/FILE NUMBER.. 1627 1
REFORMATTING DATE. AUG 16,1974

CLASSIFIED MAY 10,1976
DATE DATA TAKEN... JAN 16,1973
TIME DATA TAKEN..... 1059 HOURS
PLATFORM ALTITUDE..3062000 FEET
GROUND HEADING..... 180 DEGREES

CLASSIFICATION TAPE/FILE NUMBER ... 5297 24

CHANNELS USED

CHANNEL 6	SPECTRAL BAND	0.60 TO 0.70 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 8	SPECTRAL BAND	0.80 TO 1.10 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 11	SPECTRAL BAND	0.50 TO 0.60 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 13	SPECTRAL BAND	0.50 TO 0.60 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 15	SPECTRAL BAND	0.50 TO 0.60 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0

CLASSES

SYMBOL	CLASS	SYMBOL	CLASS
-	RURAL	W	WATER
	URBAN	T	FOREST

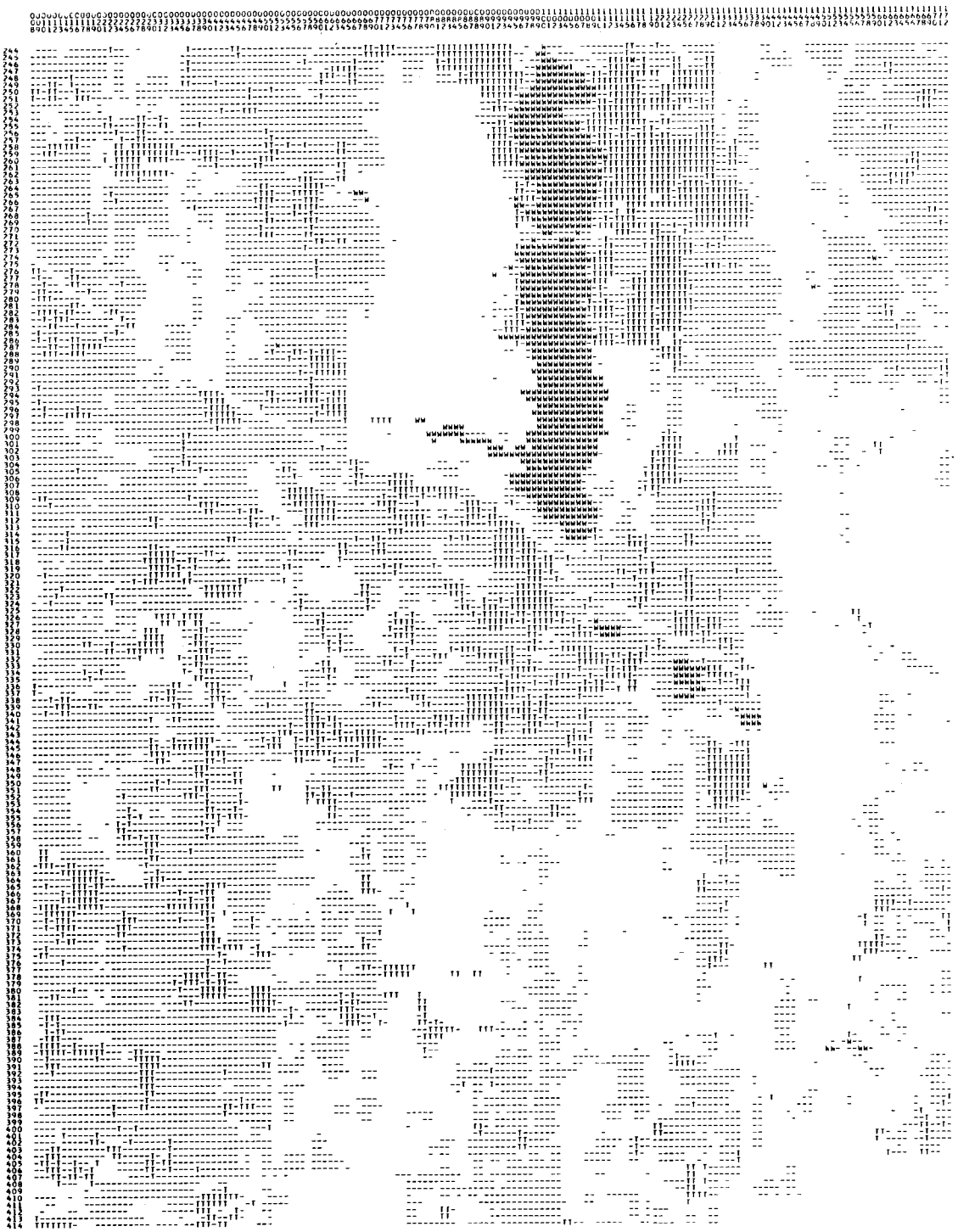


Figure 2.20 Clermont Classified with 2 Spectral and 3 PS Features.

```
USGS                    LABORATORY FOR APPLICATIONS OF REMOTE SENSING          MAY  24,1976
ROBERT GREENE                    PURDUE UNIVERSITY                            07:22:59 PM
                                                                              LARSYS VERSION 3

   CLASSIFICATION STUDY  61224175          CLASSIFIED        MAY  1,1976
   RUN NUMBER..........  73001022          DATE DATA TAKEN... JAN  16,1973
   FLIGHT LINE... 11771593     IN           TIME DATA TAKEN..... 1054 HOURS
   DATA TAPE/FILE NUMBER..  1612 2          PLATFORM ALTITUDE...3062000 FEET
   REFORMATTING DATE.  AUG  14,1974         GROUND HEADING..... 180 DEGREES

                    CLASSIFICATION TAPE/FILE NUMBER ...  5797 21

                                  CHANNELS USED

   CHANNEL  5    SPECTRAL BAND  0.50 TO  0.60 MICROMETERS    CALIBRATION CODE = 1    CO = 0.0
   CHANNEL  7    SPECTRAL BAND  0.70 TO  0.80 MICROMETERS    CALIBRATION CODE = 1    CO = 0.0
   CHANNEL 11    SPECTRAL BAND  0.0  TO  0.0  MICROMETERS    CALIBRATION CODE = 1    CO = 0.0
   CHANNEL 13    SPECTRAL BAND  .0   TO  0.0  MICROMETERS    CALIBRATION CODE = 1    CO = 0.0
   CHANNEL 15    SPECTRAL BAND  0.0  TO  0.0  MICROMETERS    CALIBRATION CODE = 1    CO = 0.0

                                    CLASSES

      SYMBOL   CLASS                              SYMBOL   CLASS
        -      RURAL                                W      WATER
               URBAN                                F      FOREST
```

Figure 2.21 Clermont Classified with 2 Spectral and 3 GTASD Features.

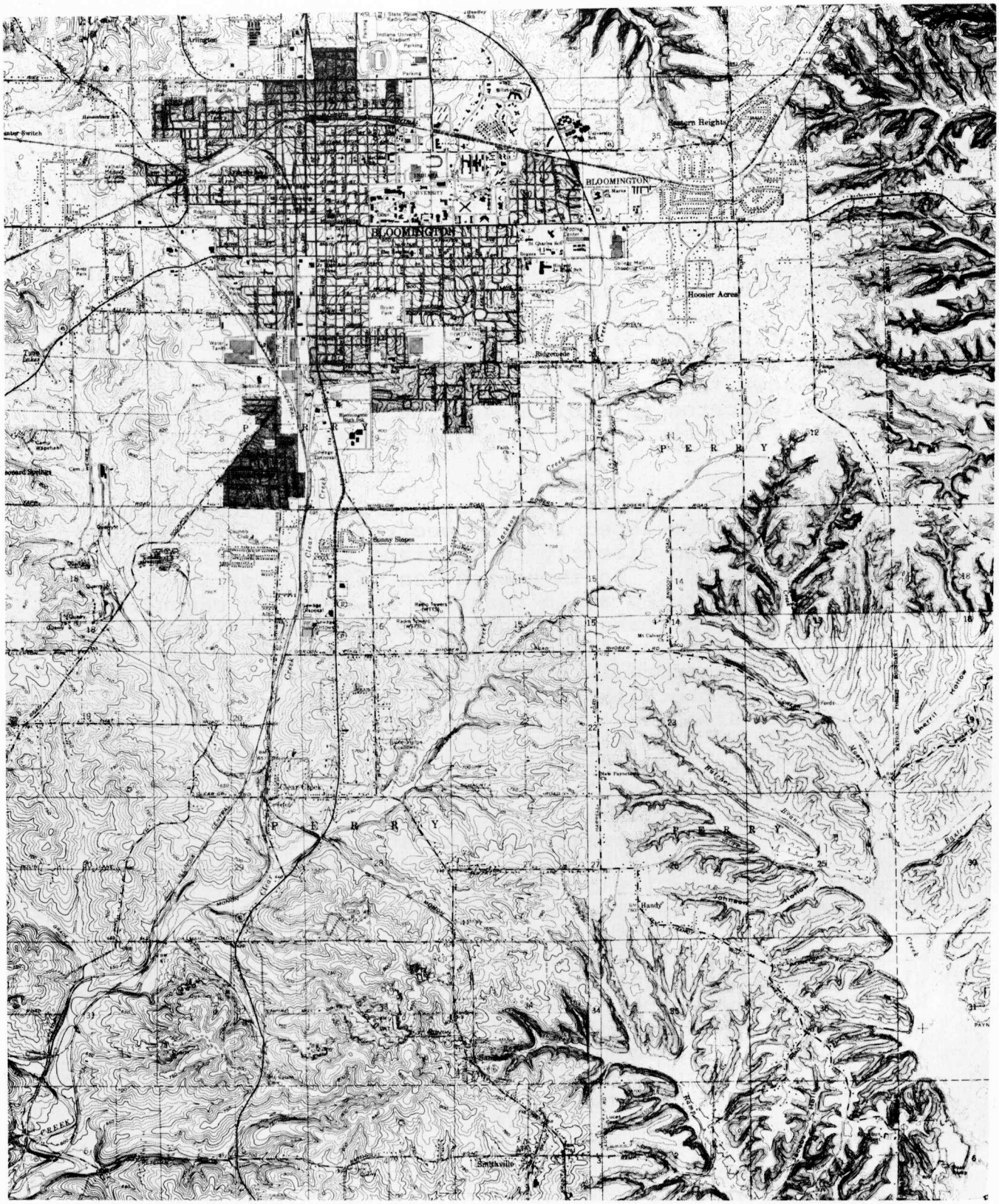


Figure 2.22 Bloomington Study Site.

amount of area covered by the water class (being less than the 15 or 16 pixel aperture in width). In this study, the south-eastern region of the classification maps are invariably in error due to the absence of the water class in the training set. This elimination allowed for the total avoidance of boundaries in the training data in contrast to the only partial isolation achieved in some of the classes in the Clermont study. Again the Modified Supervised training technique was employed and roughly 4% of the available area was used for training.

As with the Clermont phase, two forms of evaluation of the classifications were employed, the first being the accuracy achieved over a set of test fields and the second being the accuracy of the actual classification maps as compared with available ground information. The initial spectral classification is shown in Figure 2.23 and the accuracy over the test areas is indicated in Table 2.4. The two phases performed in the small field study were again performed and are documented separately.

Bloomington "Simple Augmentation" Study. The refined training areas developed in the spectral phase of the Bloomington analysis were used directly to generate the statistics for the augmentation study. An investigation of the distributions of the textural features again resulted in removing channels 5, 6, and 7 from the PS features, due to non-gaussian distributions. The difficulty encountered in the Clermont study of various classes having generally non-gaussian distributions was not encountered in the Bloomington study, possibly because all of the training areas were well isolated from class boundaries.

The classifications were performed by adding each useable textural channel to the original spectral channels in turn during the classification phase of the study. The results obtained on the test areas are tabulated in Table 2.4 for each case. All GTASD additions showed increases in test accuracy ranging from 3% to 11% overall with the ASM and ENT features producing the largest overall improvement. The classification map for the ENT addition, shown in Figure 2.24, when compared with the base spectral classification, showed a reduction in classification variability, particularly in the urban areas. However, the urban region was subject to some fringing which detracted somewhat from the 11% accuracy improvement. Nevertheless, all the GTASD classifications, particularly those for the ASM and ENT features, were found to be superior to the original spectral classification.

The PS results, also tabulated in Table 2.4, showed little change from the original classification. What effect they did have was generally detrimental. There was found to be very little difference between the best PS addition and the spectral base classification.

USGS
HERBERT GREENE

LABORATORY FOR APPLICATIONS OF REMOTE SENSING
PURDUE UNIVERSITY

JULY 26,1976
01 08 09 PM
LARSYS VERSION 3

CLASSIFICATION STUDY 619256138
RUN NUMBER..... 75000000
FLIGHT LINE... 132115595 IN
DATA TAPE/FILE NUMBER.. 161/ 4
REFORMATTING DATE. FEB 8,1974

CLASSIFIED JULY 10,1976
DATE DATA TAKEN... JUNE 9,1973
TIME DATA TAKEN..... 0959 HOURS
PLATFORM ALTITUDE..10A2000 FEET
GROUND HEADING..... 160 DEGREES

CLASSIFICATION TAPE/FILE NUMBER ... 529/ 27

CHANNELS USED

CHANNEL 1	SPECTRAL BAND	0.50 TO 0.60 MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 2	SPECTRAL BAND	0.60 TO 0.70 MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 3	SPECTRAL BAND	0.70 TO 0.80 MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 4	SPECTRAL BAND	0.80 TO 1.10 MICROMETERS	CALIBRATION CODE = 1	CO = 0.0

CLASSES

SYMBOL	CLASS	SYMBOL	CLASS
	URBAN	T	FOREST
-	AG		

Figure 2.23 Bloomington Classified with Spectral Data Only.

Table 2.4 Bloomington Spectral and "Simple Augmentation" Results

Class	Spectral	PS8	PS9	PS10	PS11	ASM	CON	COR	ENT
Urban(1123)	80.3%	83.8%	83.9%	78.5%	72.4%	97.5%	88.2%	86.6%	97.8%
Agri(776)	72.2%	64.4%	66.4%	72.0%	62.4%	85.6%	69.1%	81.3%	86.5%
Forest(842)	89.4%	89.7%	89.2%	91.1%	91.0%	91.3%	91.4%	89.5%	90.0%
Overall(2741)	80.8%	80.1%	80.6%	80.6%	75.3%	92.2%	83.8%	86.0%	92.2%

Table 2.5 Bloomington Spectral and "Augmented Training" Results

Class	Spectral	GTASD: Best-4	GTASD: Best-5	PS: Best-4	PS: Best-5
Urban(1123)	80.3%	90.7%	89.8%	51.5%	65.3%
Agri(776)	72.2%	89.7%	86.1%	63.5%	72.2%
Forest(842)	89.4%	93.3%	93.6%	85.7%	87.5%
Overall(2741)	80.8%	91.2%	89.9%	65.4%	74.1%

Figure 2.24 Bloomington Classified with Spectral Data Plus ENT Feature.

Bloomington "Augmented Training" Study. This phase followed exactly along the lines of the Clermont "Augmented Training" study. Again PS channels 5 and 6 were removed from consideration during the PS phase of the study due to their erratic behavior.

The results for the PS phase indicated that channels 2, 3 (spectral), 8 and 11 (PS) were the best 4 as determined by the Separability Processor, and the best 5 channels included three spectral channels (1, 2, 3) and two PS channels (8, 11). Both of these classifications achieved poor results in test accuracy (Table 2.5) and in overall classification performance (Figure 2.25). It was found that the classification "noise" actually seemed to increase with the incorporation of the PS features.

On the other hand, the GTASD feature phase produced a pair of superior classifications. As in the Clermont study the best four selection included the spectral source channel (2) and the ASM, CON and COR (5, 7, 9) features. The best five channel choice again added channel 4. Gains in accuracy were in the 9% to 11% range with the best four classification (Figure 2.26) showing a slight edge over the best five channel choice. These results confirmed the earlier Clermont results in establishing the superiority of the GTASD features over the PS features.

Supplemental ECHO Study. During the main study, efforts were confined to the aperture-derived feature sets, PS and GTASD. A third method available at LARS, the ECHO processor detailed elsewhere in this report, was applied using the statistics generated in the main study for the production of the spectral basis classifications. ECHO classifications were generated for comparative purposes. The results over the test fields are tabulated in Tables 2.6 and 2.7 against the best results obtained previously.

It was found that in the Clermont phase (Figure 2.27) the ECHO procedure unquestionably produced the cleanest and most accurate classification, which is reflected in the test accuracies obtained. The ECHO classification was found to be superior to all previous Clermont classifications. In the Bloomington phase, ECHO produced a classification of accuracy equivalent to the best GTASD "Simple Augmentation" result and the GTASD "Augmented Training" result. The ECHO classification was superior to the spectral basis classification and all PS classifications. This result is shown in Figure 2.28. It should be noticed that lines 131 and 132 are bad data lines in that classification and do not reflect classification inaccuracies.

Urban/Nonurban Segmentation Using Spatial/Textural Features. The objective of this final phase of the investigation was to establish whether or not spatial-textural information alone was sufficient to achieve urban-nonurban segmentation of a ground scene and to evaluate the correlation between spatial/textural classes and land cover classes.

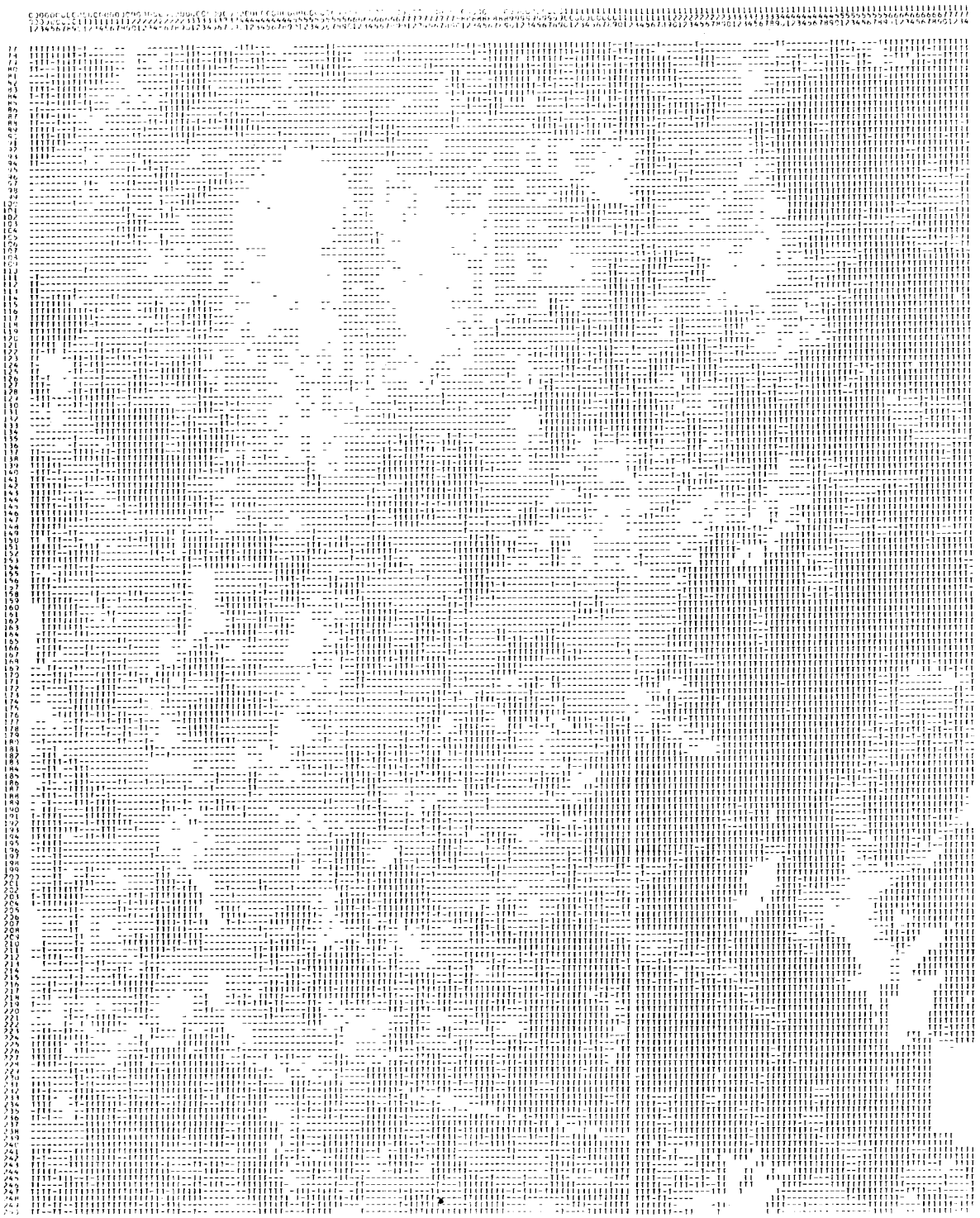


Figure 2.25 Bloomington Classified with 2 Spectral and 2 PS Features.

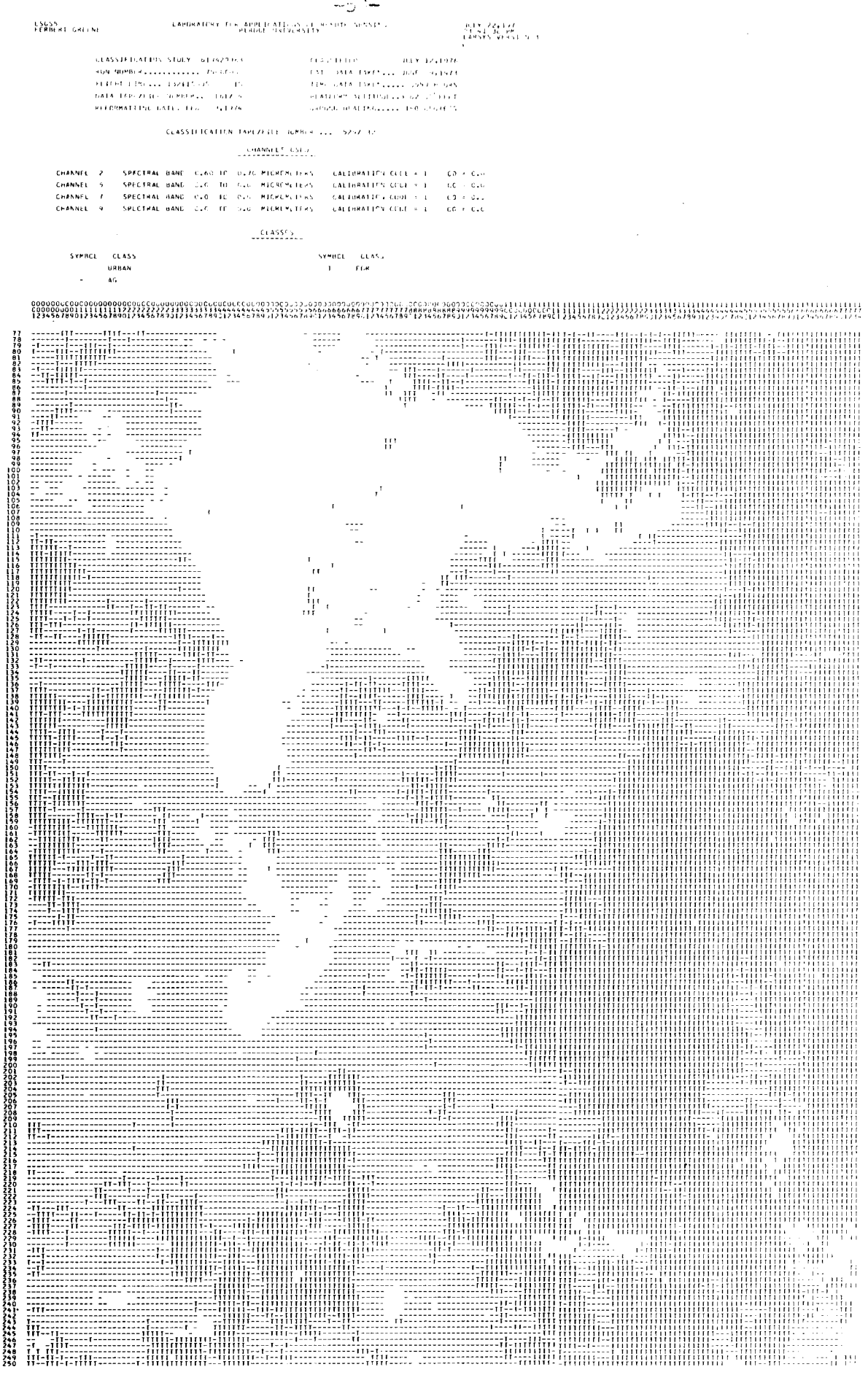


Figure 2.26 Bloomington Classified with 1 Spectral and 3 GTASD Features.

USGS
HERBERT GREEN

LABORATORY FOR APPLICATIONS OF REMOTE SENSING
PURDUE UNIVERSITY

MAY 24,1976
07 20 40 PM
LARSYS VERSION 3

CLASSIFICATION STUDY 611135329
RUN NUMBER..... 78031021
FLIGHT LINE... 117715533 IN
DATA TAPE/FILE NUMBER.. 1627 1
REFORMATTING DATE. AUG 16,1974

CLASSIFIED APR 20,1976
DATE DATA TAKEN... JAN 16,1973
TIME DATA TAKEN..... 1053 HOURS
PLATFORM ALTITUDE..1062000 FEET
GROUND HEADING..... 180 DEGREES

CLASSIFICATION TAPE/FILE NUMBER ... 5297 7

CHANNELS USED

CHANNEL 5	SPECTRAL BAND	0.50 TO 0.60 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 6	SPECTRAL BAND	0.60 TO 0.70 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 7	SPECTRAL BAND	0.70 TO 0.80 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0
CHANNEL 8	SPECTRAL BAND	0.80 TO 1.10 MICROMETERS	CALIBRATION CODE = 1	C0 = 0.0

CLASSES

SYMBOL	CLASS	SYMBOL	CLASS
-	RURAL	W	WATER
	URBAN	T	FOREST

Figure 2.27 Clermont ECHO Classification.

Figure 2.28 Bloomington ECHO Classification.

Table 2.6 Clermont ECHO Comparison

Class	Spectral	ECHO	Best SA*	Best AT**
Rural(1075)	88.2%	95.8%	92.2%	91.3%
Urban(581)	81.8%	92.4%	81.2%	80.9%
Water(110)	100.0%	100.0%	100.0%	100.0%
Forest(279)	78.5%	78.9%	78.7%	78.2%
Overall(2045)	85.7%	92.8%	87.8%	86.3%

Table 2.7 Bloomington ECHO Comparison

Class	Spectral	ECHO	Best SA*	Best AT**
Urban(1123)	80.3%	92.6%	97.8%	90.7%
Ag(776)	72.2%	94.8%	86.5%	89.7%
Forest(842)	89.4%	90.3%	90.0%	93.3%
Overall(2741)	80.8%	92.5%	92.2%	91.2%

* Simple Augmentation

** Augmented Training

The training technique employed in this section utilized an unsupervised training procedure [11]. This method was adopted so as to provide a texturally or spatially based classification procedure requiring less input of ground truth information than other available techniques. The LARSYS Cluster processor was used to generate the classes used for classification on the basis of either all the PS or all the GTASD features. After the cluster classes were generated, the LARSYS Separability processor was used to select the best 4-channel subset for classification from each feature set. The resulting classification maps were compared to known ground truth. From these comparisons, the various cluster classes were assigned to either the urban or nonurban category on the basis of a simple majority rule. With these assignments, the final classification maps are generated by a simple change of symbols.

Figure 2.29 depicts the resulting classification map for the Clermont area using the GTASD features for clustering and classification. Like three other classifications (PS for Clermont, PS and GTASD for Bloomington), little correlation was apparent between PS or GTASD cluster classes and the urban, nonurban ground cover classes.

Despite our inability to isolate urban and nonurban classes, one interesting result was forthcoming about the relationship of textural information to spectral information. During training, spectral information was ignored and only textural information was used to derive the cluster classes. A study of the statistics associated with the resulting classes showed no separability of the classes in the spectral channels which seems to indicate a lack of any useful correlation between the "textural classes" and the spectral ones.

Summary. The following observations may be drawn from this research on spatial and textural features:

1. The GTASD features were significantly better in improving classification analysis results for general land cover classes than were the PS features. In all classifications conducted during the course of this research, the GTASD features provided significantly better accuracies over test areas than did the PS features. This results was due in large part to the greater stability of the GTASD features as discussed previously over varying types of ground cover. These results are consistent with results which have appeared elsewhere [9].

2. It was determined that neither subset of textural features (PS or GTASD) was able to independently isolate urban areas from surrounding nonurban areas. This perhaps indicates that the features are useful primarily in additions to available spectral information, but do not themselves produce distinctive signatures of particular field types, at least in contexts such as those studied here.

USGS3 HERBERT GREENE — LABORATORY FOR APPLICATIONS OF REMOTE SENSING, PURDUE UNIVERSITY — MAY 24,1976 07 25 53 PM LARSYS VERSION 3

CLASSIFICATION STUDY 613555746 — CLASSIFIED MAY 14,1976
RUN NUMBER..... 73001022 — DATE DATA TAKEN... JAN 16,1973
FLIGHT LINE... L17715593 IN — TIME DATA TAKEN..... 1059 HOURS
DATA TAPE/FILE NUMBER.. 161/ 2 — PLATFORM ALTITUDE..3062000 FEET
REFORMATTING DATE. AUG 16,1974 — GROUND HEADING..... 180 DEGREES

CLASSIFICATION TAPE/FILE NUMBER ... 529/ 26

CHANNELS USED

CHANNEL 9	SPECTRAL BAND	0.0	TO	0.0	MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 11	SPECTRAL BAND	0.0	TO	0.0	MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 13	SPECTRAL BAND	0.0	TO	0.0	MICROMETERS	CALIBRATION CODE = 1	CO = 0.0
CHANNEL 15	SPECTRAL BAND	0.0	TO	0.0	MICROMETERS	CALIBRATION CODE = 1	CO = 0.0

CLASSES

SYMBOL	CLASS	GROUP	SYMBOL	CLASS	GROUP
	NS- 1/15	URBAN		NS- 9/15	URBAN
-	NS- 2/15	RURAL		NS-10/15	URBAN
-	NS- 3/15	RURAL		NS-11/15	URBAN
-	NS- 4/15	RURAL	-	NS-12/15	RURAL
	NS- 5/15	URBAN	-	NS-13/15	RURAL
-	NS- 6/15	RURAL	-	NS-14/15	RURAL
-	NS- 7/15	RURAL	-	NS-15/15	RURAL
-	NS- 8/15	RURAL			

Figure 2.29 Unsupervised Classification to Discriminate Urban and Rural (Clermont - GTASD Features).

3. It was found that the overall improvement in accuracies obtained from the use of the GTASD features was much greater for the large field study than for the small field study. This indicates that a correlation exists between the efficacy of the features and the nature of data set employed. In particular, it was seen that data containing larger field sizes, with a corresponding decrease in the number of existing boundaries, coupled with the stability of the textural features in the GTASD set, provided the best opportunity for effective use of spatial/ textural features. A small field context diminishes their effectiveness by introducing a great deal of aperture-induced "noise" in the transformed data.

4. It was found that the ECHO classification scheme was at least as good as any of the textural features we investigated. The ECHO results consistently showed improvement for each data set, indicating a relative insensitivity to field size variations.

In conclusion, it was found that the "aperture mode" of feature calculation required by the PS and GTASD features does impose some constraints upon their use. The GTASD features are most effective when they are used in regions with relatively few boundaries. It is possible that the aperture size used to calculate these features could be reduced such that they would be of use in classifications where more boundaries were present; however, this would tend to increase the "noise" due to the finite size of the aperture. Similar remarks would apply to the PS features. The best procedure thus far investigated for the incorporation of context into the classification scheme is the ECHO classifier. Besides being more consistent than the other texture measures, it is by far the least expensive and fastest of the techniques.

2.4 Data Processing Products: Maps

The LANDSAT multispectral scanner system was not designed to produce image data of geometric quality adequate for mapping purposes. However, with the development of various preprocessing techniques, some of which were pioneered at LARS, rectification of the image geometry was achieved and it became reasonable to conceive of using LANDSAT data and its derivatives in map-like formats. The practical problem we faced was how to convert the digitally produced land use classification results into such formats, preserving, in the process, the geometric quality achieved by the preprocessing operations. Thus, one phase of this project involved development of software for displaying classification results on three existing film writing devices and evaluation of output from these devices. Although the largest part of the effort went into developing and checking software to reformat the classification files to a format readable by the output devices, the crux of the effort was comparison of output products. The details of the software and

film writing devices are presented here first, then accomplishments and results follow.

Output Format Requirements. The output of the LARSYS classification processors is in FORTRAN format on a line-by-line basis with class decision number and confidence level supplied for each pixel. The format required by the typical film writer system is brightness levels in eight bit words grouped in one tape record for each scan line, with no ancillary information. Conversion of the classification results file to a film writer file is the specific purpose of the software which was developed.

Fortunately, a program existed at LARS which reformats classification results files for the LARS digital display system and which could be modified to produce the output files needed by the film writers. The original program read the classification tape and assigned either a gray level from 0 to 15 or a color code to each classification pixel as specified by the user. For color the program defined relative levels of blue, green, and red to create the desired color. Three separate black and white images were then transmitted to the digital display, producing, through multiple exposure of color film with filters, a color image of the classification.

This same approach was adopted for the modified system. The modified program writes separate tape files representing the blue, green and red images. The original gray scale of 0-15 used by the digital display is expanded to 0-255 for compatibility with the film writers. This program was created and checked out during the course of the study and three film writers were tested. Several other programs were also generated to support the study. These will be discussed after the film writing devices are discussed.

Film Writing Devices. The purpose of pursuing the output conversion study was to define a satisfactory procedure and system for converting remote sensing classification results into color film representations which were geometrically and photometrically accurate. The image display equipment at LARS is satisfactory for its intended purpose of data editing and quick-look image reproduction, but it is not accurate enough to produce map quality output products. Many film writing devices exist which offer good quality output and many graphics devices exist which can produce high quality image output. Three devices were considered in this study. They are described next.

1. DICOMED Corp. Model D-47 Film Writer

The DICOMED Corp. of Minneapolis produces a series of film writing, display, and image processing devices. The D-47 is a cathode ray tube (CRT) type film writer with color filter attachments which allow color film writing. The units specifications are:

Image Size - Maximum 4096 x 4096 pixels and up to a 99 x 99 mm image size (our experiments were run at 2048 x 2048 with 86 x 86 millimeter image size)

Geometric Accuracy - Line curvature (pincushion distortion): ± .15% typical, ± .3% maximum
Spatial repeatability: ± .03%, ± .05% max.
Orthogonality: ± .25% typical, ± .5% max.
Rectangularity: ± .15% typical, ± .3% max.
Point spacing linearity: ± .25% typical, ± .5% max.

Photometric Accuracy - Standard: ± .05 D typical, ± .075 D max.
High uniformity system: ± .025 D typical, ± .04 D max.

Recording Time - 2048 x 2048 pixels in 3 colors: 4.5 min.

The unit is available as a stand-alone system or can be tied into a computer system. The approximate cost of a stand-alone system is $70,000. No firm writing service is currently available through the company.

2. Optronics International Corp. P-1500 Photowrite System

The Optronics Corp. of Chelmsford, Massachusetts, manufactures a rotating drum scanning device which is basically different from the CRT equipment of DICOMED. The scanning action and associated geometric accuracy are all mechanically determined whereas the CRT characteristics are based on electronic techniques. The basic P-1500 can record only in black and white; however, a color writing system has recently been produced (C-3300 Colorwrite) but was not studied in this investigation. Its geometric and photometric characteristics are basically the same as the P-1500. The specifications for the P-1500 are:

Image Size - Variable from zero to 8" x 10" with larger drums available. A 17" x 22" would be the next size.

Geometric Characteristics and Accuracy - Spot sizes available: 12.5, 25, 50, 100, 200 microns
Raster: 12.5, 25, 50, 100, 200 microns
Positional Accuracy: ± 2 microns/cm RMS

Photometric Accuracy - 64 gray levels repeatable
Density Range: 0 - 2.5 D

Recording Time - Approx. 1.5 hours for 8" x 10" at 50 microns

The unit can operate stand-alone or be interfaced with a computer. The approximate cost of a stand-alone unit is about $50,000. Film writing service is available from Optronics on the P-1500 but not on the C-3300 Colorwrite.

3. Mead Technology Laboratories Digital Graphics Generator.

Mead at Dayton, Ohio, has two digital graphics generators which can produce large format output on paper or mylar film. One is a rotating drum ink jet writer which forces drops of ink into the moving surface. The second device is a laser writer which uses a mirror-deflected laser beam to write on film positioned in a concave mount. Writing is binary: a spot is either exposed or left blank.

The specifications of the devices are:

	Ink Jet Printer	Laser Film Writer
Image Size	40" x 60" max.	14.3" x 24" max.
Geometric Char.	Spot size: .005 inch. Raster size: .0035 in.	Spot size: .0025 in. Raster size: .00175 in.
Photometric Char.	4 x 4 spot array used to generate gray scale. Effective gray scale spot size is .01389 inch.	4 x 4 spot array used to generate 32 gray levels. Effective gray spot size is .007 inch.
Writing Time	Not available	2.3 minutes
Approximate Cost	Not available	$100,000

The writing process is available as a fast turn-around service from Mead.

Software Development. Two basic versions of software were developed. One was for the DICOMED unit, requiring 2048 x 2048 pixel data sets to fill the screen matrix; the second version can write any size data sets. The basic classification file display program used at LARS was modified by adding magnetic tape writing capability for the three separation files. The modifications included padding of zeros to fill a 2048-square area, rescaling the gray scale, and line and column duplication capability for enlargement factors up to six. The DICOMED version is named DIPHOTO and the Optronics version is OPTPHOTO. The OPTPHOTO version is the generalized version and can be used for any variable format device, e.g., the Mead devices.

Several other programs were developed in the course of the study. A program to reformat LARS multispectral image storage tapes was developed to enable reproduction of color and black

and white images, e.g., ERTS MSS imagery. Also, a grid pattern generator was written to place a cross-hatch grid on the device to test geometry. A color block pattern generator was written to generate a test color image to enable relating various blue, green and red level combinations to the actual colors produced by the device. In all, six programs were developed as part of the study.

Film Writing Tests. Certain data sets for two film writing devices (DICOMED and OPTRONICS) were tested during the study by requesting services from the manufacturers. The most detailed request was made of DICOMED. Four images were generated by the D-47: color classification images for Springfield West, MO; Springfield East, MO; a color block test pattern; a grid test pattern. The remaining funds in the contract for film writing enabled only the writing of the Springfield West classification by OPTRONICS. Another research activity at LARS received results from the Mead writing equipment which enabled evaluation of the laser writer at no cost to the USGS contract.

Results of the Study. The products of this portion of the USGS contract are (1) the software for converting LARS classification files to files compatible with commercial film writing equipment and (2) evaluation of the products. A qualitative evaluation follows of the products produced specifically for this project plus others produced at LARS in conjunction with other projects requiring this type of results presentation.

1. DICOMED - The quality of the classification images obtained for the Springfield, Missouri, area was very good. However, results obtained from DICOMED for other LARS projects were observed to contain a color fringing effect at edges of objects throughout the scene. This was caused by what was estimated as a one pixel misregistration among the three additive color images making up the composite image. Also, results from a DICOMED unit located at the NASA Ames Laboratory in California demonstrated the same misregistration effect for the same Springfield classification results. In the Ames result, yellow fringes were seen around green areas. The satisfactory Springfield result obtained from the LARS effort is presented in Figure 2.30. An illustration of misregistration is seen in Figure 2.31 for a classification result of Cass County, Michigan, obtained from DICOMED for another LARS activity. The yellow fringes around the green areas are cause for concern about the operational stability of the unit. From these observations it was concluded that certain critical adjustment requirements may exist for this unit. Only relatively crude geometric measurements could be made on the grid pattern image obtained from the DICOMED unit. The image quality was judged to be adequate with respect to geometry.

Figure 2.30 ERTS Classification Results Image Produced by the DICOMED D-47 CRT Film Writer for the Springfield, Missouri Area.

Figure 2.31 ERTS Classification Results Image Produced by the DICOMED D-17 CRT Film Writer for Cass County, Michigan Showing Yellow Fringing (Note: Fringing must be viewed under magnification).

The overall impression of the device is that it is adequate for producing small images for illustration in reports and displays but probably not adequate for making color separation masters for color printing of large map formats. For maps the DICOMED film size is small and extreme enlargements have to be made. The registration and geometric errors in the DICOMED image, while small, would be highly amplified in such enlargements and most likely would produce an unsatisfactory product. Nonetheless, the device is fast and convenient to use and produces good small-format results when properly adjusted.

2. OPTRONICS - This device produces only black-and-white transparencies in the present service offered, thus the color image must be created by photographic overlay. The Springfield classification image was created in this manner and is shown in Figure 2.32. The overall quality of the black-and-white products is very high. The geometry is precise so that photographic overlay should be no problem. Two problems exist, however, in making color prints from the black-and-white separations. One is in achieving accurate registration of the separations in the process of making a color negative. The other is maintaining the color balances of the blue, green, and primaries to get the desired colors. Note that in Figure 2.31 there is noticeable white fringing along roads and other red features. This is due to misregistration in the triple exposure process used in making the color negative. This is not the fault of the film writer and more exact photographic processing can possibly correct it. Note also that the colors are much different from those in Figure 2.29. This is also due to the color photographic processing and can be corrected by adjusting the primary levels. Thus, the OPTRONICS writer can make high quality separation transparencies for printing; however, caution must be used, since getting the images back in registration and balance for color reproduction is not a trivial task.

Large drum sizes are available, so printing masters could be made directly on this device. This type of device was judged desirable for large-format precision products for the cost involved but it must be noted that precision photo laboratory capabilities must be available to produce color transparencies from black-and-white separation transparencies.

3. Mead Technology - The two devices offered by Mead are new approaches to the image generation process in that ink jets or laser beams are used. Products obtained from Mead for another LARS activity indicate great promise for large-format low resolution products. The geometry is excellent and the spot resolution may be adequate for printing. However, the maximum gray or color spot density for the Mead devices is nominally only 100 per inch whereas the DICOMED system can write 4096 lines on 70 mm of film for a rate of 1486 lines per inch. The maximum rate for the OPTRONICS is 2000 per inch,

Figure 2.32 ERTS Classification Results Image Produced by the OPTRONICS P-1500 Photowrite System for Springfield, Missouri Area.

so that much finer images can be created with this device, too. This may not be required for printing, especially if the resolution of the data is low and square pixel blocks are meant to be visible. The specimens studied were larger than 8½" x 11" and have not been reproduced in this report.

Conclusions. The study has created software for interfacing LARS data and classification results on three state-of-the art image generation devices. All three devices have some advantages, although the color registration instability of DICOMED may render this device unacceptable. Two of the devices (Mead and OPTRONICS) are acceptable for map plate generation and one of these (OPTRONICS) is acceptable for high quality film image generation although problems in making accurate color negatives are significant. The DICOMED device makes good small-format images but is judged undesirable for large format and printing master generation.

2.5 Data Processing Products: Tabular Aggregations

This effort resulted from growing interest in the tabular summarization of classification results based on user-defined areas of arbitrary shape and location (e.g. counties, watersheds, census tracts). Prior to this effort, most of the software developed at LARS had been based on the use of rectangular "fields," primarily because this was sufficient for the high resolution, large-scale data available from aircraft sensor systems flown over agricultural areas. The primary features of interest in such cases are agricultural fields, which can for the most part be outlined by one or more rectangular boundaries. However, with the coming of satellite data and new applications in the earth resources area, the need for defining and manipulating data in terms of nonrectangular areas has increased substantially.

Under the earlier joint study, the aggregation of classification results by census tract was demonstrated using LANDSAT data from the vicinity of San José, California. To accomplish this demonstration, the census tract boundaries were manually overlaid on the LANDSAT data and manually coded for computer input. The coded boundaries and the corresponding classification results were then read by a program which tabulated, for each census tract, the number of pixels classified into each land use class. To make this process practical, it clearly was necessary to automate the boundary digitization, which therefore became one of the objectives of the present effort.

To begin with, it was decided to digitize the county boundaries for the Springfield, Missouri area, and tabulate the classification results for this area on a county-by-county basis. The county boundaries for the one degree by two degree area contained in the Springfield quadrangle map were digitized on a table digitizer at USGS and sent to LARS in the form of a deck

of punched cards. In order to interface the boundaries coded in this form with the classification results processor, it was necessary to develop software which could decode the digitized boundaries and register them with the LANDSAT data. Software to accomplish this was written and eventually became known as the "USGS-LARS County Boundary System." The system adds two pseudo-data channels to a digital multispectral data tape, one channel containing the actual digitized boundaries, the other containing templates of the bounded areas. In this format, either the boundaries or the areas can be viewed on the LARS digital display system or in the form of line-printer output. The other major output of the software is a punched card deck containing the coded boundaries, now registered with the LANDSAT data, which are used as input to the aggregation program. This program is a modified version of the standard LARSYS *PRINTRESULTS processor, which prints maps and tabular summaries of classification results.

The USGS-LARS County Boundary System was used to generate aggregation results for the Springfield data. These results proved to be adequate for demonstration purposes, but the county boundaries were not considered to be as accurately registered to the data as might be desired. This was attributable to the fact that a relatively small number of checkpoints were used in the process of registering the coded boundaries with the LANDSAT data. Since this difficulty could be easily corrected, no effort was made to improve on the demonstration results, but effort was directed instead toward additional sets of classification results and boundaries.

As a further step in improving the practicality of this approach, the next set of coded boundaries, county boundaries for the Indianapolis one degree by two degree quadrangle, were transmitted to LARS on magnetic tape after digitization at USGS. Use of the coded boundaries in this form required only minor modification of the software, after which aggregations for the Indianapolis results were performed and attention was turned to applying the system to census tracts in the Washington, D.C. area.

To handle the Washington, D.C. task, it was necessary to increase the capacity of the system substantially, since the number of census tracts was much larger than the number of counties processed in the previous two areas. Results for the Washington area were obtained near the end of the contract period and are included as an appendix to this report (Appendix C).

Detailed System Description. The process of obtaining tabular classification results for arbitrarily shaped areas digitized from a map is a rather complex multistep process. For our purposes here, however, we shall consider it a two-step process: the first step consists of digitizing and overlaying the boundaries on the data; the second step consists of tabulating the classification results by area and printing them in an appropriately formatted table. The first part of this task

requires the conversion of the boundaries, digitized in terms of an X-Y coordinate system, into a coordinate system compatible with the LANDSAT data set. As we have implemented this step, the software produces three products: two channels of pseudo-data defining the areas, which are added to the multispectral LANDSAT tape; and a set of boundary-defining punched cards used as input to the second phase of the task. The second phase is accomplished by a computer program which actually performs the tabulation.

The procedures used in carrying out this process are described briefly below. More detailed documentation is available from LARS in an unpublished technical note, User Guide for USGS-LARS County Boundary System, by David Freeman and Keith Philipp, April 1975. Program listings for the software used to carry out the boundary registration operations are available upon request.

The procedures consist of both manual and automated steps. See Figure 2.33. An example of a manual step is the checkpoint acquisition from both the 1:24,000 scale map and from the digital display of the LANDSAT data. Examples of automated steps are the conversion of the coded boundaries from X-Y coordinates to latitude/longitude form and the regression calculations used to generate a functional fit of the manually acquired checkpoints to the coded boundary information.

Step 1. Select area of interest. The materials required for this step include the desired LANDSAT data set and a corresponding topographic map. The map may be at any scale, although 1:24,000 has proved to be a good scale for accurate registration of boundaries with the LANDSAT data. The LANDSAT data should be checked for data quality and appropriateness (cloud cover, time of year, etc.). The LANDSAT data is first converted into LARSYS format, after which it may be further preprocessed to modify its geometric characteristics (rotation to north-south, removal of skew due to earth rotation during collection, rescaling).

For processing the Washington, D.C. data, we generated LARS Run 72041909, a geometrically corrected bitemporal LANDSAT MSS data set of the Washington, D.C. area. The first four channels are data from October 11, 1972, LANDSAT scene ID 1080-15192; the next four channels are data from April 9, 1973, scene ID 1260-15201. Fifteen USGS 7.5 minute quadrangle topographic maps covering most of the corresponding area were also obtained.

Step 2. Digitize the boundaries. For accurate boundary digitization, a table digitizer or similar device is used. Several conditions which must be met in the digitization process are shown in Appendix A. A particularly important aspect is that the corners of the map from which the boundaries are digitized must also be digitized and their latitude and longitude coordinates recorded.

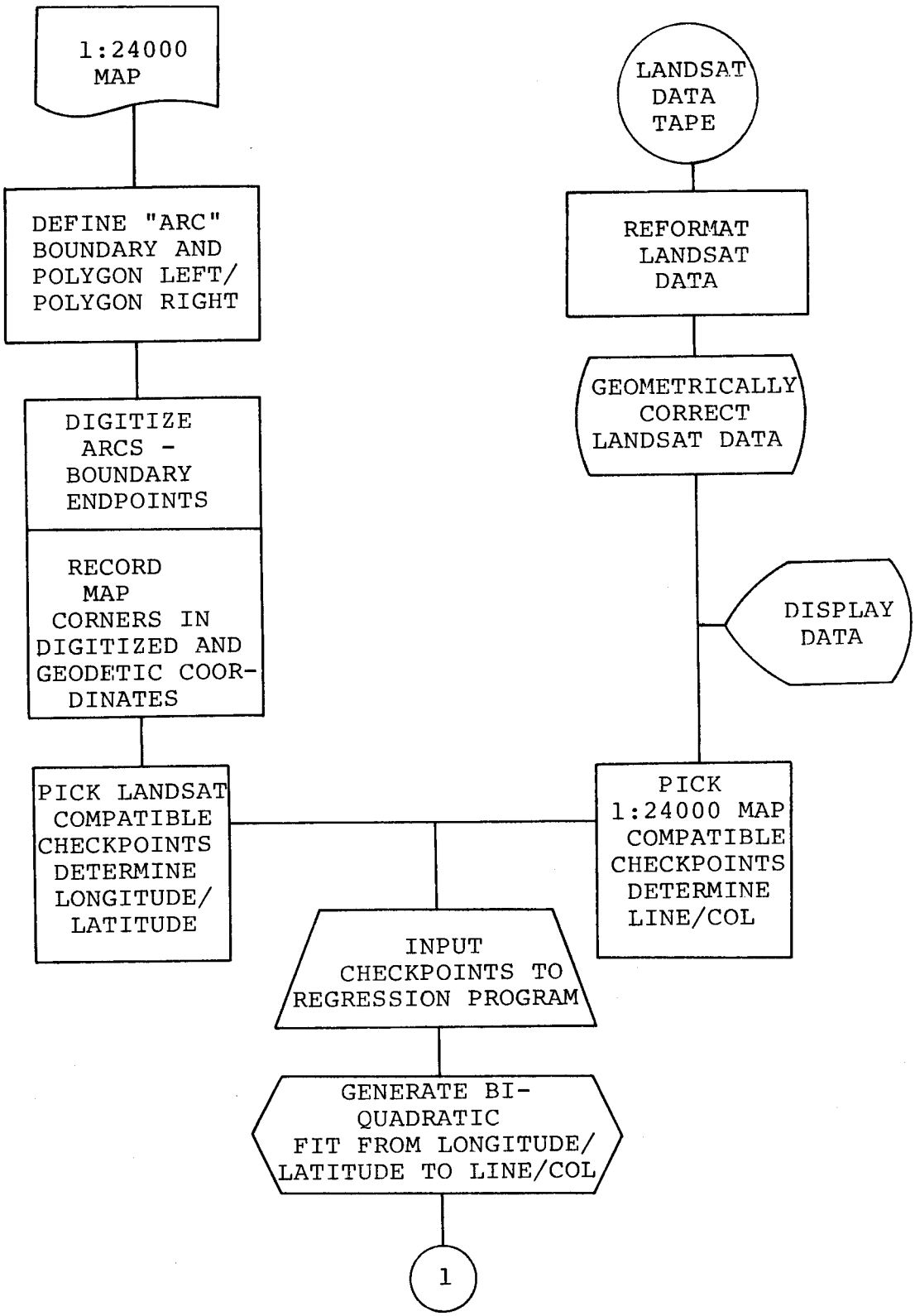


Figure 2.33 USGS-LARS County Boundary System: Operational Flowchart.

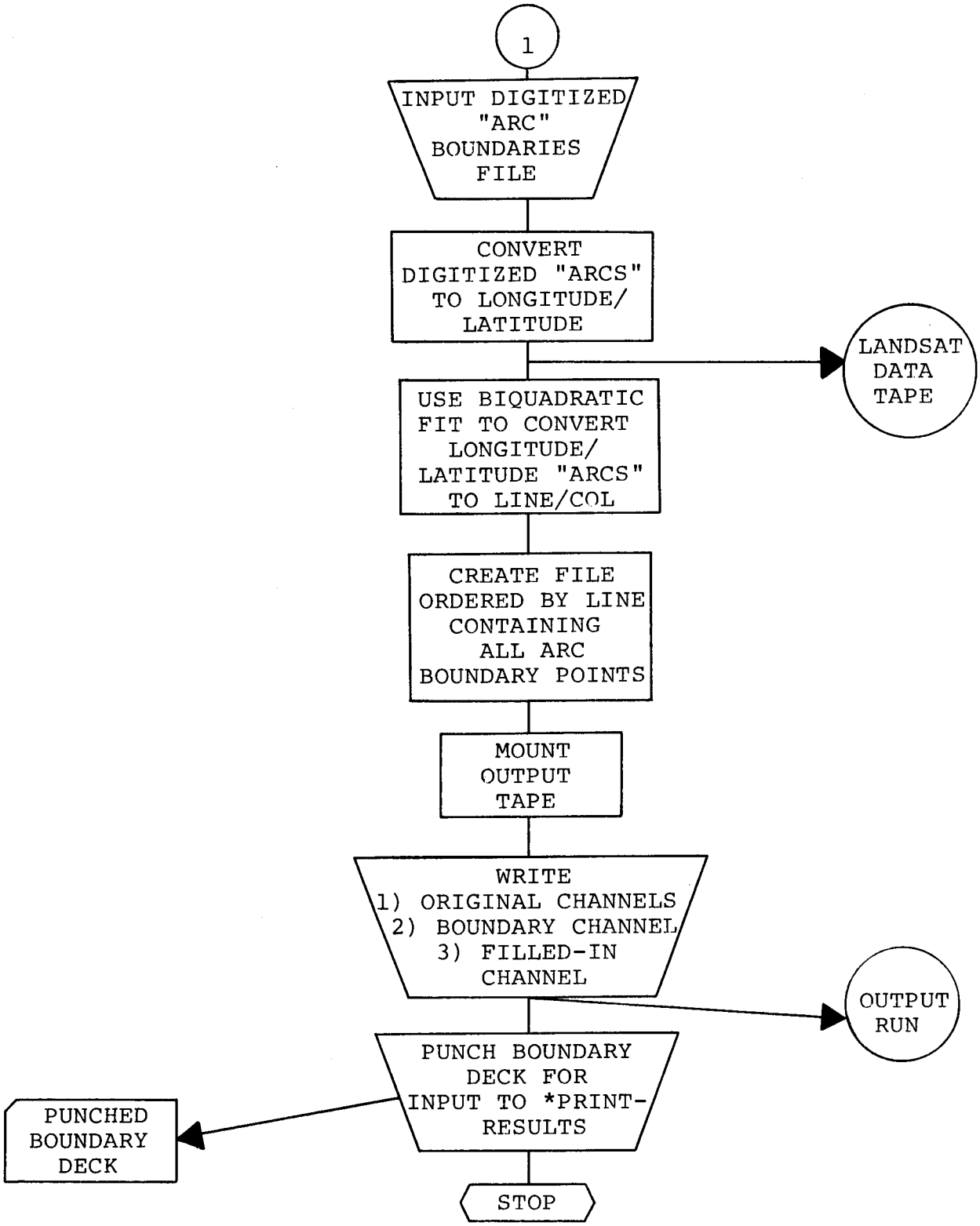


Figure 2.33 (cont'd)

For the Washington, D.C. analysis, the boundary digitization was performed at USGS, and a magnetic tape containing the digitized census tract boundaries was mailed to LARS. As it turned out, however, the UTM coordinates of the map corners were recorded, rather than their latitude and longitude. Conversion to latitude and longitude was carried out manually.

The digitized boundaries are comprised of "arcs," which are further broken down into line segments. End points of both the line segments and arcs are recorded. The arcs are sequentially numbered and a "polygon left" and a "polygon right" are associated with each arc. The principle task of the software is to reassemble the line segments into arcs and the arcs into boundaries, which are subsequently registered with the LANDSAT data.

Step 3. Acquire checkpoints. The next step is to compare the LANDSAT data to an appropriate map to determine a set of precisely locatable checkpoints. At this stage in the process, the latitude/longitude of the boundary data set is well known; in this step the latitude/longitude of the LANDSAT data is precisely determined. By accurately referencing both the boundary data set and the LANDSAT data to a common coordinate system, it is then possible to precisely register the boundaries to the data.

The geometrically corrected LANDSAT data may be viewed on a digital display system or in the form of line printer output. Selection of well-distributed checkpoints will insure a good fit between the digitized boundaries and the LANDSAT data set. A minimum of seven checkpoints is required. Twenty or more checkpoints is recommended.

For the Washington, D.C. data set, three to four checkpoints were selected from each 7.5 minute quadrangle to provide a good distribution. These were located at easily identifiable intersections of highways, rivers, etc. A list of the 52 checkpoints acquired for the Washington, D.C. data is recorded in Appendix B.

Upon completion of this step, the only remaining manual processing step is the evaluation of the registration results.

Step 4. Derive latitude/longitude-to-line/column transformation. The purpose of this step is to use the checkpoints to derive a biquadratic mapping function for converting from latitude/longitude coordinates to the LANDSAT line/column coordinates. A regression procedure is used to determine the coefficients in the following equations:

$$X^{LAT}_{ACCESSED} = A_1 + A_2X + A_3Y + A_4X^2 + A_5Y^2 + A_6XY$$

$$Y^{LONG}_{ACCESSED} = B_1 + B_2X + B_3Y + B_4X^2 + B_5Y^2 + B_6XY$$

where: X = Output Line Number
Y = Output Column Number

Using these equations, one can determine the appropriate latitude/longitude coordinates corresponding to any given line/column coordinates.

Step 5. Convert the digitized boundaries to latitude/longitude coordinates. The map corner coordinates are used to develop the necessary transformation to convert the "raw" boundary coordinates to latitude/longitude.

Step 6. Convert the digitized boundaries to LANDSAT line/column coordinates. The results of Steps 4 and 5 provide the information required for this operation.

Step 7. Register the boundaries and LANDSAT data. This is the point at which the boundary data and the LANDSAT data are physically merged in the computer.

The Washington, D.C. census tract boundaries were successfully registered with (overlaid on) a data set of the same area, and a check of several points distributed over the area showed at most a 1 or 2 pixel error.

Step 8. Prepare output files. A file is written on tape which contains the LANDSAT data plus two additional channels -- a channel of area boundaries and a channel of area templates. Although both of these channels contain essentially the same information, there are situations in which each one can be used much more conveniently than the other.

Also, the file of cards is prepared and punched, which serves to define the individual areas for aggregation of results by the modified LARSYS *PRINTRESULTS processor.

Aggregation of Classification Results. The "on-line" *PRINTRESULTS processor of LARSYS is able to perform the aggregation function for user-specified areas, but the test fields must be rectangular. The "modified *PRINTRESULTS," given fields of arbitrarily shaped boundaries, computes both the number of points in each class and the percentages of each class classified into each field. This is accomplished by allowing a special, and more complicated, test field specification format. The output of the program includes aggregation results in terms of number of points and percentage, as well as a printout map with field boundaries outlined.

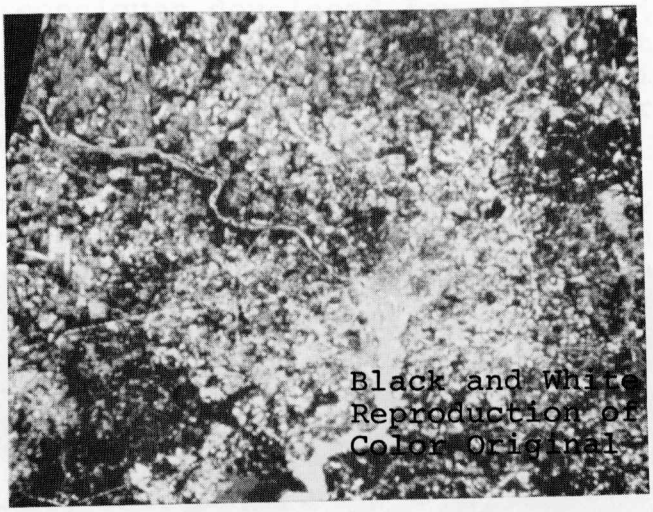
Using LARS Run 72041909 (see description under Step 1 above) and training statistics developed interactively using the LARS system, a classification of the Washington, D.C. area was produced at the University of Illinois using the ILLAC IV computer via the ARPA network (the same classification discussed in Section 2.1). Figure 2.34 shows a simulated color-IR image of the area processed and a color-coded classification of the same area. Figure 2.35 shows the digitized and registered census tract boundaries overlaid on the data.

Since the modified *PRINTRESULTS is LARSYS-compatible, using it merely requires obtaining access to the modified program module, reading in a control card deck complete with the output deck from the boundary overlay system, and typing "run larsys." In Appendix C are three sets of computer output. The first (Table C1) is a list of the polygon IDs extracted from the original tape containing the digitized census tract boundaries, including the calculated latitude, longitude, line and column of an interior point of each census tract. The other two (Tables C2 and C3) contain the classification results for each census tract. There are thirteen (13) groups of classes defined:

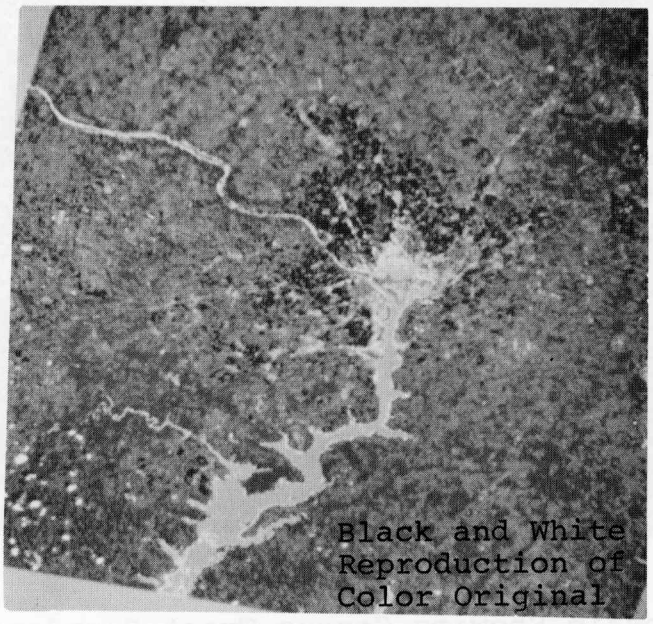
	Group	Classification Class Numbers	Description
1.	RSDS	1-5	Residential, single family
2.	RSDM	6	Residential, multiple families
3.	DISTRB	7,8,9	Disturbed land, new construction, quarry
4.	CM/IND	10,12,13	Commercial, industrial
5.	PKLOT	11	Parking lot
6.	OPEN	14	Open spaces, grassy
7.	AGRI	15,16, 17	Agriculture
8.	WDLND	18	Woodland, field and trees
9.	TREES	19,20	Trees
10.	WATER	21,22,24	Water
11.	RNWY	23	Bright runway
12.	CLOUD	25	Clouds
13.	SHADOW	26	Cloud shadows

The results are tabulated for each census tract in terms of both the number of pixels in each class and the percentage of the census tract in each class.

Conclusions. One outcome of this task has been a demonstration that arbitrarily shaped boundaries can be overlaid on remotely sensed data. The boundary digitization and



Simulated color-IR from LANDSAT channels 4, 5 and 6 (October 11, 1974).



Color-coded classification of the multitemporal data (Red=RSDS, Lavender=RSDM, Light brown=DISTRB, Light yellow=CM/IND, Medium gray=PKLOT, Light green=OPEN, Medium light green=AGRI, Medium green=WDLND, Dark green=TREES, Aqua=WATER, Light gray=RNWY, White=CLOUD, Dark gray=SHADOW).

Figure 2.34 Washington, D.C. Area Analysis

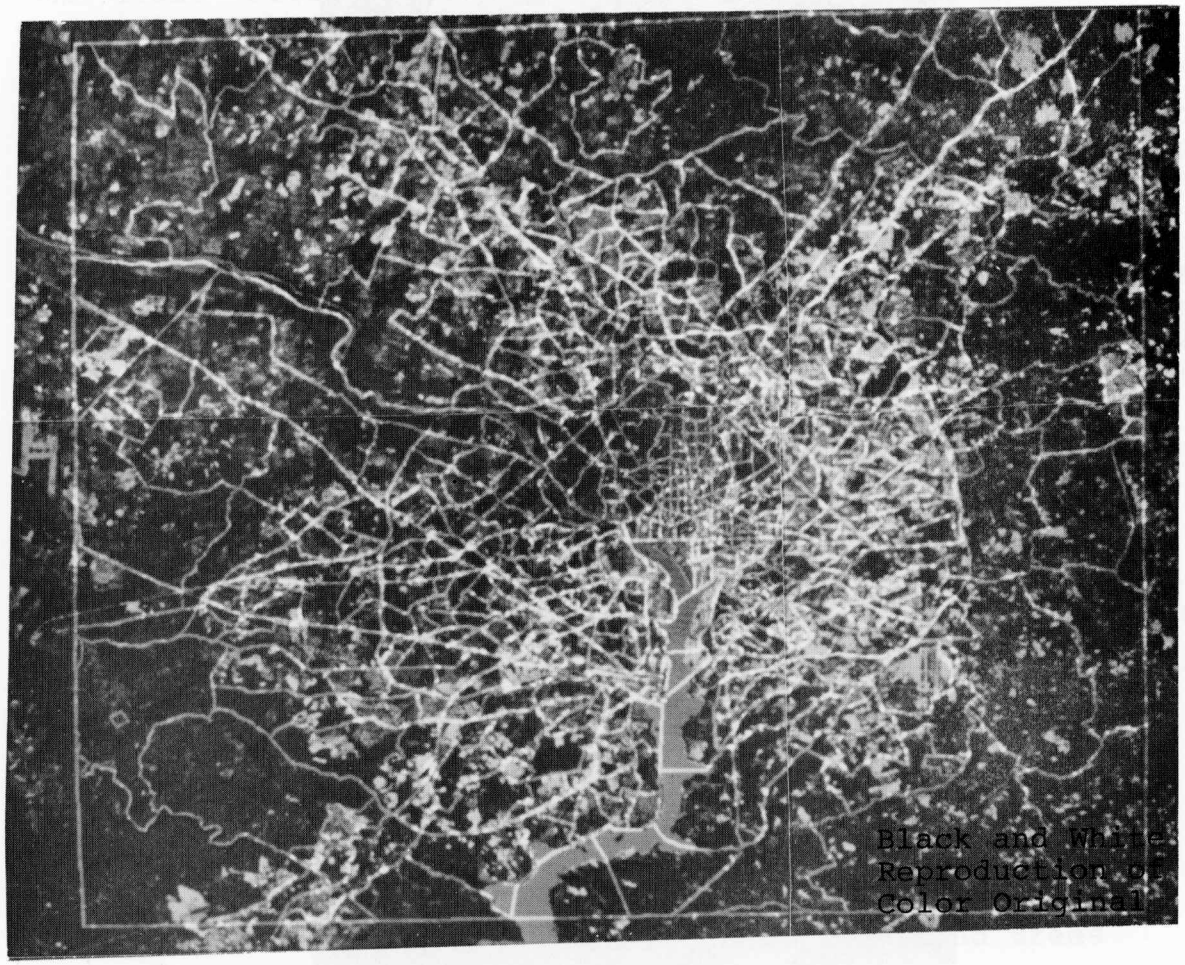


Figure 2.35 Mosaic Showing Census Tract Boundaries Overlaid on the Data.

registration techniques developed for this project have been the basis for increased boundary overlay work throughout the laboratory. County boundaries, watersheds, soil types, land use, topographic and range and township boundaries have all been registered.

The other major result of this project involved tabulating classification results using the arbitrarily shaped boundaries. The LARSYS programs were modified to accomplish this. There are still some cumbersome steps involved in obtaining the desired results, but these can be facilitated by further refinement of the research software. A particularly useful capability which could be added would be to print a polygon identifier on the map-type output produced from the classification results.

REFERENCES

1. Richard Ellefsen, Philip Swain, and James Wray, "Urban Land-Use Mapping by Machine Processing of ERTS-1 Multispectral Data: A San Francisco Bay Area Example," Proceedings Symposium on Machine Processing of Remotely Sensed Data, Purdue University, IEEE Catalog No. 73 CHO 834-2 GE, Institute of Electrical and Electronics Engineers, New York, NY, October 1973, pp. 2A-7 to 2A-22.

2. Philip H. Swain, "Implementation and Evaluation of Illiac-IV Algorithms for Multispectral Image Processing: Final Report," LARS Technical Memorandum T-16, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana, July 1974.

3. J. Anderson, E. Hardy, and J. Roach, "A Land-Use Classification System for Use with Remote Sensor Data," U.S. Geological Survey Circular 671, Washington, D.C., 1972.

4. R. Ellefsen, L. Gaydos, P. Swain, J. R. Wray, "New Techniques in Mapping Urban Land Use and Monitoring Change for Selected U.S. Metropolitan Areas: An Experiment Employing Computer-Assisted Analysis of ERTS-1 MSS Data," Commission VII Symposium, International Society of Photogrammetry, Banff, Alberta, Canada, October 1974.

5. T. L. Phillips, ed., "LARSYS User's Manual," (3 vols.), Purdue University, Laboratory for Applications of Remote Sensing, West Lafayette, Indiana, June 1973.

6. P. E. Anuta and M. E. Bauer, "An Analysis of Temporal Data for Crop Species Classification and Urban Change Detection," Information Note 110873, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana, November 1973.

7. R. L. Kettig and D. A. Landgrebe, "Computer Classification of Remotely Sensed Multispectral Image Data by Extraction and Classification of Homogeneous Objects," LARS Information Note 050975, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana, May 1975.

8. R. M. Haralick, K. Shanmugam and I. Dinstein, "Textural Features for Image Classification," IEEE Trans. Systems, Man, and Cybernetics, Vol. SMC-3, pp. 610-621, Nov. 1973.

9. J. S. Weszka, C. R. Dyer and A. Rosenfeld, "A Comparative Study of Texture Measures for Terrain Classification," IEEE Trans. Systems, Man, and Cybernetics, Vol. SMC-6, pp. 269-285, April 1976.

10. R. J. Hornung and J. A. Smith, "Incorporation of Spatial Information as Additional Features for Multispectral Land-Use Classification," NAS Report 9-12972, Vol. 1, Colorado State University, Fort Collins, Colorado, June 1974.

11. M. D. Fleming, J. S. Berkebile, and R. M. Hoffer, "Computer-Aided Analysis of LANDSAT-1 MSS Data: A Comparison of Three Approaches, including a 'Modified Clustering' Approach," Information Note 072475, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana, 1975.

ADDITIONAL RELATED PUBLICATIONS

1. R. Ellefsen, "Automatic Digital Processing of ERTS-1 MSS Data In An Urban Land-Use Mapping Experiment," Proc. American Society of Photogrammetry 40th Annual Meeting, American Society of Photogrammetry, Falls Church, VA, March 1974.

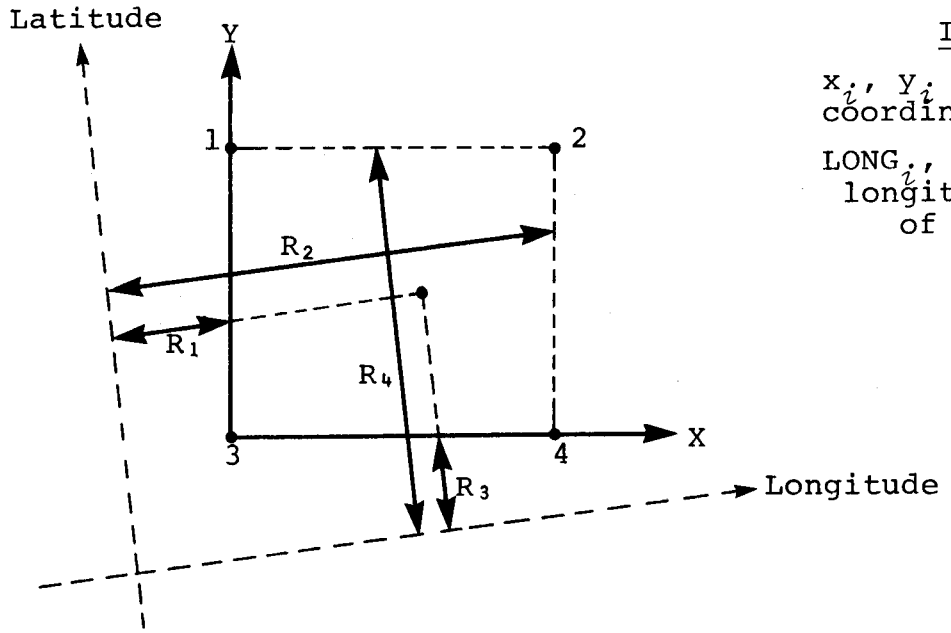
2. R. Ellefsen, L. Gaydos, and J. Wray, "Computer-Aided Mapping of Land Use Using ERTS Multispectral Scanner Data," Primer Congreso Panamericano y Tercero Nacional de Fotogrametria Fotointerpretacion y Geodesia, Mexico, July 1974.

3. R. Ellefsen, "ADP Pattern Recognition of Urban Land Uses from Satellite-Borne Multispectral Scanner," Fourth Annual Conference on the Application of Remote Sensing of Arid Land Resources and Environments, Tucson, Arizona, November, 1973.

APPENDICES

Appendix A

CONVERSION FROM DIGITIZED POINTS TO LATITUDE/LONGITUDE COORDINATES



Input

x_i, y_i (i=1,2,3 or 4)= x,y coordinates of map corners

$LONG_i$, LAT_i (i=1,2,3 or 4)= longitude and latitude of map corners

x,y = arbitrary digitized point

Differences

$DLONG_{13} = LONG_1 - LONG_3$
$DLONG_{24} = LONG_2 - LONG_4$
$DLAT_{43} = LAT_4 - LAT_3$
$DLAT_{21} = LAT_2 - LAT_1$

$$R_1 = LONG_3 + \left(\frac{y}{y_1} \times DLONG_{13}\right)$$

$$R_2 = LONG_4 + \left(\frac{y}{y_1} \times DLONG_{24}\right)$$

$$LONG_{x,y} = R_1 + \left(\frac{x}{x_4} \times (R_2 - R_1)\right)$$

$$R_3 = LAT_3 + \left(\frac{x}{x_4} \times DLAT_{43}\right)$$

$$R_4 = LAT_1 = \left(\frac{x}{x_4} \times DLAT_{21}\right)$$

$$LAT_{x,y} = R_3 + \left(\frac{y}{y_1} \times (R_4 - R_3)\right)$$

ASSUMPTIONS

1. The 4 checkpoints are the map corners.
2. Point #3 is at 0,0.
3. The latitudes and longitudes of the 4 checkpoints are given.

Appendix B

CHECKPOINTS USED FOR WASHINGTON D.C. CENSUS TRACT BOUNDARIES OVERLAY

(LARS Run 72041904)

col	line	long	lat
625	495	77 15.4000	39 00.0
523	365	77 19.7500	39 05.25
545	409	77 18.8333	39 03.5833
665	332	77 14.2000	39 06.5833
754	386	77 09.8333	39 04.4167
775	478	77 09.0000	39 00.7500
806	325	77 07.7500	39 06.8333
878	420	77 04.5000	39 03.1000
884	333	77 04.6667	39 06.6000
926	477	77 02.5167	39 00.7833
965	467	77 00.8000	39 01.2500
996	433	76 59.4167	39 02.5833
1032	409	76 57.7833	39 03.75
1140	349	76 53.4167	39 06.00
1137	493	76 53.4833	39 00.1667
1162	322	76 52.5167	39 07.0000
1279	450	76 47.2500	39 01.9167
1210	344	76 50.8333	39 05.8333
538	526	77 18.9000	38 58.6000
625	628	77 15.2833	38 54.6167
660	523	77 13.8333	38 58.75
732	542	77 10.7500	38 58.1667
657	614	77 13.8667	38 55.1167
900	657	77 03.5833	38 53.3333
850	620	77 05.6667	38 54.8833
810	646	77 07.4167	38 53.8333
873	542	77 04.7000	38 58.0500
960	604	77 01.0333	38 55.6333
1047	621	76 57.7500	38 54.8333
1146	507	76 53.2000	38 59.4333
1011	536	76 58.8333	38 58.2500
1023	667	76 58.0667	38 53.2500
1192	618	76 51.1333	38 55.0333
1201	573	76 50.6667	38 56.8333
1336	569	76 45.0833	38 57.0000
559	842	77 18.0167	38 45.8333
559	794	77 18.0167	38 47.7833
526	710	77 19.4333	38 51.1667
499	695	77 20.7167	38 51.7500
673	738	77 13.0833	38 50.0833
736	801	77 10.5167	38 47.4667
672	676	77 13.7500	38 51.9167
948	706	77 01.3333	38 51.4000
924	799	77 02.3833	38 47.5833
921	682	77 02.5667	38 52.3333
843	738	77 05.8667	38 50.0667

Appendix B (Cont.)

CHECKPOINTS USED FOR WASHINGTON D.C.

CENSUS TRACT BOUNDARIES OVERLAY

col	line	long	lat
989	688	76 59.5833	38 52.1000
1092	761	76 55.1167	38 49.2000
1058	696	76 56.8333	38 52.0833
1109	711	76 54.6333	38 51.3667
1169	731	76 52.0333	38 50.3500
1286	803	76 46.9167	38 47.4833

APPENDIX C

WASHINGTON, D.C. AREA RESULTS

Table C1. Washington, D.C. Census Tract Polygon IDs

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
2	700500	77.42635	39.06843	388.	392.
3	700400	77.41831	39.18556	400.	220.
4	700301	77.31887	39.18746	539.	218.
5	700201	77.29597	39.18801	571.	217.
6	700300	77.29956	39.17411	566.	238.
7	700802	77.28103	39.16187	592.	256.
8	700803	77.22492	39.16705	671.	249.
9	700700	77.25068	39.15395	634.	268.
10	700801	77.26145	39.15434	619.	267.
11	700800	77.22066	39.10268	676.	344.
12	700704	77.20638	39.13088	696.	303.
13	700703	77.19403	39.14118	714.	287.
14	700701	77.19359	39.14240	714.	286.
15	700702	77.18004	39.13852	733.	291.
16	700100	77.19120	39.18976	718.	216.
17	700600	77.35981	39.06323	481.	401.
18	701206	77.22698	39.06667	667.	397.
19	701002	77.19651	39.09319	710.	358.
20	701003	77.18016	39.10139	733.	346.
21	701004	77.17446	39.08758	740.	367.
22	700900	77.16293	39.08986	757.	363.
23	700901	77.15300	39.09591	771.	354.
24	700902	77.14348	39.09264	784.	359.
25	701100	77.13664	39.08382	793.	372.
26	701207	77.15336	39.09689	770.	353.
27	701302	77.11958	39.10196	818.	346.
28	703201	77.11507	39.09066	824.	362.
29	701300	77.10114	39.18468	844.	224.
30	701301	77.14354	39.14547	784.	281.
31	703202	77.06615	39.11171	893.	332.
32	703203	77.07987	39.09226	873.	360.
33	703205	77.06926	39.07554	888.	385.
34	703200	77.07733	39.08043	877.	378.
35	703301	77.08740	39.07836	862.	381.
36	703300	77.10484	39.06888	838.	395.
37	703400	77.08897	39.05945	860.	409.
38	703401	77.07639	39.07001	878.	393.
39	703402	77.07341	39.06254	882.	404.
40	703403	77.07419	39.05596	881.	414.
41	703700	77.07071	39.04918	885.	424.
42	703701	77.05261	39.05668	911.	413.
43	701101	77.11534	39.07357	823.	388.
44	700903	77.12678	39.05798	807.	411.
45	700904	77.13135	39.06277	801.	403.
46	701000	77.16496	39.07331	754.	383.
47	701001	77.17962	39.05592	733.	413.
48	605300	76.87491	39.18221	1162.	228.
49	606100	76.87372	39.18175	1164.	228.
50	605100	76.91720	39.12946	1102.	306.
51	606500	76.83506	39.19585	1213.	237.
52	601100	76.78732	39.18022	1286.	230.
53	601200	76.78694	39.17909	1286.	232.
54	750600	76.73727	39.17981	1356.	231.
55	740400	76.77989	39.14709	1296.	279.
56	740101	76.77895	39.14830	1297.	277.
57	740100	76.73587	39.13282	1358.	300.
58	606400	76.84258	39.14717	1208.	279.
59	606200	76.82869	39.15823	1227.	263.
60	606300	76.81865	39.12117	1241.	318.
61	800201	76.87464	39.11409	1162.	328.
62	800101	76.86501	39.10982	1176.	335.
63	800100	76.89028	39.10089	1140.	348.
64	800102	76.85334	39.10018	1192.	349.
65	800201	76.89734	39.08483	1130.	372.
66	800202	76.92861	39.07662	1086.	384.
67	701400	76.92020	39.13044	1098.	304.
68	807402	76.92928	39.07558	1085.	385.
69	701402	77.02679	39.12447	948.	313.
70	701401	77.03358	39.11978	938.	320.
71	703204	77.03538	39.11966	936.	320.
72	701501	76.99363	39.04283	994.	433.
73	701502	77.00217	39.07468	982.	386.
74	703207	77.02598	39.03584	948.	444.
75	703206	77.02922	39.06351	944.	403.
76	701500	76.98006	39.05013	1013.	423.
77	740500	76.84077	39.10257	1210.	345.
78	800200	76.84919	39.09310	1198.	359.
79	741100	76.78154	39.11623	1293.	325.
80	740600	76.73431	39.06171	1359.	405.
81	740700	76.75203	39.03503	1334.	445.
82	800404	76.74787	39.00865	1339.	484.
83	807400	76.85176	39.01690	1193.	472.
84	807401	76.90324	39.02328	1121.	462.
85	806703	76.89793	39.01564	1128.	474.
86	806701	76.86923	39.00049	1168.	496.
87	806700	76.89921	38.97263	1126.	537.
88	806702	76.90295	38.99661	1121.	502.
89	806800	76.90383	38.99547	1119.	503.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
90	803605	76.84354	38.97449	1204.	534.
91	803606	76.83185	38.97936	1221.	527.
92	800300	76.81408	38.95739	1245.	560.
93	800403	76.83030	38.97971	1223.	527.
94	800402	76.76114	39.00305	1321.	492.
95	800400	76.74622	39.00834	1342.	484.
96	800401	76.75780	38.98405	1325.	520.
97	800503	76.74223	38.97693	1347.	531.
98	800504	76.73868	38.96322	1352.	551.
99	800502	76.74351	38.97654	1345.	531.
100	800500	76.75178	38.94996	1333.	570.
101	800501	76.79913	38.94330	1266.	580.
102	806900	76.91106	39.01376	1109.	476.
103	807000	76.91765	39.00569	1100.	488.
104	807300	76.93780	39.01655	1072.	472.
105	807200	76.93491	38.99642	1076.	502.
106	807301	76.97764	39.01103	1016.	480.
107	701600	76.97427	39.01752	1021.	471.
108	805902	76.97858	39.00978	1014.	482.
109	803604	76.87545	38.97691	1159.	531.
110	803602	76.89231	38.96685	1135.	546.
111	803603	76.89669	38.95713	1143.	560.
112	803607	76.86681	38.95919	1171.	557.
113	803601	76.86007	38.94453	1180.	579.
114	803600	76.84202	38.94576	1206.	577.
115	803502	76.85068	38.93063	1193.	599.
116	803400	76.87555	38.92551	1158.	607.
117	803401	76.86618	38.92018	1171.	614.
118	803200	76.89759	38.92892	1127.	602.
119	803300	76.87676	38.92599	1156.	606.
120	803700	76.89013	38.94728	1138.	574.
121	804101	76.88842	38.93683	1140.	590.
122	803800	76.89452	38.94702	1132.	575.
123	803801	76.90960	38.95328	1111.	566.
124	806602	76.90003	38.97157	1124.	539.
125	806601	76.91665	38.97132	1101.	539.
126	806600	76.92084	38.96004	1095.	556.
127	807100	76.91585	38.97548	1102.	533.
128	807101	76.93166	38.98346	1080.	521.
129	806501	76.91568	38.97443	1102.	534.
130	806400	76.93970	38.97236	1069.	537.
131	806500	76.94340	38.96507	1063.	548.
132	803900	76.92473	38.95343	1089.	565.
133	804000	76.91144	38.95172	1108.	568.
134	806300	76.92676	38.95152	1086.	568.
135	804100	76.91071	38.93311	1109.	595.
136	804200	76.91866	38.93459	1098.	593.
137	803100	76.91297	38.91772	1105.	618.
138	804300	76.91773	38.91704	1099.	619.
139	804400	76.94218	38.93620	1064.	591.
140	803000	76.89979	38.90788	1124.	632.
141	802901	76.91197	38.89539	1106.	651.
142	802900	76.90086	38.88743	1122.	663.
143	802801	76.89384	38.88792	1132.	662.
144	803501	76.89851	38.90811	1125.	632.
145	803500	76.86331	38.88953	1175.	660.
146	804700	76.95955	38.93263	1040.	596.
147	804600	76.95688	38.93578	1044.	591.
148	804500	76.95065	38.94257	1053.	581.
149	804800	76.97382	38.94327	1020.	580.
150	804900	76.98823	38.95450	1000.	564.
151	805000	76.99665	38.96090	988.	554.
152	805100	76.95975	38.94969	1040.	571.
153	806200	76.94840	38.94600	1056.	576.
154	806100	76.96232	38.95580	1036.	562.
155	806000	76.96325	38.95640	1035.	561.
156	805900	76.95076	38.96618	1053.	547.
157	805800	76.97269	38.96401	1022.	550.
158	805901	76.96488	38.98419	1033.	520.
159	805801	76.98050	38.97202	1011.	538.
160	805200	76.99761	38.96182	987.	553.
161	805201	76.98910	38.96675	999.	546.
162	805300	77.00741	38.97057	973.	540.
163	701700	77.00885	38.97068	971.	540.
164	701800	77.02362	38.98498	951.	519.
165	702500	77.03087	38.98810	941.	514.
166	702401	77.02268	38.99627	952.	502.
167	702400	77.02191	38.99716	953.	501.
168	702600	77.03186	38.98893	939.	513.
169	702601	77.04416	39.00080	922.	495.
170	702800	77.03296	38.99905	938.	498.
171	805500	76.98137	38.97274	1010.	537.
172	805400	76.98871	38.97730	1000.	530.
173	805600	76.98061	38.98426	1011.	520.
174	805700	76.97464	38.98397	1020.	520.
175	701701	77.00006	38.98248	984.	522.
176	701701	76.99285	38.99215	994.	508.
177	701900	76.99658	38.98705	989.	516.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
178	702000	76.98697	39.00030	1002.	496.
179	702300	77.01084	38.99881	969.	498.
180	702301	77.01145	38.99972	968.	497.
181	702200	76.99701	38.99958	988.	497.
182	702100	76.99581	38.99967	990.	497.
183	702101	76.99621	39.01730	990.	471.
184	703209	77.00793	39.02927	973.	453.
185	702900	77.02301	38.99771	952.	500.
186	703000	77.02127	39.00787	954.	485.
187	703001	77.03312	39.01522	938.	474.
188	703100	77.03079	39.02201	941.	464.
189	703900	77.04267	39.01359	924.	476.
190	703901	77.04668	39.02555	919.	459.
191	703208	77.04847	39.04128	917.	436.
192	702700	77.04538	39.00128	920.	495.
193	705200	77.05526	38.98676	906.	516.
194	705300	77.07370	38.97610	880.	531.
195	705600	77.08910	38.96412	858.	549.
196	705500	77.08961	38.96544	858.	547.
197	705400	77.08909	38.96902	859.	542.
198	705100	77.07730	38.97709	875.	530.
199	704801	77.10448	38.97568	837.	532.
200	704800	77.08947	38.98594	858.	517.
201	705000	77.08824	38.98615	860.	517.
202	704700	77.10510	38.99009	836.	511.
203	705902	77.10839	38.97694	832.	530.
204	705700	77.10542	38.96478	836.	548.
205	705701	77.10292	38.94940	839.	571.
206	705800	77.11404	38.94063	823.	583.
207	705901	77.12400	38.97319	810.	536.
208	705900	77.13849	38.98436	789.	519.
209	704600	77.11859	38.99308	818.	506.
210	704900	77.09789	38.99417	847.	505.
211	704501	77.12987	39.00242	802.	492.
212	704502	77.12848	39.00199	804.	493.
213	704401	77.11094	39.00520	828.	488.
214	704500	77.14322	39.02118	783.	465.
215	704400	77.11953	39.01619	817.	472.
216	704300	77.09311	39.01271	854.	477.
217	701206	77.14745	39.03826	778.	440.
218	706000	77.14426	39.02176	782.	464.
219	704100	77.09201	39.01223	855.	478.
220	704200	77.08133	39.02326	870.	462.
221	704000	77.04921	39.02889	915.	454.

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
222	703601	77.06170	39.02632	893.	458.
223	703800	77.05338	39.04063	903.	436.
224	703600	77.07515	39.03300	879.	448.
225	703501	77.07633	39.03309	877.	448.
226	701202	77.08927	39.02998	859.	452.
227	701201	77.08711	39.03249	862.	448.
228	701200	77.09009	39.03903	858.	439.
229	703500	77.07634	39.05077	878.	421.
230	701203	77.12076	39.04495	815.	430.
231	706001	77.26460	39.03285	613.	447.
232	407600	77.32824	39.05689	525.	411.
233	407700	77.15658	38.94678	764.	574.
234	600900	77.37149	39.01521	464.	471.
235	601000	77.42604	39.04236	388.	431.
236	601100	77.37236	39.01419	462.	473.
237	407800	77.37007	39.01423	466.	473.
238	408900	77.34454	38.99948	501.	495.
239	409000	77.36628	38.96716	470.	542.
240	409100	77.37171	38.95920	463.	554.
241	409200	77.34334	38.99858	503.	496.
242	409400	77.42307	38.96140	391.	550.
243	410300	77.42065	38.89038	393.	654.
244	410500	77.41880	38.83934	395.	729.
245	410400	77.41874	38.83502	395.	735.
246	409500	77.34616	38.85099	496.	713.
247	409300	77.31250	38.92389	545.	606.
248	409600	77.24300	38.91508	642.	620.
249	409700	77.27495	38.90981	597.	627.
250	410000	77.27583	38.89316	596.	652.
251	409900	77.27516	38.89400	597.	651.
252	409800	77.26401	38.90280	612.	638.
253	410100	77.24707	38.88026	636.	671.
254	406600	77.24208	38.89778	643.	645.
255	407900	77.21933	38.91160	675.	625.
256	406700	77.21792	38.90973	677.	628.
257	408600	77.21525	38.90943	681.	629.
258	408300	77.21790	38.91087	677.	626.
259	408700	77.18593	38.91099	722.	627.
260	408400	77.18405	38.90970	724.	628.
261	408500	77.17325	38.91224	740.	625.
262	408800	77.18335	38.90893	725.	630.
263	408000	77.17842	38.93496	733.	591.
264	408100	77.17711	38.93416	735.	593.
265	408200	77.15333	38.92123	768.	612.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
266	100300	77.12026	38.93361	814.	594.
267	100400	77.11796	38.92926	817.	600.
268	100500	77.11434	38.90958	822.	629.
269	100200	77.14621	38.91321	777.	624.
270	100100	77.16035	38.90222	757.	640.
271	101100	77.16601	38.88841	749.	660.
272	500100	77.17366	38.89247	739.	654.
273	500200	77.17341	38.88231	739.	669.
274	500300	77.16501	38.88559	751.	664.
275	406900	77.19315	38.89101	711.	656.
276	407000	77.22059	38.87536	673.	679.
277	407100	77.20264	38.86675	698.	691.
278	407200	77.18484	38.87850	723.	674.
279	1600	77.02829	38.98412	944.	520.
280	1800	77.02820	38.97760	944.	529.
281	1700	77.02762	38.97052	945.	540.
282	1500	77.07172	38.97172	883.	538.
283	1100	77.07832	38.96655	874.	546.
284	1000	77.08686	38.95977	862.	555.
285	900	77.10168	38.94796	841.	573.
286	800	77.10420	38.91683	836.	619.
287	1001	77.08568	38.93796	863.	588.
288	1200	77.07899	38.94609	872.	576.
289	200	77.08065	38.90287	869.	639.
290	300	77.08089	38.91327	859.	624.
291	700	77.08325	38.92199	866.	611.
292	400	77.07334	38.92265	880.	610.
293	600	77.07288	38.93238	881.	596.
294	100	77.06399	38.88980	892.	659.
295	4100	77.05850	38.91730	901.	618.
296	500	77.05388	38.92051	907.	613.
297	1300	77.05716	38.93295	903.	595.
298	1801	77.04459	38.96210	921.	552.
299	2000	77.04361	38.96148	922.	553.
300	1900	77.02866	38.96163	943.	553.
301	2100	77.02886	38.96039	943.	555.
302	2101	77.01949	38.95790	956.	559.
303	9504	77.00942	38.95512	970.	563.
304	9505	77.00944	38.95262	970.	566.
305	2600	77.03825	38.94844	930.	572.
306	2700	77.03816	38.93790	930.	588.
307	2701	77.03787	38.93157	930.	597.
308	3900	77.03818	38.92616	929.	605.
309	4000	77.04900	38.92316	914.	610.
310	4201	77.04639	38.91389	918.	623.
311	5500	77.04519	38.90961	919.	629.
312	3800	77.03804	38.92532	930.	606.
313	4200	77.03794	38.91843	930.	617.
314	5300	77.03788	38.91326	930.	624.
315	5301	77.03775	38.90659	930.	634.
316	2500	77.03718	38.94793	931.	573.
317	2200	77.02801	38.95120	944.	568.
318	2201	77.01934	38.95129	956.	568.
319	2400	77.02697	38.94537	945.	577.
320	2300	77.01944	38.94568	956.	577.
321	2501	77.03696	38.94036	931.	583.
322	2800	77.03714	38.93695	931.	589.
323	2900	77.03340	38.93640	936.	590.
324	3000	77.03299	38.92922	937.	601.
325	3100	77.02870	38.93074	943.	598.
326	3200	77.02485	38.93577	948.	591.
327	3700	77.03380	38.92576	935.	606.
328	3600	77.02871	38.92598	943.	605.
329	3500	77.02418	38.92638	949.	605.
330	3400	77.01861	38.92742	957.	603.
331	3300	77.01270	38.92562	965.	606.
332	4300	77.03697	38.91856	931.	616.
333	4400	77.03220	38.91963	938.	615.
334	4500	77.02712	38.91409	945.	623.
335	5200	77.03674	38.91337	931.	624.
336	5000	77.03237	38.91322	937.	624.
337	4900	77.02715	38.91315	945.	624.
338	4800	77.02222	38.90864	951.	631.
339	5400	77.05002	38.90230	912.	640.
340	5401	77.04392	38.90016	921.	643.
341	5201	77.03695	38.90626	931.	634.
342	5100	77.03277	38.90454	937.	637.
343	4901	77.02703	38.90375	945.	638.
344	4801	77.02221	38.90319	951.	639.
345	5600	77.05836	38.88948	900.	659.
346	5700	77.05025	38.88969	912.	659.
347	5701	77.04357	38.88956	921.	659.
348	5800	77.03376	38.88977	935.	659.
349	5900	77.02014	38.88994	954.	659.
350	2301	77.00310	38.93125	979.	598.
351	9500	76.99681	38.93383	988.	594.
352	9501	76.99036	38.93502	997.	592.
353	9502	76.98193	38.93533	1009.	592.

Table C1. Washington, D.C. Census Tract P

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
354	9200	77.00930	38.91715	970.	619.
355	9300	76.99607	38.92193	988.	612.
356	9400	76.98001	38.92827	1011.	602.
357	3301	77.01451	38.91275	962.	625.
358	4600	77.01525	38.90572	961.	635.
359	8700	77.00950	38.91067	969.	628.
360	4700	77.02213	38.90219	951.	641.
361	8600	77.00957	38.89751	969.	647.
362	8500	77.00423	38.90040	977.	643.
363	9101	76.99702	38.92040	987.	614.
364	9100	76.98017	38.92664	1011.	605.
365	8800	77.00243	38.90919	979.	630.
366	9000	76.97858	38.91685	1013.	619.
367	8801	76.99353	38.90408	992.	638.
368	8900	76.97688	38.91155	1015.	627.
369	8300	77.00444	38.89950	976.	645.
370	8301	76.99885	38.89953	984.	645.
371	8400	76.99553	38.89590	989.	650.
372	8200	77.00950	38.88976	969.	659.
373	8100	76.99530	38.88998	989.	659.
374	8000	76.99051	38.89688	996.	648.
375	8001	76.99061	38.89290	996.	654.
376	7900	76.98395	38.89356	1005.	653.
377	7901	76.97765	38.89365	1014.	653.
378	8901	76.98307	38.89989	1006.	644.
379	7800	76.96241	38.89746	1035.	648.
380	7801	76.96365	38.89019	1033.	658.
381	7802	76.95114	38.89569	1051.	650.
382	7803	76.93582	38.89037	1073.	658.
383	7804	76.94296	38.90212	1063.	641.
384	7806	76.92708	38.89753	1085.	648.
385	7807	76.92871	38.89038	1083.	658.
386	7704	76.91705	38.88940	1099.	660.
387	7705	76.93495	38.88929	1074.	660.
388	7706	76.92809	38.88035	1083.	673.
389	7702	76.94136	38.88934	1065.	660.
390	7700	76.95559	38.88907	1045.	660.
391	7701	76.95832	38.88294	1041.	669.
392	7600	76.97908	38.87615	1012.	679.
393	7601	76.97122	38.87274	1022.	684.
394	7602	76.95285	38.86475	1048.	696.
395	6802	76.96535	38.88924	1031.	660.
396	6800	76.97899	38.88914	1012.	660.
397	6801	76.97907	38.88436	1012.	667.
398	7100	76.98027	38.87684	1010.	678.
399	6900	76.98545	38.88013	1003.	673.
400	6700	76.98509	38.88911	1003.	660.
401	6600	76.99660	38.88900	987.	660.
402	7000	76.99298	38.88213	992.	670.
403	6500	77.00537	38.88123	975.	671.
404	7200	76.99227	38.87141	993.	686.
405	6400	77.01074	38.86375	967.	697.
406	6301	77.01685	38.85998	958.	703.
407	6300	77.01538	38.87245	960.	684.
408	6001	77.01046	38.87688	967.	678.
409	6000	77.01063	38.87958	967.	674.
410	6100	77.01902	38.87685	955.	678.
411	6200	77.02362	38.88867	949.	660.
412	7501	76.96409	38.85154	1032.	715.
413	7500	76.97496	38.86270	1017.	699.
414	7401	76.96523	38.85056	1031.	717.
415	7400	77.00394	38.86025	976.	702.
416	7404	76.98174	38.84618	1007.	723.
417	7303	76.97952	38.83993	1010.	732.
418	9600	77.00459	38.85951	975.	703.
419	7301	77.00744	38.85141	971.	715.
420	7302	76.99576	38.84285	987.	728.
421	9700	76.99384	38.83714	990.	736.
422	9800	76.99521	38.83693	988.	737.
423	7305	77.00845	38.83087	969.	745.
424	7306	77.00380	38.82139	976.	759.
425	7300	77.01899	38.82373	954.	756.
426	7307	77.01093	38.81582	966.	767.
427	101000	77.14572	38.88183	778.	670.
428	100900	77.13899	38.88007	787.	672.
429	100800	77.13389	38.89602	794.	649.
430	100700	77.12636	38.88100	805.	671.
431	100600	77.11504	38.88847	821.	660.
432	101500	77.10847	38.88918	830.	659.
433	101600	77.08633	38.89151	861.	656.
434	101700	77.08427	38.89102	864.	657.
435	101800	77.09537	38.88687	848.	663.
436	101900	77.09388	38.87306	850.	683.
437	102000	77.10395	38.88098	836.	671.
438	101400	77.11010	38.88886	828.	660.
439	101300	77.11484	38.86777	821.	691.
440	101200	77.14070	38.87876	785.	674.
441	404400	77.15521	38.87208	764.	684.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
442	404700	77.15701	38.87166	762.	685.
443	404600	77.15819	38.87201	760.	684.
444	404500	77.17632	38.86909	734.	688.
445	407500	77.18862	38.86702	717.	691.
446	404900	77.18059	38.85730	728.	705.
447	405700	77.22049	38.85288	672.	712.
448	405800	77.20316	38.84638	696.	721.
449	405900	77.19315	38.84935	711.	717.
450	406000	77.19525	38.83083	707.	744.
451	405200	77.17156	38.83799	741.	734.
452	405000	77.17541	38.84654	735.	721.
453	405100	77.14461	38.84353	778.	726.
454	405500	77.17421	38.82604	737.	751.
455	405400	77.15765	38.83601	760.	737.
456	405300	77.14486	38.84227	778.	728.
457	200102	77.13935	38.81629	785.	766.
458	200302	77.13802	38.81565	787.	767.
459	200301	77.12075	38.82095	800.	759.
460	200103	77.12916	38.82184	800.	758.
461	200300	77.12449	38.82441	806.	754.
462	200101	77.13242	38.82629	795.	751.
463	200104	77.11419	38.83050	821.	745.
464	200100	77.12150	38.84011	811.	731.
465	999998	77.11364	38.82982	822.	746.
466	103000	77.09768	38.83447	844.	740.
467	200500	77.11433	38.81226	820.	772.
468	200600	77.11366	38.81122	821.	774.
469	200801	77.08986	38.81307	855.	771.
470	200800	77.08917	38.82661	856.	751.
471	200700	77.08817	38.80807	857.	778.
472	202001	77.05707	38.79287	900.	801.
473	202000	77.05229	38.79888	907.	792.
474	201900	77.06462	38.80523	890.	783.
475	201500	77.06257	38.80728	893.	780.
476	201600	77.05964	38.80831	897.	778.
477	201800	77.04822	38.80680	913.	781.
478	201700	77.04817	38.78946	913.	806.
479	200900	77.07663	38.81900	873.	762.
480	201400	77.06676	38.81883	887.	763.
481	201300	77.05680	38.81440	901.	769.
482	201000	77.08538	38.83406	861.	740.
483	201100	77.07801	38.83325	872.	741.
484	201201	77.06748	38.83172	886.	744.
485	201200	77.05982	38.83197	897.	743.
486	404800	77.13929	38.86557	786.	694.
487	102100	77.13713	38.86583	789.	693.
488	102200	77.12765	38.85824	803.	704.
489	102800	77.12053	38.85294	812.	712.
490	102900	77.10719	38.84132	831.	729.
491	102700	77.10988	38.85631	827.	707.
492	102300	77.11614	38.86219	819.	699.
493	102600	77.10076	38.85866	840.	704.
494	103100	77.09536	38.84713	848.	721.
495	102400	77.10030	38.87031	841.	687.
496	102500	77.09453	38.86630	849.	693.
497	103200	77.09229	38.86073	852.	701.
498	103800	77.07502	38.85259	876.	713.
499	103300	77.07654	38.86492	874.	695.
500	103700	77.07026	38.86118	883.	701.
501	103500	77.06854	38.86139	886.	700.
502	103600	77.06557	38.85799	890.	705.
503	103400	77.05275	38.84158	907.	729.
504	410700	77.38919	38.77680	435.	821.
505	901200	77.41684	38.77351	396.	826.
506	410600	77.41788	38.81179	395.	769.
507	901200	77.41623	38.75785	397.	848.
508	900400	77.30168	38.65869	554.	995.
509	900300	77.26339	38.68565	609.	956.
510	900200	77.28090	38.65544	583.	1000.
511	900500	77.28460	38.64865	578.	1010.
512	900600	77.26250	38.64896	609.	1010.
513	900100	77.24157	38.66681	639.	984.
514	402900	77.26441	38.68755	607.	953.
515	404100	77.27742	38.69602	589.	941.
516	402800	77.27628	38.69514	591.	942.
517	402900	77.24662	38.67331	632.	974.
518	401300	77.23881	38.66665	643.	984.
519	401200	77.19393	38.70834	706.	924.
520	999998	77.13693	38.65136	785.	1007.
521	801301	77.06242	38.65282	890.	1006.
522	403000	77.34795	38.83398	494.	738.
523	311100	77.31901	38.83618	534.	735.
524	310800	77.30874	38.84748	549.	719.
525	406800	77.24154	38.86617	643.	692.
526	407400	77.22191	38.87527	671.	679.
527	407300	77.24198	38.86518	642.	693.
528	310900	77.30741	38.84693	551.	719.
529	311000	77.27241	38.84207	599.	727.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
530	311200	77.31271	38.83775	543.	733.
531	403100	77.26834	38.84013	605.	730.
532	403200	77.31713	38.82690	537.	749.
533	403700	77.24933	38.79545	631.	796.
534	406100	77.26589	38.81217	608.	771.
535	405600	77.24478	38.83822	638.	733.
536	406200	77.21856	38.83383	675.	740.
537	406300	77.21119	38.83213	685.	742.
538	406400	77.19725	38.83010	704.	745.
539	406500	77.24813	38.79653	632.	794.
540	403300	77.21850	38.79366	674.	798.
541	403400	77.21240	38.80394	683.	783.
542	403500	77.18584	38.81191	719.	772.
543	403800	77.23385	38.78026	652.	818.
544	403900	77.21870	38.79274	674.	800.
545	404000	77.19807	38.79628	703.	795.
546	404200	77.28852	38.76906	575.	834.
547	404300	77.20402	38.77474	694.	826.
548	402302	77.20963	38.72078	685.	905.
549	402000	77.19105	38.74049	711.	877.
550	401400	77.18122	38.77952	726.	820.
551	403600	77.17367	38.79350	737.	799.
552	200400	77.14438	38.81306	778.	771.
553	401500	77.15737	38.78051	759.	818.
554	401600	77.12184	38.80003	810.	790.
555	401700	77.12165	38.78637	810.	810.
556	401800	77.08545	38.79215	860.	802.
557	401900	77.08050	38.79910	868.	792.
558	402100	77.14614	38.78178	775.	817.
559	402200	77.11636	38.77180	817.	831.
560	402301	77.18663	38.73930	717.	878.
561	402300	77.16329	38.70869	749.	923.
562	402600	77.14256	38.71431	779.	915.
563	402400	77.08125	38.78030	866.	819.
564	400100	77.08150	38.77259	866.	830.
565	400300	77.08186	38.77110	865.	833.
566	400200	77.06122	38.79065	894.	804.
567	402700	77.10575	38.74471	831.	871.
568	402500	77.10414	38.74474	833.	871.
569	400500	77.08584	38.74289	859.	874.
570	401100	77.12248	38.68824	806.	954.
571	400700	77.09883	38.71406	840.	916.
572	400800	77.07651	38.71201	871.	919.
573	400900	77.06458	38.71098	888.	921.
574	400600	77.08252	38.73093	863.	891.
575	401000	77.06315	38.71080	890.	921.
576	400400	77.06091	38.76336	894.	844.
577	801402	77.04204	38.74756	920.	867.
578	801302	77.04265	38.74643	920.	869.
579	801403	77.00734	38.78042	970.	819.
580	801404	76.99928	38.80193	982.	788.
581	801500	77.00706	38.81438	971.	770.
582	801600	77.00638	38.81752	972.	765.
583	801702	76.99349	38.80631	990.	781.
584	801703	76.99630	38.82525	986.	754.
585	801704	76.98716	38.83247	999.	743.
586	801802	76.97937	38.83760	1010.	736.
587	801803	76.95825	38.83508	1040.	739.
588	801801	76.95630	38.82898	1043.	748.
589	801800	76.95738	38.82762	1041.	750.
590	801804	76.96268	38.84704	1034.	722.
591	802500	76.95753	38.85365	1041.	712.
592	802600	76.92209	38.87066	1092.	687.
593	802700	76.91737	38.87807	1098.	676.
594	802800	76.92091	38.87032	1093.	688.
595	802401	76.92220	38.86934	1091.	689.
596	802301	76.88871	38.86292	1138.	699.
597	802300	76.90098	38.86074	1121.	702.
598	802201	76.85791	38.87052	1182.	687.
599	802102	76.91016	38.85271	1108.	714.
600	802200	76.85434	38.85642	1187.	708.
601	802100	76.86968	38.83939	1165.	733.
602	802101	76.89717	38.84612	1126.	723.
603	802001	76.92586	38.84946	1086.	718.
604	802400	76.92063	38.85234	1093.	714.
605	802000	76.92629	38.84826	1085.	720.
606	801901	76.94994	38.81786	1051.	765.
607	801902	76.87694	38.83032	1154.	747.
608	801701	76.95061	38.81652	1050.	767.
609	801700	76.94702	38.81352	1055.	771.
610	801900	76.94927	38.81689	1052.	766.
611	801401	76.97395	38.80541	1017.	783.
612	801400	76.94671	38.80122	1056.	789.
613	801303	76.95371	38.77547	1045.	827.
614	801203	76.90759	38.80412	1111.	785.
615	801903	76.91214	38.80132	1104.	789.
616	801202	76.94197	38.75873	1061.	852.
617	801201	76.92543	38.75382	1084.	859.

Table C1. Washington, D.C. Census Tract Polygon IDs (continued)

AREA NO	POLYGON ID	INTERIOR POINT			
		Longitude	Latitude	Column	Line
618	801200	76.91497	38.71861	1098.	910.
619	801100	76.85102	38.74457	1189.	873.
620	801204	76.89082	38.78297	1134.	816.
621	801101	76.90679	38.80493	1112.	784.
622	801102	76.85077	38.80620	1191.	782.
623	800700	76.80508	38.74864	1254.	867.
624	800600	76.81242	38.87067	1246.	687.
625	800800	76.72741	38.77676	1364.	825.
626	800900	76.74567	38.65815	1335.	999.
627	801000	76.80865	38.65714	1247.	1001.
628	999998	76.85759	38.65609	1178.	1002.
629	999998	76.93356	38.65469	1071.	1004.
630	801300	77.03320	38.65314	931.	1006.
631	740300	76.98900	38.84498	997.	725.
632	701205	77.14432	39.03960	782.	438.
633	9900	77.14354	38.81541	779.	767.
634	1400	77.07474	38.96760	879.	544.

Table C2. Washington, D.C. Census Tract Results

Classification Study No. 609749565
LARS Data Run No. 72041909

Geometrically corrected bitemporal overlay:
LANDSAT Scene ID 1080-15192 (October 11, 1972)
LANDSAT Scene ID 1260-15201 (April 9, 1973)

Number of lines: 1399
Number of columns: 1852
Number of spectral classes: 26
Number of land-cover classes: 13

	Group	Classification Class Numbers	Description
1.	RSDS	1-5	Residential, single family
2.	RSDM	6	Residential, multiple families
3.	DISTRB	7,8,9	Disturbed land, new construction, quarry
4.	CM/IND	10,12,13	Commercial, industrial
5.	PKLOT	11	Parking lot
6.	OPEN	14	Open spaces, grassy
7.	AGRI	15,16,17	Agriculture
8.	WDLND	18	Woodland, field and trees
9.	TREES	19,20	Trees
10.	WATER	21,22,24	Water
11.	RNWY	23	Bright runway
12.	CLOUD	25	Clouds
13.	SHADOW	26	Cloud shadows

Table C2. Washington, D.C. Census Tract Results (cont'd.)**

Number of Pixels Classified Into

Tract No.	Tract ID	No.of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RUN-WAY	CLOUD	SHADOW
1	*	886228	87123	2334	9069	280928	1152	4481	126722	37041	189264	133259	14	5553	9288
2	700500	16706	1910	35	23	47	8	729	7981	2140	3197	557	0	0	79
3	700400	5457	494	1	11	12	5	188	2268	766	1711	0	0	0	1
4	700301	243	40	0	6	5	0	4	120	32	36	0	0	0	0
5	700301	44	0	0	0	0	0	0	2	15	27	0	0	0	0
6	700300	1529	231	1	30	5	8	34	653	102	447	18	0	0	0
7	700802	3056	429	3	29	7	8	249	1322	416	593	0	0	0	0
8	700803	1697	381	0	140	34	7	76	574	116	353	15	1	0	0
9	700700	2298	681	24	44	74	36	27	737	146	511	14	1	0	3
10	700801	3153	606	5	81	33	21	274	1107	270	724	29	0	0	3
11	700800	1457	139	2	18	15	7	162	743	126	243	1	0	0	1
12	700704	1165	227	3	32	41	25	61	576	105	92	3	0	0	0
13	700703	704	251	5	10	18	11	33	288	69	16	2	1	0	0
14	700701	1838	294	2	41	30	16	64	1043	161	187	0	0	0	0
15	700702	1613	398	4	11	8	7	13	622	210	339	1	0	0	0
16	700100	4640	368	0	57	9	16	175	2777	480	758	0	0	0	0
17	700600	26344	2199	100	162	200	38	1958	10958	2942	6837	895	0	0	55
18	701206	2371	454	3	11	18	4	7	1090	395	387	2	0	0	0
19	701002	1441	235	0	30	19	2	168	744	166	77	0	0	0	0
20	701003	662	345	0	7	14	10	8	112	39	127	0	0	0	0
21	701004	441	207	5	8	11	2	19	123	28	38	0	0	0	0
22	700900	350	161	9	9	56	22	0	61	21	11	0	0	0	0
23	700901	345	168	2	6	43	48	0	50	17	11	0	0	0	0

*Unclassified

**No attempt has been made by Purdue/LARS to verify the accuracy of these results. They are provided here to illustrate the capability to overlay arbitrary geographic or juridictional boundaries on the LANDSAT data and use them as a basis for tabulating the classification results.

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No.of Pixels	Number of Pixels Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RUN-WAY	CLOUD	SHADOW
1		886228	87123	2334	9069	280928	1152	4481	126722	37041	189264	133259	14	5553	9288
2	700500	16706	1910	35	23	47	8	729	7981	2140	3197	557	0	0	79
3	700400	5457	494	1	11	12	5	188	2268	766	1711	0	0	0	1
4	700301	243	40	0	6	5	0	4	120	32	36	0	0	0	0
5	700301	44	0	0	0	0	0	0	2	15	27	0	0	0	0
6	700300	1529	231	1	30	5	8	34	653	102	447	18	0	0	0
7	700802	3056	429	3	29	7	8	249	1322	416	593	0	0	0	0
8	700803	1697	381	0	140	34	7	76	574	116	353	15	1	0	0
9	700700	2298	681	24	44	74	36	27	737	146	511	14	1	0	3
10	700801	3153	606	5	81	33	21	274	1107	270	724	29	0	0	3
11	700800	1457	139	2	18	15	7	162	743	126	243	1	0	0	1
12	700704	1165	227	3	32	41	25	61	576	105	92	3	0	0	0
13	700703	704	251	5	10	18	11	33	288	69	16	2	1	0	0
14	700701	1838	294	2	41	30	16	64	1043	161	187	0	0	0	0
15	700702	1613	398	4	11	8	7	13	622	210	339	1	0	0	0
16	700100	4640	368	0	57	9	16	175	2777	480	758	0	0	0	0
17	700600	26344	2199	100	162	200	38	1958	10958	2942	6837	895	0	0	55
18	701206	2371	454	3	11	18	4	7	1090	395	387	2	0	0	0
19	701002	1441	235	0	30	19	2	168	744	166	77	0	0	0	0
20	701003	662	345	0	7	14	10	8	112	39	127	0	0	0	0
21	701004	441	207	5	8	11	2	19	123	28	38	0	0	0	0
22	700900	350	161	9	9	56	22	0	61	21	11	0	0	0	0
23	700901	345	168	2	6	43	48	0	50	17	11	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No.of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RUN-WAY	CLOUD	SHADOW
24	700902	848	250	0	24	40	35	8	193	53	242	3	0	0	0
25	701100	561	414	1	0	11	7	0	87	15	26	0	0	0	0
26	701207	3662	576	8	56	42	23	204	1530	476	665	81	0	0	1
27	701302	880	208	3	0	1	1	7	385	64	169	41	0	0	1
28	703201	850	491	0	1	2	6	58	156	39	97	0	0	0	0
29	701300	5039	1106	6	123	48	29	176	2147	478	919	7	0	0	0
30	701301	14983	2028	6	21	8	13	361	6088	2028	4387	40	1	0	2
31	703202	1158	231	0	51	12	7	81	421	155	200	0	0	0	0
32	703203	821	370	0	8	21	7	13	281	27	94	0	0	0	0
33	703205	615	301	0	3	1	0	0	127	54	129	0	0	0	0
34	703200	947	673	4	3	15	9	2	137	20	84	0	0	0	0
35	703301	348	290	0	0	12	0	0	43	1	2	0	0	0	0
36	703300	362	287	0	0	5	5	0	47	5	13	0	0	0	0
37	703400	375	291	0	0	9	10	0	48	4	13	0	0	0	0
38	703401	281	240	0	0	0	0	0	34	3	4	0	0	0	0
39	703402	255	217	0	0	2	0	0	33	1	2	0	0	0	0
40	703403	138	115	0	1	0	1	0	21	0	0	0	0	0	0
41	703700	242	193	0	1	1	0	0	27	10	10	0	0	0	0
42	703701	254	232	0	0	0	1	0	19	1	1	0	0	0	0
43	701101	453	322	2	3	27	31	0	56	10	2	0	0	0	0
44	700903	292	51	0	1	33	39	23	102	23	20	0	0	0	0
45	700904	184	73	0	0	1	2	1	56	14	35	1	0	0	1
46	701000	1106	305	1	3	4	6	117	323	131	214	1	0	0	1
47	701001	549	202	0	2	1	1	0	133	70	140	0	0	0	0
48	605300	1198	230	0	0	2	0	4	416	160	386	0	0	0	0
49	606100	2459	576	3	50	22	20	10	871	299	605	0	3	0	0
50	605100	11368	1024	20	42	20	19	329	4433	1336	3917	211	0	0	17

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No.of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
51	606500	2495	380	3	291	51	53	5	1029	174	507	0	2	0	0
52	601100	586	79	0	9	2	0	0	82	54	360	0	0	0	0
53	601200	2604	501	28	192	52	21	2	570	152	1085	1	0	0	0
54	750600	220	45	2	0	3	3	0	41	7	119	0	0	0	0
55	740400	691	117	8	21	30	4	11	302	45	152	0	0	0	1
56	740101	3977	682	15	51	25	8	5	644	208	2339	0	0	0	0
57	740100	22	5	0	1	0	0	0	9	1	6	0	0	0	0
58	606400	4434	661	36	327	99	47	3	937	349	1964	5	6	0	0
59	606200	5336	847	20	10	17	5	74	1679	543	1906	225	1	0	9
60	606300	2755	488	22	75	99	51	4	743	121	1134	17	1	0	0
61	800201	170	51	0	4	0	0	0	61	11	43	0	0	0	0
62	800101	327	196	1	0	5	4	0	67	9	45	0	0	0	0
63	800100	645	196	1	40	32	16	0	164	51	145	0	0	0	0
64	800102	285	132	5	0	65	26	0	53	1	3	0	0	0	0
65	800201	1898	274	6	102	45	22	9	496	164	777	3	0	0	0
66	800202	2339	603	3	92	27	3	3	632	195	750	27	1	0	3
67	701400	4707	822	8	179	26	24	54	1315	454	1725	99	0	0	1
68	807402	2022	608	0	244	35	40	1	552	88	453	1	0	0	0
69	701402	7121	875	9	58	7	7	78	2809	1025	2149	97	0	0	7
70	701401	4756	898	0	29	5	3	134	1644	614	1429	0	0	0	0
71	703204	2222	449	2	21	23	12	179	720	252	564	0	0	0	0
72	701501	2493	571	0	8	2	2	9	807	275	819	0	0	0	0
73	701502	949	475	0	17	0	3	0	320	69	65	0	0	0	0
74	703207	794	479	0	0	6	1	0	93	37	178	0	0	0	0
75	703206	819	340	3	3	7	4	2	134	47	274	4	0	0	1
76	701500	1835	774	3	24	49	34	39	352	124	434	2	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
77	740500	3376	534	29	66	87	35	0	631	74	1860	33	0	0	27
78	800200	4557	879	22	97	91	57	5	844	152	2398	1	0	0	11
79	741100	752	144	2	4	3	1	0	185	28	382	2	0	0	1
80	740600	10524	1120	40	133	168	45	46	1760	206	6962	15	2	0	27
81	740700	1623	83	4	75	5	0	0	157	18	1265	10	0	0	6
82	800404	10890	1333	63	79	52	18	20	1417	410	7306	91	0	0	101
83	807400	4841	571	14	347	38	13	266	1437	194	1956	2	3	0	0
84	807401	3247	1187	9	112	174	63	7	1069	105	521	0	0	0	0
85	806703	1251	305	2	2	1	1	45	262	52	575	1	0	0	5
86	806701	1435	462	16	16	21	10	1	161	18	710	19	0	0	1
87	806700	2263	583	14	52	25	14	1	436	70	1061	7	0	0	0
88	806702	899	132	18	80	81	66	1	247	10	251	12	0	0	1
89	806800	356	234	6	0	14	0	0	37	2	63	0	0	0	0
90	803605	698	457	2	9	12	9	0	110	10	89	0	0	0	0
91	803606	781	322	12	3	17	2	0	77	14	332	2	0	0	0
92	800300	211	27	1	1	0	0	2	84	6	90	0	0	0	0
93	800403	3689	760	15	9	13	5	100	636	275	1857	13	0	0	6
94	800402	765	354	0	14	6	1	12	154	39	185	0	0	0	0
95	800400	383	129	5	3	55	7	1	80	11	90	0	0	0	2
96	800401	751	530	1	23	20	16	0	120	13	27	0	1	0	0
97	800503	421	329	0	3	11	13	0	49	9	7	0	0	0	0
98	800504	251	198	0	2	1	0	0	47	0	3	0	0	0	0
99	800502	2853	572	8	10	10	7	344	798	276	816	9	0	0	3
100	800500	2670	526	12	1	42	33	0	470	218	1349	17	0	0	2
101	800501	8618	1334	64	6	71	48	59	2599	967	3437	31	0	0	2
102	806900	315	254	4	2	7	1	0	27	0	20	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
103	807000	816	406	8	3	64	19	0	132	19	164	0	0	0	1
104	807300	917	317	2	4	7	5	6	309	50	217	0	0	0	0
105	807200	877	263	12	12	69	54	54	264	30	116	3	0	0	0
106	807301	948	473	1	23	14	12	13	181	49	182	0	0	0	0
107	701600	437	235	3	3	4	3	0	55	11	123	0	0	0	0
108	805902	659	366	3	2	9	7	3	92	34	143	0	0	0	0
109	803604	473	375	0	7	2	2	0	75	8	4	0	0	0	0
110	803602	718	360	1	28	55	46	0	104	17	107	0	0	0	0
111	803603	172	83	0	3	13	4	0	31	8	30	0	0	0	0
112	803607	1079	414	14	30	32	15	0	160	18	395	0	1	0	0
113	803601	838	154	8	121	76	48	0	288	10	131	1	1	0	0
114	803600	554	192	1	5	10	13	0	117	37	179	0	0	0	0
115	803502	878	265	10	47	92	40	0	222	22	177	0	3	0	0
116	803400	112	78	0	6	0	1	0	21	4	2	0	0	0	0
117	803401	279	134	3	1	11	8	0	70	15	37	0	0	0	0
118	803200	321	87	10	12	18	16	51	85	7	33	0	2	0	0
119	803300	613	254	11	11	99	37	7	123	21	47	3	0	0	0
120	803700	1331	578	10	5	9	7	15	332	81	294	0	0	0	0
121	804101	471	236	3	4	47	13	0	93	22	53	0	0	0	0
122	803800	349	252	30	0	12	0	0	4	4	47	0	0	0	0
123	803801	347	232	0	0	3	1	0	42	9	60	0	0	0	0
124	806602	360	176	1	1	9	5	0	55	14	99	0	0	0	0
125	806601	355	210	1	9	16	10	0	65	3	41	0	0	0	0
126	806600	237	154	1	0	19	13	0	23	9	18	0	0	0	0
127	807100	141	53	0	0	0	0	0	14	7	66	0	0	0	1
128	807101	593	390	9	0	45	12	1	50	10	76	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
129	806501	493	247	7	2	28	5	2	106	7	87	1	0	0	1
130	806400	273	214	3	1	7	8	0	18	1	14	7	0	0	0
131	806500	322	175	10	7	31	10	0	67	15	7	0	0	0	0
132	803900	213	168	3	2	2	3	0	30	1	4	0	0	0	0
133	804000	562	234	4	7	97	41	0	144	15	18	2	0	0	0
134	806300	369	147	13	10	98	34	0	54	9	3	0	0	0	1
135	804100	189	106	0	0	1	0	0	15	10	57	0	0	0	0
136	804200	516	291	8	1	29	29	0	98	17	43	0	0	0	0
137	803100	501	226	19	28	43	12	0	52	16	105	0	0	0	0
138	804300	851	203	18	24	153	75	0	218	23	108	28	1	0	0
139	804400	572	166	12	7	39	7	11	260	30	39	0	0	0	1
140	803000	334	209	3	4	16	1	0	63	11	27	0	0	0	0
141	802901	130	101	0	0	5	0	0	17	4	3	0	0	0	0
142	802900	259	159	4	6	30	6	0	35	8	11	0	0	0	0
143	802801	1240	356	0	6	5	5	10	244	159	455	0	0	0	0
144	803501	1144	243	8	9	32	20	25	340	136	330	0	1	0	0
145	803500	8640	1559	63	71	166	99	62	2455	845	3247	49	3	2	19
146	804700	234	196	4	0	16	0	0	14	1	3	0	0	0	0
147	804600	212	170	6	0	19	1	0	15	1	0	0	0	0	0
148	804500	60	38	0	3	8	1	0	10	0	0	0	0	0	0
149	804800	124	73	1	0	14	12	0	19	0	5	0	0	0	0
150	804900	261	185	3	0	11	4	0	32	4	22	0	0	0	0
151	805000	431	266	0	10	34	21	0	82	15	3	0	0	0	0
152	805100	307	198	1	3	23	12	0	59	9	2	0	0	0	0
153	806200	314	219	4	2	5	1	0	58	6	18	0	1	0	0
154	806100	230	174	3	0	7	2	0	29	1	12	2	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
155	806000	201	162	0	2	15	4	0	12	2	4	0	0	0	0
156	805900	503	217	0	5	51	40	0	113	21	56	0	0	0	0
157	805800	335	263	0	6	9	5	1	49	0	2	0	0	0	0
158	805901	101	74	3	0	0	0	0	10	3	9	2	0	0	0
159	805801	186	146	0	0	6	6	0	28	0	0	0	0	0	0
160	805200	240	180	1	4	13	13	1	20	2	6	0	0	0	0
161	805201	187	127	0	0	5	10	0	33	7	5	0	0	0	0
162	805300	188	136	2	0	4	4	0	3	7	32	0	0	0	0
163	701700	177	127	16	1	14	2	0	6	0	11	0	0	0	0
164	701800	354	234	21	1	21	5	0	26	12	34	0	0	0	0
165	702500	258	67	15	5	125	40	0	5	0	1	0	0	0	0
166	702401	211	113	10	0	48	7	0	19	6	8	0	0	0	0
167	702400	207	165	4	0	4	1	0	11	1	21	0	0	0	0
168	702600	78	48	8	0	17	0	0	4	1	0	0	0	0	0
169	702601	95	64	4	2	12	0	0	10	1	2	0	0	0	0
170	702800	336	244	7	1	22	6	0	37	5	14	0	0	0	0
171	805500	246	160	2	0	14	3	0	47	6	14	0	0	0	0
172	805400	206	156	0	0	4	7	0	16	3	20	0	0	0	0
173	805600	189	77	1	1	31	33	0	43	0	3	0	0	0	0
174	805700	274	224	0	0	8	12	0	28	0	2	0	0	0	0
175	701701	116	60	4	0	2	1	0	8	0	41	0	0	0	0
176	701701	19	12	0	3	0	1	0	3	0	0	0	0	0	0
177	701900	118	78	18	1	5	0	0	5	2	9	0	0	0	0
178	702000	178	127	4	1	3	3	0	22	9	9	0	0	0	0
179	702300	129	74	12	0	17	5	0	4	0	17	0	0	0	0
180	702301	143	106	5	0	0	1	0	11	4	16	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
181	702200	346	292	0	0	1	2	0	22	9	20	0	0	0	0
182	702100	357	251	1	2	7	4	0	61	19	12	0	0	0	0
183	702101	348	259	3	4	12	5	0	28	12	25	0	0	0	0
184	703209	358	274	0	0	2	1	0	44	7	30	0	0	0	0
185	702900	550	383	2	0	25	19	0	50	10	61	0	0	0	0
186	703000	186	91	0	0	0	0	23	42	7	23	0	0	0	0
187	703001	227	136	0	1	3	3	0	51	16	17	0	0	0	0
188	703100	377	292	0	0	0	4	0	34	10	37	0	0	0	0
189	703900	323	231	1	1	5	5	0	44	22	14	0	0	0	0
190	703901	469	326	0	0	17	26	0	68	21	11	0	0	0	0
191	703208	403	213	0	0	9	5	1	97	24	54	0	0	0	0
192	702700	725	338	27	3	33	7	1	121	20	175	0	0	0	0
193	705200	347	288	1	0	0	0	1	17	6	34	0	0	0	0
194	705300	213	140	5	2	6	2	1	12	3	41	1	0	0	0
195	705600	360	272	6	1	29	4	0	20	5	23	0	0	0	0
196	705500	554	346	5	0	28	11	39	53	19	52	1	0	0	0
197	705400	439	196	8	0	15	3	18	88	19	91	1	0	0	0
198	705100	771	516	8	2	5	4	8	91	38	98	1	0	0	0
199	704801	226	91	30	1	58	9	8	24	2	3	0	0	0	0
200	704800	156	64	11	2	66	8	0	5	0	0	0	0	0	0
201	705000	466	234	7	0	10	8	47	95	25	40	0	0	0	0
202	704700	415	323	2	0	0	0	1	9	11	69	0	0	0	0
203	705902	644	457	0	3	4	1	6	89	25	59	0	0	0	0
204	705700	413	332	0	0	14	5	0	18	6	38	0	0	0	0
205	705701	558	370	8	0	28	5	0	45	12	80	9	0	0	1
206	705800	1992	729	54	0	43	2	0	78	52	541	441	0	0	52

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
207	705901	768	464	3	0	2	0	2	65	34	198	0	0	0	0
208	705900	1131	526	4	1	1	0	9	237	82	271	0	0	0	0
209	704600	406	317	3	0	4	0	1	16	3	62	0	0	0	0
210	704900	487	222	18	2	32	2	29	137	12	31	2	0	0	0
211	704501	474	283	2	4	0	0	4	53	8	120	0	0	0	0
212	704502	355	274	0	2	0	0	2	43	12	22	0	0	0	0
213	704401	645	440	3	6	5	5	0	103	25	58	0	0	0	0
214	704500	481	315	2	0	1	2	3	84	22	52	0	0	0	0
215	704400	475	299	1	8	9	4	1	68	46	38	1	0	0	0
216	704300	428	307	2	0	1	0	0	15	18	85	0	0	0	0
217	701206	1105	536	0	4	4	4	17	291	65	184	0	0	0	0
218	706000	4784	1316	5	19	38	10	106	1356	551	1379	3	0	0	1
219	704100	790	556	4	0	6	2	1	87	40	94	0	0	0	0
220	704200	252	168	3	0	32	14	0	26	5	4	0	0	0	0
221	704000	468	334	8	0	2	0	0	24	31	69	0	0	0	0
222	703601	264	182	3	2	4	1	0	28	17	27	0	0	0	0
223	703800	263	128	1	0	60	43	0	17	11	3	0	0	0	0
224	703600	367	285	0	1	4	3	2	49	6	17	0	0	0	0
225	703501	333	232	4	0	2	2	0	30	9	54	0	0	0	0
226	701202	890	264	0	2	7	1	59	228	85	244	0	0	0	0
227	701201	354	211	0	0	20	15	4	36	44	24	0	0	0	0
228	701200	509	317	6	2	28	24	0	74	12	46	0	0	0	0
229	703500	474	281	0	1	0	0	5	66	34	87	0	0	0	0
230	701203	1012	292	15	5	142	84	17	235	38	183	1	0	0	0
231	706001	11293	1472	152	51	172	13	350	2876	989	4446	732	2	0	38
232	407600	9375	1089	27	6	23	1	310	1536	755	5521	100	0	0	7

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
233	407700	561	112	2	0	16	0	4	70	44	312	1	0	0	0
234	600900	6343	1050	12	3	40	68	193	1115	560	3201	90	0	0	11
235	601000	1137	275	0	0	0	0	0	154	178	530	0	0	0	0
236	601100	3313	1150	10	24	98	35	26	662	220	1086	1	0	0	1
237	407800	10935	1543	8	11	13	7	200	3315	1378	4437	17	0	0	6
238	408900	2691	376	8	0	7	2	35	722	426	1109	6	0	0	0
239	409000	1126	318	2	1	23	11	0	242	141	388	0	0	0	0
240	409100	1208	425	7	56	43	14	0	302	91	270	0	0	0	0
241	409200	9282	1692	21	107	97	46	336	2484	930	3527	42	0	0	0
242	409400	12621	1743	6	50	37	50	114	3909	1240	5433	35	0	0	4
243	410300	4648	1200	2	62	20	20	38	767	352	2185	2	0	0	0
244	410500	2294	391	5	0	6	0	4	258	288	1338	2	0	0	2
245	410400	248	93	7	4	68	21	0	38	12	5	0	0	0	0
246	409500	4178	856	2	2	3	1	12	876	452	1973	1	0	0	0
247	409300	4488	1104	9	19	31	10	67	1292	506	1446	3	0	0	1
248	409600	570	233	1	9	6	7	107	119	32	56	0	0	0	0
249	409700	350	198	5	0	4	3	3	80	34	23	0	0	0	0
250	410000	1113	223	0	7	12	5	5	409	268	183	1	0	0	0
251	409900	917	596	0	1	22	1	0	179	84	34	0	0	0	0
252	409800	582	285	5	4	36	7	0	118	47	80	0	0	0	0
253	410100	552	348	0	0	8	2	2	94	34	64	0	0	0	0
254	406600	1240	369	0	16	15	7	0	188	187	458	0	0	0	0
255	407900	2176	592	5	26	88	45	3	372	198	847	0	0	0	0
256	406700	740	275	0	3	6	11	2	166	118	159	0	0	0	0
257	408600	794	449	0	15	11	6	1	215	44	53	0	0	0	0
258	408300	1129	508	5	22	37	11	2	230	112	200	1	0	0	1

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
259	408700	435	136	0	0	2	0	0	99	65	133	0	0	0	0
260	408400	443	257	1	0	7	0	0	128	32	18	0	0	0	0
261	408500	758	436	1	3	15	2	0	202	48	51	0	0	0	0
262	408800	934	507	1	0	2	0	0	151	80	189	4	0	0	0
263	408000	859	413	3	0	9	2	13	225	68	126	0	0	0	0
264	408100	1258	473	4	0	22	2	15	358	172	210	2	0	0	0
265	408200	736	348	1	0	3	1	2	120	76	185	0	0	0	0
266	100300	1002	682	2	1	1	0	30	116	38	132	0	0	0	0
267	100400	861	539	3	0	0	0	2	26	45	245	1	0	0	0
268	100500	422	283	5	0	9	12	0	40	13	60	0	0	0	0
269	100200	684	547	7	0	10	1	0	49	30	40	0	0	0	0
270	100100	450	371	0	0	1	1	0	40	21	11	5	0	0	0
271	101100	517	327	1	1	20	10	0	90	27	41	0	0	0	0
272	500100	308	180	6	0	45	12	0	31	15	18	0	0	0	1
273	500200	377	274	0	1	5	5	0	53	17	22	0	0	0	0
274	500300	378	228	13	3	50	17	0	42	6	19	0	0	0	0
275	406900	742	273	2	8	8	2	71	223	77	77	0	0	0	1
276	407000	502	211	2	1	23	7	1	95	24	138	0	0	0	0
277	407100	280	186	1	4	5	2	0	43	15	24	0	0	0	0
278	407200	337	259	6	0	15	4	1	27	15	10	0	0	0	0
279	1600	604	320	5	0	1	0	0	13	1	264	0	0	0	0
280	1800	116	52	3	1	7	4	0	16	1	32	0	0	0	0
281	1700	297	186	52	0	38	8	0	11	1	1	0	0	0	0
282	1500	1079	573	3	0	1	0	0	39	21	442	0	0	0	0
283	1100	415	258	29	0	52	3	0	39	6	28	0	0	0	0
284	1000	555	485	12	0	14	0	0	23	5	16	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
285	900	1078	576	48	0	46	1	0	56	16	277	49	0	0	9
286	800	1106	451	25	2	28	1	2	85	44	302	150	0	0	16
287	1001	198	107	11	0	13	1	0	24	10	31	1	0	0	0
288	1200	263	196	24	0	9	0	0	9	2	23	0	0	0	0
289	200	409	101	63	0	54	4	0	58	5	29	90	0	0	5
290	300	234	74	6	0	10	4	5	23	19	93	0	0	0	0
291	700	182	78	34	0	5	1	0	14	2	46	2	0	0	0
292	400	334	161	29	0	17	1	1	55	18	51	1	0	0	0
293	600	322	195	27	0	10	0	1	24	7	54	4	0	0	0
294	100	533	110	128	0	92	10	0	42	12	72	61	0	0	6
295	4100	195	75	58	0	0	0	0	1	2	59	0	0	0	0
296	500	337	167	68	0	17	0	0	26	5	53	1	0	0	0
297	1300	928	353	58	1	26	3	3	44	42	397	0	0	0	0
298	1801	365	131	48	0	0	0	9	70	13	93	1	0	0	0
299	2000	419	176	75	0	12	1	0	17	7	131	0	0	0	0
300	1900	388	211	93	0	33	5	0	34	3	9	0	0	0	0
301	2100	139	30	90	0	15	0	0	4	0	0	0	0	0	0
302	2101	151	49	63	0	36	0	0	3	0	0	0	0	0	0
303	9504	194	119	17	0	26	5	0	20	0	7	0	0	0	0
304	9505	239	137	13	1	23	3	0	38	3	21	0	0	0	0
305	2600	345	132	2	0	5	0	0	13	13	180	0	0	0	0
306	2700	106	16	45	0	2	0	0	3	0	39	0	0	0	1
307	2701	120	31	69	0	1	0	0	7	0	11	1	0	0	0
308	3900	80	12	35	0	4	0	0	5	1	14	8	0	0	1
309	4000	93	10	49	0	17	0	0	4	0	9	3	0	0	1
310	4201	48	0	24	0	24	0	0	0	0	0	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
311	5500	138	27	37	1	58	1	0	11	1	1	0	0	0	1
312	3800	71	0	20	0	45	1	0	4	0	0	1	0	0	0
313	4200	49	0	14	0	32	0	0	0	0	0	3	0	0	0
314	5300	71	1	28	0	41	0	0	0	0	0	1	0	0	0
315	5301	55	0	2	0	50	0	0	0	0	0	3	0	0	0
316	2500	137	62	45	0	17	0	0	6	1	6	0	0	0	0
317	2200	101	23	68	0	8	1	0	1	0	0	0	0	0	0
318	2201	124	38	62	0	0	0	0	23	0	1	0	0	0	0
319	2400	127	10	87	0	19	1	0	9	0	0	1	0	0	0
320	2300	92	11	79	0	2	0	0	0	0	0	0	0	0	0
321	2501	116	26	75	0	6	0	0	3	0	5	1	0	0	0
322	2800	92	0	57	0	30	0	0	0	0	5	0	0	0	0
323	2900	64	0	40	0	23	0	0	0	0	0	1	0	0	0
324	3000	40	0	16	0	20	3	0	0	0	0	1	0	0	0
325	3100	66	0	39	0	26	1	0	0	0	0	0	0	0	0
326	3200	113	2	54	0	52	4	0	1	0	0	0	0	0	0
327	3700	62	14	29	0	16	0	0	1	0	2	0	0	0	0
328	3600	68	0	29	0	34	4	0	1	0	0	0	0	0	0
329	3500	77	2	25	0	42	1	0	7	0	0	0	0	0	0
330	3400	234	27	52	1	96	8	0	19	0	0	31	0	0	0
331	3300	90	9	46	0	12	1	0	18	0	0	4	0	0	0
332	4300	57	2	37	0	17	0	0	0	0	0	1	0	0	0
333	4400	64	0	24	0	40	0	0	0	0	0	0	0	0	0
334	4500	46	0	25	0	20	0	0	1	0	0	0	0	0	0
335	5200	76	1	29	0	45	0	0	1	0	0	0	0	0	0
336	5000	100	0	27	0	70	0	0	1	0	0	2	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
337	4900	62	0	27	0	29	0	0	3	0	0	3	0	0	0
338	4800	60	0	29	0	29	1	0	1	0	0	0	0	0	0
339	5400	61	4	5	0	51	1	0	0	0	0	0	0	0	0
340	5401	76	1	4	0	68	2	0	1	0	0	0	0	0	0
341	5201	33	0	2	0	29	0	0	1	0	0	1	0	0	0
342	5100	72	4	4	0	61	0	0	3	0	0	0	0	0	0
343	4901	50	0	13	0	37	0	0	0	0	0	0	0	0	0
344	4801	60	0	18	0	39	2	0	0	0	0	1	0	0	0
345	5600	228	35	23	6	66	8	0	15	0	4	68	0	0	3
346	5700	168	43	12	0	81	4	0	14	3	0	11	0	0	0
347	5701	190	63	9	0	53	5	7	51	0	0	2	0	0	0
348	5800	343	32	8	5	237	15	8	33	1	0	4	0	0	0
349	5900	192	19	9	12	110	19	1	20	2	0	0	0	0	0
350	2301	416	134	34	11	19	5	44	125	11	28	5	0	0	0
351	9500	341	172	12	3	7	2	0	83	27	34	1	0	0	0
352	9501	380	186	25	17	55	22	0	56	5	14	0	0	0	0
353	9502	284	206	18	0	1	2	4	30	6	17	0	0	0	0
354	9200	332	143	67	0	27	2	0	70	11	11	1	0	0	0
355	9300	320	184	60	0	55	5	0	12	0	4	0	0	0	0
356	9400	337	267	42	0	5	0	0	20	2	1	0	0	0	0
357	3301	56	0	24	0	32	0	0	0	0	0	0	0	0	0
358	4600	87	5	51	0	27	0	0	4	0	0	0	0	0	0
359	8700	184	12	65	0	86	6	0	15	0	0	0	0	0	0
360	4700	145	0	7	2	118	14	0	4	0	0	0	0	0	0
361	8600	137	0	2	0	104	29	0	0	0	0	2	0	0	0
362	8500	109	0	45	0	59	1	0	0	0	0	4	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
363	9101	380	54	48	7	172	56	0	42	0	0	1	0	0	0
364	9100	298	204	39	0	16	5	0	28	4	2	0	0	0	0
365	8800	418	77	91	5	146	15	0	68	5	10	1	0	0	0
366	9000	709	155	26	14	195	32	1	166	69	47	4	0	0	0
367	8801	120	18	65	0	26	4	0	7	0	0	0	0	0	0
368	8900	528	125	23	5	50	3	13	174	45	75	15	0	0	0
369	8300	81	4	33	0	39	4	0	0	0	0	1	0	0	0
370	8301	56	4	36	0	15	0	0	0	0	0	1	0	0	0
371	8400	93	0	62	0	28	1	0	1	0	0	1	0	0	0
372	8200	143	32	38	5	33	20	0	12	1	0	0	2	0	0
373	8100	63	0	51	0	12	0	0	0	0	0	0	0	0	0
374	8000	78	0	53	0	23	2	0	0	0	0	0	0	0	0
375	8001	127	16	80	0	15	3	0	13	0	0	0	0	0	0
376	7900	262	199	0	0	6	0	0	35	3	19	0	0	0	0
377	7901	208	43	19	5	47	7	0	45	1	0	41	0	0	0
378	8901	234	134	2	2	23	11	0	41	10	11	0	0	0	0
379	7800	725	148	24	12	131	17	2	247	37	34	72	0	0	1
380	7801	242	109	32	1	47	4	2	17	3	2	25	0	0	0
381	7802	236	95	40	0	40	6	0	23	10	21	1	0	0	0
382	7803	191	137	9	0	6	2	1	34	0	2	0	0	0	0
383	7804	254	167	34	0	29	7	0	17	0	0	0	0	0	0
384	7806	110	66	0	2	7	4	0	28	2	1	0	0	0	0
385	7807	190	122	2	1	10	9	0	43	3	0	0	0	0	0
386	7704	263	133	3	4	33	24	0	58	6	2	0	0	0	0
387	7705	163	112	3	0	4	3	0	19	10	12	0	0	0	0
388	7706	161	103	1	2	10	2	0	11	2	30	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
389	7702	219	86	17	0	13	2	0	63	9	29	0	0	0	0
390	7700	395	138	59	0	25	0	10	65	6	11	79	0	0	2
391	7701	700	352	16	0	9	0	0	64	42	217	0	0	0	0
392	7600	268	85	40	1	49	3	11	41	2	0	36	0	0	0
393	7601	377	196	40	1	38	4	0	13	5	80	0	0	0	0
394	7602	242	197	3	1	10	3	0	12	4	12	0	0	0	0
395	6802	248	59	13	10	54	21	0	67	2	1	20	1	0	0
396	6800	55	6	35	0	13	0	0	1	0	0	0	0	0	0
397	6801	59	4	32	0	16	2	0	3	0	0	2	0	0	0
398	7100	140	3	17	1	71	21	0	6	0	0	21	0	0	0
399	6900	101	5	32	0	52	6	0	5	0	0	1	0	0	0
400	6700	88	3	71	0	13	1	0	0	0	0	0	0	0	0
401	6600	69	2	39	1	21	6	0	0	0	0	0	0	0	0
402	7000	116	17	35	0	56	5	0	2	0	0	1	0	0	0
403	6500	145	22	43	3	45	17	0	14	0	0	1	0	0	0
404	7200	353	6	9	2	213	53	0	2	0	0	68	0	0	0
405	6400	173	18	7	0	98	16	4	21	0	0	9	0	0	0
406	6301	128	8	4	0	6	0	2	23	0	0	85	0	0	0
407	6300	113	9	5	0	40	5	9	4	0	0	41	0	0	0
408	6001	35	6	0	0	19	8	0	2	0	0	0	0	0	0
409	6000	187	36	6	9	101	19	0	16	0	0	0	0	0	0
410	6100	121	3	0	4	75	30	0	5	0	0	4	0	0	0
411	6200	1907	247	26	9	264	31	150	351	11	5	808	0	0	5
412	7501	165	70	3	1	12	10	0	34	11	24	0	0	0	0
413	7500	255	75	53	1	39	12	3	23	3	46	0	0	0	0
414	7401	289	126	6	1	34	16	0	48	25	33	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
415	7400	310	111	4	1	39	19	2	87	4	1	42	0	0	0
416	7404	165	87	0	2	13	2	0	36	2	23	0	0	0	0
417	7303	248	105	3	3	15	9	0	42	17	54	0	0	0	0
418	9600	346	172	15	0	17	9	3	71	15	43	1	0	0	0
419	7301	242	143	16	2	10	0	0	27	1	26	17	0	0	0
420	7302	218	136	2	3	12	5	0	39	13	8	0	0	0	0
421	9700	92	22	1	2	32	12	0	20	3	0	0	0	0	0
422	9800	128	64	12	1	15	8	0	22	4	2	0	0	0	0
423	7305	200	103	12	1	18	6	0	47	10	3	0	0	0	0
424	7306	310	206	6	0	5	3	1	49	17	23	0	0	0	0
425	7300	2068	244	11	64	183	92	15	386	3	3	1066	0	0	1
426	7307	964	68	2	37	148	38	3	86	4	3	573	1	0	1
427	101000	238	195	3	0	4	0	0	12	14	10	0	0	0	0
428	100900	350	292	6	0	5	0	0	17	4	26	0	0	0	0
429	100800	79	65	0	0	4	1	0	7	1	1	0	0	0	0
430	100700	363	262	3	1	17	10	0	38	11	21	0	0	0	0
431	100600	200	174	0	0	6	2	0	4	5	9	0	0	0	0
432	101500	368	257	24	0	35	7	0	20	12	11	2	0	0	0
433	101600	346	157	32	1	53	7	0	38	8	49	1	0	0	0
434	101700	195	73	41	0	71	2	0	8	0	0	0	0	0	0
435	101800	328	223	13	1	62	4	0	13	0	12	0	0	0	0
436	101900	225	164	4	0	17	11	0	15	9	5	0	0	0	0
437	102000	202	137	13	0	30	7	0	13	1	1	0	0	0	0
438	101400	305	162	2	2	81	12	0	17	18	11	0	0	0	0
439	101300	540	396	4	0	8	0	0	47	23	62	0	0	0	0
440	101200	335	235	0	0	10	0	0	32	16	42	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
441	404400	107	42	0	0	41	11	0	10	2	1	0	0	0	0
442	404700	382	261	0	0	5	1	0	33	27	55	0	0	0	0
443	404600	534	309	1	0	34	3	1	84	23	79	0	0	0	0
444	404500	209	187	0	0	2	0	0	17	3	0	0	0	0	0
445	407500	1009	453	4	0	31	11	0	109	57	344	0	0	0	0
446	404900	318	177	0	0	1	0	0	53	28	59	0	0	0	0
447	405700	706	235	1	0	22	9	0	87	81	271	0	0	0	0
448	405800	422	273	1	0	8	3	0	70	29	38	0	0	0	0
449	405900	352	260	0	0	0	0	0	32	20	40	0	0	0	0
450	406000	502	213	2	9	61	12	1	86	50	68	0	0	0	0
451	405200	401	246	1	0	0	1	0	63	33	57	0	0	0	0
452	405000	454	233	0	0	0	0	0	72	48	101	0	0	0	0
453	405100	407	252	3	2	3	1	0	87	31	25	3	0	0	0
454	405500	603	157	0	12	22	4	91	195	48	74	0	0	0	0
455	405400	509	268	0	4	9	2	2	156	39	29	0	0	0	0
456	405300	554	202	3	34	37	25	0	87	49	114	1	1	0	1
457	200102	236	96	2	2	23	9	0	71	19	14	0	0	0	0
458	200302	177	35	2	2	81	19	0	31	2	5	0	0	0	0
459	200301	342	203	2	3	18	7	0	60	24	25	0	0	0	0
460	200103	203	36	0	3	7	4	0	62	31	60	0	0	0	0
461	200300	96	23	0	0	27	11	0	25	5	5	0	0	0	0
462	200101	237	120	0	8	8	5	0	37	9	50	0	0	0	0
463	200104	47	7	0	0	14	6	0	9	2	9	0	0	0	0
464	200100	290	121	5	23	24	9	0	47	9	52	0	0	0	0
465	999998	666	275	8	24	41	30	4	145	58	81	0	0	0	0
466	103000	196	105	4	0	47	7	0	30	0	3	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
467	200500	107	73	0	1	5	1	0	17	8	2	0	0	0	0
468	200600	446	204	29	11	58	11	0	82	14	37	0	0	0	0
469	200801	207	107	4	1	23	4	1	39	21	5	2	0	0	0
470	200800	398	257	0	0	4	1	1	69	30	36	0	0	0	0
471	200700	552	123	44	16	189	28	0	135	7	5	1	1	0	3
472	202001	151	48	8	1	38	5	2	30	0	0	18	0	0	1
473	202000	101	18	30	0	50	1	0	2	0	0	0	0	0	0
474	201900	159	17	36	0	96	4	2	3	0	1	0	0	0	0
475	201500	260	207	2	0	0	0	3	25	10	13	0	0	0	0
476	201600	203	59	47	6	71	5	0	15	0	0	0	0	0	0
477	201800	217	53	47	0	91	17	0	9	0	0	0	0	0	0
478	201700	715	161	70	2	304	23	0	69	9	13	61	0	0	3
479	200900	449	333	3	0	32	4	0	33	13	31	0	0	0	0
480	201400	236	204	0	0	4	0	0	5	8	15	0	0	0	0
481	201300	229	179	8	0	29	4	0	9	0	0	0	0	0	0
482	201000	159	106	3	0	24	9	0	10	0	7	0	0	0	0
483	201100	346	224	5	0	27	4	0	10	5	70	1	0	0	0
484	201201	97	75	0	0	12	1	0	4	2	3	0	0	0	0
485	201200	229	129	10	0	51	5	0	27	3	4	0	0	0	0
486	404800	641	321	6	14	116	46	0	92	21	25	0	0	0	0
487	102100	239	135	3	3	10	1	0	32	9	46	0	0	0	0
488	102200	189	121	3	2	7	1	0	18	10	27	0	0	0	0
489	102800	393	233	11	4	38	6	0	48	16	37	0	0	0	0
490	102900	313	172	7	0	42	24	0	39	5	24	0	0	0	0
491	102700	143	82	5	1	19	5	0	29	2	0	0	0	0	0
492	102300	431	292	5	1	26	10	0	42	17	38	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
493	102600	182	135	1	0	16	5	0	17	4	4	0	0	0	0
494	103100	238	154	0	0	27	16	1	30	2	8	0	0	0	0
495	102400	219	148	1	15	6	9	0	35	2	0	0	3	0	0
496	102500	135	86	4	0	11	7	0	21	4	2	0	0	0	0
497	103200	424	191	9	1	47	9	23	105	30	9	0	0	0	0
498	103800	200	97	1	0	36	12	7	36	6	5	0	0	0	0
499	103300	53	34	6	0	3	0	5	5	0	30	0	0	0	0
500	103700	369	202	7	0	29	9	9	48	23	39	1	0	0	2
501	103500	187	20	2	0	0	0	0	19	19	127	0	0	0	0
502	103600	191	175	1	0	7	1	0	4	1	2	0	0	0	0
503	103400	2357	565	90	45	691	187	31	650	19	19	53	0	0	7
504	410700	135	29	0	0	0	0	0	22	26	58	0	0	0	0
505	901200	34	2	1	0	0	0	0	0	2	29	0	0	0	0
506	410600	13174	1405	21	51	7	0	232	1855	1876	7564	63	0	11	89
507	901200	19505	2081	54	538	72	19	1	2097	2223	11242	754	3	50	371
508	900400	708	129	3	8	7	7	15	219	95	203	0	0	0	22
509	900300	1156	368	7	11	31	14	9	190	65	444	15	0	0	2
510	900200	1006	557	12	26	38	17	0	174	15	153	14	0	0	0
511	900500	286	142	0	1	3	0	0	26	13	101	0	0	0	0
512	900600	106	32	0	0	20	14	0	38	1	1	0	0	0	0
513	900100	1590	272	13	9	44	29	9	207	109	535	347	0	0	16
514	402900	106	5	0	12	15	16	0	32	1	20	2	0	0	3
515	404100	15982	1236	14	23	8	5	56	1497	1736	10941	352	0	5	109
516	402800	2872	273	7	55	38	14	98	1090	273	957	50	0	7	10
517	402900	2616	577	67	36	33	17	5	465	134	1248	17	0	0	17
518	401300	6385	533	25	26	272	7	11	585	673	3366	799	0	0	88

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
519	401200	5423	770	33	84	170	83	39	689	327	1873	1318	4	0	33
520	999998	6679	369	15	58	318	16	1	513	256	2419	2685	0	0	29
521	801301	7936	755	30	34	321	15	8	740	642	3554	1759	0	2	76
522	403000	769	184	0	0	3	7	0	76	97	400	2	0	0	0
523	311100	453	231	8	0	36	10	0	54	32	78	0	0	0	4
524	310800	691	335	2	0	34	18	0	201	51	50	0	0	0	0
525	406800	1938	624	5	38	64	32	2	621	160	392	0	0	0	0
526	407400	1139	320	27	14	81	29	1	169	50	440	2	4	0	2
527	407300	1347	595	3	2	16	9	1	154	96	470	1	0	0	0
528	310900	743	343	8	19	41	36	1	158	48	86	0	3	0	0
529	311000	1029	324	5	53	66	29	53	185	120	192	1	1	0	0
530	311200	469	232	9	4	27	4	2	88	47	56	0	0	0	0
531	403100	1572	444	3	10	18	9	50	352	143	539	0	0	0	4
532	403200	3416	866	2	129	34	20	18	722	251	1334	8	0	0	32
533	403700	3632	430	5	116	22	15	37	659	246	2067	4	0	11	20
534	406100	2395	1267	2	20	19	9	3	365	221	486	2	0	0	1
535	405600	717	342	3	1	2	0	0	100	66	203	0	0	0	0
536	406200	248	90	1	0	2	6	0	94	13	42	0	0	0	0
537	406300	504	298	3	2	13	4	0	121	19	44	0	0	0	0
538	406400	1156	476	2	6	25	21	3	255	130	238	0	0	0	0
539	406500	1247	678	6	4	52	16	0	191	48	208	42	0	0	2
540	403300	284	189	0	0	7	3	0	24	17	34	10	0	0	0
541	403400	766	510	0	2	12	6	0	90	50	96	0	0	0	0
542	403500	1336	577	7	59	126	42	0	229	85	202	8	1	0	0
543	403800	936	550	6	42	12	17	1	169	44	95	0	0	0	0
544	403900	572	279	5	0	5	2	0	42	33	202	4	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
545	404000	578	423	2	1	42	14	0	83	1	12	0	0	0	0
546	404200	5880	1186	5	237	67	32	77	943	355	2929	3	1	0	45
547	404300	1581	378	2	98	38	19	0	309	74	663	0	0	0	0
548	402302	848	206	47	39	47	31	0	169	14	278	12	1	0	4
549	402000	1282	498	31	114	116	19	0	300	49	153	1	1	0	0
550	401400	797	397	16	28	50	22	0	128	11	141	0	4	0	0
551	403600	623	217	15	11	82	13	0	66	29	188	2	0	0	0
552	200400	809	106	39	90	226	74	0	164	25	78	1	4	0	2
553	401500	967	363	27	7	29	7	0	113	65	351	2	3	0	0
554	401600	1081	488	7	2	20	8	3	186	84	283	0	0	0	0
555	401700	590	365	0	0	7	6	1	138	40	33	0	0	0	0
556	401800	262	150	3	0	1	1	0	52	23	32	0	0	0	0
557	401900	405	230	13	1	49	16	0	46	20	25	2	0	0	3
558	402100	1817	458	4	86	39	17	1	446	238	523	5	0	0	0
559	402200	624	309	1	4	4	3	11	139	47	106	0	0	0	0
560	402301	2408	489	11	125	39	12	0	558	149	1020	1	0	0	4
561	402300	31	5	0	0	1	3	0	19	3	0	0	0	0	0
562	402600	3165	482	7	92	81	27	88	723	180	1463	4	0	0	18
563	402400	2108	320	3	45	24	8	4	386	115	1200	0	0	0	3
564	400100	516	226	0	11	41	30	0	119	37	52	0	0	0	0
565	400300	458	288	0	4	7	7	2	68	25	57	0	0	0	0
566	400200	1168	323	27	7	51	5	73	153	42	87	369	0	0	31
567	402700	1095	369	2	19	23	12	0	301	66	301	0	0	0	2
568	402500	641	203	1	34	21	44	0	185	26	127	0	0	0	0
569	400500	836	337	1	4	42	50	5	235	78	84	0	0	0	0
570	401100	1603	420	16	60	50	14	11	435	72	248	227	0	8	42

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
571	400700	757	367	1	4	23	25	0	225	55	57	0	0	0	0
572	400800	1045	448	3	22	6	9	2	187	96	263	8	0	0	1
573	400900	790	470	10	3	30	5	0	106	22	62	75	0	0	7
574	400600	903	422	5	1	9	12	8	219	81	130	3	0	0	13
575	401000	763	484	0	0	4	0	10	182	26	57	0	0	0	0
576	400400	898	444	3	0	11	0	1	130	70	156	65	0	0	18
577	801402	4361	437	11	33	128	30	11	476	242	771	2184	0	0	38
578	801302	5527	1024	46	20	88	13	33	805	394	1534	1539	0	0	31
579	801403	421	184	0	0	3	3	0	67	45	119	0	0	0	0
580	801404	576	246	0	15	30	38	2	157	40	48	0	0	0	0
581	801500	242	171	0	0	5	0	2	42	0	21	0	0	0	1
582	801600	161	75	2	0	34	21	0	18	9	2	0	0	0	0
583	801702	764	359	0	10	18	24	1	140	77	135	0	0	0	0
584	801703	527	207	6	23	17	12	0	97	55	110	0	0	0	0
585	801704	650	161	2	11	18	14	0	133	90	221	0	0	0	0
586	801802	500	173	0	16	5	5	7	119	48	127	0	0	0	0
587	801803	174	126	0	0	2	6	11	19	3	7	0	0	0	0
588	801801	237	180	0	5	16	14	0	20	1	0	0	1	0	0
589	801800	163	76	0	12	4	7	0	43	7	14	0	0	0	0
590	801804	158	109	0	1	5	0	1	28	12	2	0	0	0	0
591	802500	381	279	2	3	6	0	2	32	20	37	0	0	0	0
592	802600	225	158	13	1	22	9	0	16	3	3	0	0	0	0
593	802700	312	216	3	0	16	13	0	45	10	9	0	0	0	0
594	802800	2008	677	6	44	38	31	2	438	247	525	0	0	0	0
595	802401	602	233	5	24	32	28	0	180	35	65	0	0	0	0
596	802301	58	32	0	2	0	5	0	14	2	3	0	0	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)
Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
597	802300	410	304	0	4	15	4	0	55	16	12	0	0	0	0
598	802201	1569	643	2	36	29	33	0	280	133	413	0	0	0	0
599	802102	427	238	2	19	26	12	0	60	32	38	0	0	0	0
600	802200	1122	141	1	64	13	22	0	369	140	371	0	1	0	0
601	802100	532	135	0	40	23	11	0	121	46	156	0	0	0	0
602	802101	567	128	1	104	8	10	1	210	40	65	0	0	0	0
603	802001	108	44	1	0	27	20	0	16	0	0	0	0	0	0
604	802400	1055	457	3	3	28	10	6	306	86	156	0	0	0	0
605	802000	372	167	0	11	6	16	2	89	34	47	0	0	0	0
606	801901	1215	323	2	163	121	129	0	210	46	218	0	3	0	0
607	801902	1368	485	2	124	37	38	0	265	55	359	2	1	0	0
608	801701	281	78	0	23	4	10	1	82	32	51	0	0	0	0
609	801700	463	181	1	12	6	4	6	102	66	85	0	0	0	0
610	801900	953	558	1	16	7	8	5	193	81	84	0	0	0	0
611	801401	1510	396	1	27	53	16	44	437	269	267	0	0	0	0
612	801400	2187	535	2	24	13	13	21	407	241	931	0	0	0	0
613	801303	4149	856	3	28	21	11	8	693	713	1815	0	0	0	1
614	801203	1707	594	1	72	7	12	9	458	199	355	0	0	0	0
615	801903	792	367	2	5	14	22	0	205	61	114	1	0	0	0
616	801202	1821	402	0	128	34	20	1	512	138	583	0	3	0	0
617	801201	1643	503	0	36	8	9	11	489	160	425	0	2	0	0
618	801200	3946	867	3	58	14	11	17	974	343	1651	7	1	0	0
619	801100	473	60	0	0	1	3	3	115	154	137	0	0	0	0
620	801204	2796	450	2	73	11	10	16	681	369	1183	1	0	0	0
621	801101	3557	752	10	298	154	129	154	1395	231	278	5	151	0	0
622	801102	296	86	1	19	30	19	0	70	22	47	0	2	0	0

Table C2. Washington, D.C. Census Tract Results (cont'd.)

Number of Pixels Classified Into

Tract No.	Tract ID	No. of Pixels	RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
623	800700	16822	2784	7	264	45	34	76	4480	2398	6728	5	0	0	1
624	800600	10728	1601	40	48	107	50	43	2214	1090	5425	36	1	0	73
625	800800	13951	1940	3	87	13.	5	49	3682	1677	6470	17	0	0	8
626	800900	736	47	0	5	0	1	0	179	66	438	0	0	0	0
627	801000	23965	2894	38	314	92	36	52	4064	1982	14449	15	0	0	29
628	999998	202	51	0	2	2	2	0	38	23	81	3	0	0	0
629	999998	1534	83	3	5	252	4	3	152	80	811	121	0	0	20
630	801300	11558	1489	1	95	4	6	91	2082	1517	6255	1	0	0	17
631	740300	150	51	5	1	15	5	2	54	9	8	0	0	0	0
632	701205	69	5	30	0	30	2	0	2	0	0	0	0	0	0
633	9900	16	10	0	0	0	3	0	3	0	0	0	0	0	0
634	1400	276	54	18	3	71	8	28	75	1	0	18	0	0	0
TOTAL	-------	1663246	275560	10398	19967	302256	8317	16448	306865	102261	449799	154233	258	5649	11235

Table C3. Washington, D.C. Census Tract Results**

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
1	*	886228	9.8	0.3	1.0	31.7	0.1	0.5	14.3	4.2	21.4	15.0	0.0	0.6	1.0
2	700500	16706	11.4	0.2	0.1	0.3	0.0	4.4	47.8	12.8	19.1	3.3	0.0	0.0	0.5
3	700400	5457	9.1	0.0	0.2	0.2	0.1	3.4	41.6	14.0	31.4	0.0	0.0	0.0	0.0
4	700301	243	16.5	0.0	2.5	2.1	0.0	1.6	49.4	13.2	14.8	0.0	0.0	0.0	0.0
5	700301	44	0.0	0.0	0.0	0.0	0.0	0.0	4.5	34.1	61.4	0.0	0.0	0.0	0.0
6	700300	1529	15.1	0.1	2.0	0.3	0.5	2.2	42.7	6.7	29.2	1.2	0.0	0.0	0.0
7	700802	3056	14.0	0.1	0.9	0.2	0.3	8.1	43.3	13.6	19.4	0.0	0.0	0.0	0.0
8	700803	1697	22.5	0.0	8.2	2.0	0.4	4.5	33.8	6.8	20.8	0.9	0.1	0.0	0.0
9	700700	2298	29.6	1.0	1.9	3.2	1.6	1.2	32.1	6.4	22.2	0.6	0.0	0.0	0.1
10	700801	3153	19.2	0.2	2.6	1.0	0.7	8.7	35.1	8.6	23.0	0.9	0.0	0.0	0.1
11	700800	1457	9.5	0.1	1.2	1.0	0.5	11.1	51.0	8.6	16.7	0.1	0.0	0.0	0.1
12	700704	1165	19.5	0.3	2.7	3.5	2.1	5.2	49.4	9.0	7.9	0.3	0.0	0.0	0.0
13	700703	704	35.7	0.7	1.4	2.6	1.6	4.7	40.9	9.8	2.3	0.3	0.1	0.0	0.0
14	700701	1838	16.0	0.1	2.2	1.6	0.9	3.5	56.7	8.8	10.2	0.0	0.0	0.0	0.0
15	700702	1613	24.7	0.2	0.7	0.5	0.4	0.8	38.6	13.0	21.0	0.1	0.0	0.0	0.0
16	700100	4640	7.9	0.0	1.2	0.2	0.3	3.8	59.8	10.3	16.3	0.0	0.0	0.0	0.0
17	700600	26344	8.3	0.4	0.6	0.8	0.1	7.4	41.6	11.2	26.0	3.4	0.0	0.0	0.2
18	701206	2371	19.1	0.1	0.5	0.8	0.2	0.3	46.0	16.7	16.3	0.1	0.0	0.0	0.0
19	701002	1441	16.3	0.0	2.1	1.3	0.1	11.7	51.6	11.5	5.3	0.0	0.0	0.0	0.0
20	701003	662	52.1	0.0	1.1	2.1	1.5	1.2	16.9	5.9	19.2	0.0	0.0	0.0	0.0
21	701004	441	46.9	1.1	1.8	2.5	0.5	4.3	27.9	6.3	8.6	0.0	0.0	0.0	0.0
22	700900	350	46.0	2.6	2.6	16.0	6.3	0.0	17.4	6.0	3.1	0.0	0.0	0.0	0.0
23	700901	345	48.7	0.6	1.7	12.5	13.9	0.0	14.5	4.9	3.2	0.0	0.0	0.0	0.0
24	700902	848	29.5	0.0	2.8	4.7	4.1	0.9	22.8	6.3	28.5	0.4	0.0	0.0	0.0
25	701100	561	73.8	0.2	0.0	2.0	1.2	0.0	15.5	2.7	4.6	0.0	0.0	0.0	0.0
26	701207	3662	15.7	0.2	1.5	1.1	0.6	5.6	41.8	13.0	18.2	2.2	0.0	0.0	0.0

* Unclassified

**No attempt has been made by Purdue/LARS to verify the accuracy of these results. They are provided here to illustrate the capability to overlay arbitrary geographic or juridictional boundaries on the LANDSAT data and use them as a basis for tabulating the classification results.

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
27	701302	880	23.6	0.3	0.0	0.1	0.1	0.8	43.8	7.3	19.2	4.7	0.0	0.0	0.1
28	703201	850	57.8	0.0	0.1	0.2	0.7	6.8	18.4	4.6	11.4	0.1	0.0	0.0	0.0
29	701300	5039	21.9	0.1	2.4	1.0	0.6	3.5	42.6	9.5	18.2	0.1	0.0	0.0	0.0
30	701301	14983	13.5	0.0	0.1	0.1	0.1	2.4	40.6	13.5	29.3	0.3	0.0	0.0	0.0
31	703202	1158	19.9	0.0	4.4	1.0	0.6	7.0	36.4	13.4	17.3	0.0	0.0	0.0	0.0
32	703203	821	45.1	0.0	1.0	2.6	0.9	1.6	34.2	3.3	11.4	0.0	0.0	0.0	0.0
33	703205	615	48.9	0.0	0.5	0.2	0.0	0.0	20.7	8.8	21.0	0.0	0.0	0.0	0.0
34	703200	947	71.1	0.4	0.3	1.6	1.0	0.2	14.5	2.1	8.9	0.0	0.0	0.0	0.0
35	703301	348	83.3	0.0	0.0	3.4	0.0	0.0	12.4	0.3	0.6	0.0	0.0	0.0	0.0
36	703300	362	79.3	0.0	0.0	1.4	1.4	0.0	13.0	1.4	3.6	0.0	0.0	0.0	0.0
37	703400	375	77.6	0.0	0.0	2.4	2.7	0.0	12.8	1.1	3.5	0.0	0.0	0.0	0.0
38	703401	281	85.4	0.0	0.0	0.0	0.0	0.0	12.1	1.1	1.4	0.0	0.0	0.0	0.0
39	703402	255	85.1	0.0	0.0	0.8	0.0	0.0	12.9	0.4	0.8	0.0	0.0	0.0	0.0
40	703403	138	83.3	0.0	0.7	0.0	0.7	0.0	15.2	0.0	0.0	0.0	0.0	0.0	0.0
41	703700	242	79.8	0.0	0.4	0.4	0.0	0.0	11.2	4.1	4.1	0.0	0.0	0.0	0.0
42	703701	254	91.3	0.0	0.0	0.0	0.4	0.0	7.5	0.4	0.4	0.0	0.0	0.0	0.0
43	701101	453	71.1	0.4	0.7	6.0	6.8	0.0	12.4	2.2	0.4	0.0	0.0	0.0	0.0
44	700903	292	17.5	0.0	0.3	11.3	13.4	7.9	34.9	7.9	6.8	0.0	0.0	0.0	0.0
45	700904	184	39.7	0.0	0.0	0.5	1.1	0.5	30.4	7.6	19.0	0.5	0.0	0.0	0.5
46	701000	1106	27.6	0.1	0.3	0.4	0.5	10.6	29.2	11.8	19.3	0.1	0.0	0.0	0.1
47	701001	549	36.8	0.0	0.4	0.2	0.2	0.0	24.2	12.8	25.5	0.0	0.0	0.0	0.0
48	605300	1198	19.2	0.0	0.0	0.2	0.0	0.3	34.7	13.4	32.2	0.0	0.0	0.0	0.0
49	606100	2459	23.4	0.1	2.0	0.9	0.8	0.4	35.4	12.2	24.6	0.0	0.1	0.0	0.0
50	605100	11368	9.0	0.2	0.4	0.2	0.2	2.9	39.0	11.8	34.5	1.9	0.0	0.0	0.1
51	606500	2495	15.2	0.1	11.7	2.0	2.1	0.2	41.2	7.0	20.3	0.0	0.1	0.0	0.0
52	601100	586	13.5	0.0	1.5	0.3	0.0	0.0	14.0	9.2	61.4	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
53	601200	2604	19.2	1.1	7.4	2.0	0.8	0.1	21.9	5.8	41.7	0.0	0.0	0.0	0.0
54	750600	220	20.5	0.9	0.0	1.4	1.4	0.0	18.6	3.2	54.1	0.0	0.0	0.0	0.0
55	740400	691	16.9	1.2	3.0	4.3	0.6	1.6	43.7	6.5	22.0	0.0	0.0	0.0	0.1
56	740101	3977	17.1	0.4	1.3	0.6	0.2	0.1	16.2	5.2	58.8	0.0	0.0	0.0	0.0
57	740100	22	22.7	0.0	4.5	0.0	0.0	0.0	40.9	4.5	27.3	0.0	0.0	0.0	0.0
58	606400	4434	14.9	0.8	7.4	2.2	1.1	0.1	21.1	7.9	44.3	0.1	0.1	0.0	0.0
59	606200	5336	15.9	0.4	0.2	0.3	0.1	1.4	31.5	10.2	35.7	4.2	0.0	0.0	0.2
60	606300	2755	17.7	0.8	2.7	3.6	1.9	0.1	27.0	4.4	41.2	0.6	0.0	0.0	0.0
61	800201	170	30.0	0.0	2.4	0.0	0.0	0.0	35.9	6.5	25.3	0.0	0.0	0.0	0.0
62	800101	327	59.9	0.3	0.0	1.5	1.2	0.0	20.5	2.8	13.8	0.0	0.0	0.0	0.0
63	800100	645	30.4	0.2	6.2	5.0	2.5	0.0	25.4	7.9	22.5	0.0	0.0	0.0	0.0
64	800102	285	46.3	1.8	0.0	22.8	9.1	0.0	18.6	0.4	1.1	0.0	0.0	0.0	0.0
65	800201	1898	14.4	0.3	5.4	2.4	1.2	0.5	26.1	8.6	40.9	0.2	0.0	0.0	0.0
66	800202	2339	25.8	0.1	3.9	1.2	0.1	0.1	27.0	8.3	32.1	1.2	0.0	0.0	0.1
67	701400	4707	17.5	0.2	3.8	0.6	0.5	1.1	27.9	9.6	36.6	2.1	0.0	0.0	0.0
68	807402	2022	30.1	0.0	12.1	1.7	2.0	0.0	27.3	4.4	22.4	0.0	0.0	0.0	0.0
69	701402	7121	12.3	0.1	0.8	0.1	0.1	1.1	39.4	14.4	30.2	1.4	0.0	0.0	0.1
70	701401	4756	18.9	0.0	0.6	0.1	0.1	2.8	34.6	12.9	30.0	0.0	0.0	0.0	0.0
71	703204	2222	20.2	0.1	0.9	1.0	0.5	8.1	32.4	11.3	25.4	0.0	0.0	0.0	0.0
72	701501	2493	22.9	0.0	0.3	0.1	0.1	0.4	32.4	11.0	32.9	0.0	0.0	0.0	0.0
73	701502	949	50.1	0.0	1.8	0.0	0.3	0.0	33.7	7.3	6.8	0.0	0.0	0.0	0.0
74	703207	794	60.3	0.0	0.0	0.8	0.1	0.0	11.7	4.7	22.4	0.0	0.0	0.0	0.0
75	703206	819	41.5	0.4	0.4	0.9	0.5	0.2	16.4	5.7	33.5	0.5	0.0	0.0	0.1
76	701500	1835	42.2	0.2	1.3	2.7	1.9	2.1	19.2	6.8	23.7	0.1	0.0	0.0	0.0
77	740500	3376	15.8	0.9	2.0	2.6	1.0	0.0	18.7	2.2	55.1	1.0	0.0	0.0	0.8
78	800200	4557	19.3	0.5	2.1	2.0	1.3	0.1	18.5	3.3	52.6	0.0	0.0	0.0	0.2

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
79	741100	752	19.1	0.3	0.5	0.4	0.1	0.0	24.6	3.7	50.8	0.3	0.0	0.0	0.1
80	740600	10524	10.6	0.4	1.3	1.6	0.4	0.4	16.7	2.0	66.2	0.1	0.0	0.0	0.3
81	740700	1623	5.1	0.2	4.6	0.3	0.0	0.0	9.7	1.1	77.9	0.6	0.0	0.0	0.4
82	800404	10890	12.2	0.6	0.7	0.5	0.2	0.2	13.0	3.8	67.1	0.8	0.0	0.0	0.9
83	807400	4841	11.8	0.3	7.2	0.8	0.3	5.5	29.7	4.0	40.4	0.0	0.1	0.0	0.0
84	807401	3247	36.6	0.3	3.4	5.4	1.9	0.2	32.9	3.2	16.0	0.0	0.0	0.0	0.0
85	806703	1251	24.4	0.2	0.2	0.1	0.1	3.6	20.9	4.2	46.0	0.1	0.0	0.0	0.4
86	806701	1435	32.2	1.1	1.1	1.5	0.7	0.1	11.2	1.3	49.5	1.3	0.0	0.0	0.1
87	806700	2263	25.8	0.6	2.3	1.1	0.6	0.0	19.3	3.1	46.9	0.3	0.0	0.0	0.0
88	806702	899	14.7	2.0	8.9	9.0	7.3	0.1	27.5	1.1	27.9	1.3	0.0	0.0	0.1
89	806800	356	65.7	1.7	0.0	3.9	0.0	0.0	10.4	0.6	17.7	0.0	0.0	0.0	0.0
90	803605	698	65.5	0.3	1.3	1.7	1.3	0.0	15.8	1.4	12.8	0.0	0.0	0.0	0.0
91	803606	781	41.2	1.5	0.4	2.2	0.3	0.0	9.9	1.8	42.5	0.3	0.0	0.0	0.0
92	800300	211	12.8	0.5	0.5	0.0	0.0	0.9	39.8	2.8	42.7	0.0	0.0	0.0	0.0
93	800403	3689	20.6	0.4	0.2	0.4	0.1	2.7	17.2	7.5	50.3	0.4	0.0	0.0	0.2
94	800402	765	46.3	0.0	1.8	0.8	0.1	1.6	20.1	5.1	24.2	0.0	0.0	0.0	0.0
95	800400	383	33.7	1.3	0.8	14.4	1.8	0.3	20.9	2.9	23.5	0.0	0.0	0.0	0.5
96	800401	751	70.6	0.1	3.1	2.7	2.1	0.0	16.0	1.7	3.6	0.0	0.1	0.0	0.0
97	800503	421	78.1	0.0	0.7	2.6	3.1	0.0	11.6	2.1	1.7	0.0	0.0	0.0	0.0
98	800504	251	78.9	0.0	0.8	0.4	0.0	0.0	18.7	0.0	1.2	0.0	0.0	0.0	0.0
99	800502	2853	20.0	0.3	0.4	0.4	0.2	12.1	28.0	9.7	28.6	0.3	0.0	0.0	0.1
100	800500	2670	19.7	0.4	0.0	1.6	1.2	0.0	17.6	8.2	50.5	0.6	0.0	0.0	0.1
101	800501	8618	15.5	0.7	0.1	0.8	0.6	0.7	30.2	11.2	39.9	0.4	0.0	0.0	0.0
102	806900	315	80.6	1.3	0.6	2.2	0.3	0.0	8.6	0.0	6.3	0.0	0.0	0.0	0.0
103	807000	816	49.8	1.0	0.4	7.8	2.3	0.0	16.2	2.3	20.1	0.0	0.0	0.0	0.1
104	807300	917	34.6	0.2	0.4	0.8	0.5	0.7	33.7	5.5	23.7	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into											
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
105	807200	877	30.0	1.4	1.4	7.9	6.2	6.2	30.1	3.4	13.2	0.3	0.0	0.0	0.0
106	807301	948	49.9	0.1	2.4	1.5	1.3	1.4	19.1	5.2	19.2	0.0	0.0	0.0	0.0
107	701600	437	53.8	0.7	0.7	0.9	0.7	0.0	12.6	2.5	28.1	0.0	0.0	0.0	0.0
108	805902	659	55.5	0.5	0.3	1.4	1.1	0.5	14.0	5.2	21.7	0.0	0.0	0.0	0.0
109	803604	473	79.3	0.0	1.5	0.4	0.4	0.0	15.9	1.7	0.8	0.0	0.0	0.0	0.0
110	803602	718	50.1	0.1	3.9	7.7	6.4	0.0	14.5	2.4	14.9	0.0	0.0	0.0	0.0
111	803603	172	48.3	0.0	1.7	7.6	2.3	0.0	18.0	4.7	17.4	0.0	0.0	0.0	0.0
112	803607	1079	38.4	1.3	2.8	3.0	1.4	0.0	14.8	1.7	36.6	0.0	0.1	0.0	0.0
113	803601	838	18.4	1.0	14.4	9.1	5.7	0.0	34.4	1.2	15.6	0.1	0.1	0.0	0.0
114	803600	554	34.7	0.2	0.9	1.8	2.3	0.0	21.1	6.7	32.3	0.0	0.0	0.0	0.0
115	803502	878	30.2	1.1	5.4	10.5	4.6	0.0	25.3	2.5	20.2	0.0	0.3	0.0	0.0
116	803400	112	69.6	0.0	5.4	0.0	0.9	0.0	18.8	3.6	1.8	0.0	0.0	0.0	0.0
117	803401	279	48.0	1.1	0.4	3.9	2.9	0.0	25.1	5.4	13.3	0.0	0.0	0.0	0.0
118	803200	321	27.1	3.1	3.7	5.6	5.0	15.9	26.5	2.2	10.3	0.0	0.6	0.0	0.0
119	803300	613	41.4	1.8	1.8	16.2	6.0	1.1	20.1	3.4	7.7	0.5	0.0	0.0	0.0
120	803700	1331	43.4	0.8	0.4	0.7	0.5	1.1	24.9	6.1	22.1	0.0	0.0	0.0	0.0
121	804101	471	50.1	0.6	0.8	10.0	2.8	0.0	19.7	4.7	11.3	0.0	0.0	0.0	0.0
122	803800	349	72.2	8.6	0.0	3.4	0.0	0.0	1.1	1.1	13.5	0.0	0.0	0.0	0.0
123	803801	347	66.9	0.0	0.0	0.9	0.3	0.0	12.1	2.6	17.3	0.0	0.0	0.0	0.0
124	806602	360	48.9	0.3	0.3	2.5	1.4	0.0	15.3	3.9	27.5	0.0	0.0	0.0	0.0
125	806601	355	59.2	0.3	2.5	4.5	2.8	0.0	18.3	0.8	11.5	0.0	0.0	0.0	0.0
126	806600	237	65.0	0.4	0.0	8.0	5.5	0.0	9.7	3.8	7.6	0.0	0.0	0.0	0.0
127	807100	141	37.6	0.0	0.0	0.0	0.0	0.0	9.9	5.0	46.8	0.0	0.0	0.0	0.7
128	807101	593	65.8	1.5	0.0	7.6	2.0	0.2	8.4	1.7	12.8	0.0	0.0	0.0	0.0
129	806501	493	50.1	1.4	0.4	5.7	1.0	0.4	21.5	1.4	17.6	0.2	0.0	0.0	0.2
130	806400	273	78.4	1.1	0.4	2.6	2.9	0.0	6.6	0.4	5.1	2.6	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
131	806500	322	54.3	3.1	2.2	9.6	3.1	0.0	20.8	4.7	2.2	0.0	0.0	0.0	0.0
132	803900	213	78.9	1.4	0.9	0.9	1.4	0.0	14.1	0.5	1.9	0.0	0.0	0.0	0.0
133	804000	562	41.6	0.7	1.2	17.3	7.3	0.0	25.6	2.7	3.2	0.4	0.0	0.0	0.0
134	806300	369	39.8	3.5	2.7	26.6	9.2	0.0	14.6	2.4	0.8	0.0	0.0	0.0	0.3
135	804100	189	56.1	0.0	0.0	0.5	0.0	0.0	7.9	5.3	30.2	0.0	0.0	0.0	0.0
136	804200	516	56.4	1.6	0.2	5.6	5.6	0.0	19.0	3.3	8.3	0.0	0.0	0.0	0.0
137	803100	501	45.1	3.8	5.6	8.6	2.4	0.0	10.4	3.2	21.0	0.0	0.0	0.0	0.0
138	804300	851	23.9	2.1	2.8	18.0	8.8	0.0	25.6	2.7	12.7	3.3	0.1	0.0	0.0
139	804400	572	29.0	2.1	1.2	6.8	1.2	1.9	45.5	5.2	6.8	0.0	0.0	0.0	0.2
140	803000	334	62.6	0.9	1.2	4.8	0.3	0.0	18.9	3.3	8.1	0.0	0.0	0.0	0.0
141	802901	130	77.7	0.0	0.0	3.8	0.0	0.0	13.1	3.1	2.3	0.0	0.0	0.0	0.0
142	802900	259	61.4	1.5	2.3	11.6	2.3	0.0	13.5	3.1	4.2	0.0	0.0	0.0	0.0
143	802801	1240	28.7	0.0	0.5	0.4	0.4	0.8	19.7	12.8	36.7	0.0	0.0	0.0	0.0
144	803501	1144	21.2	0.7	0.8	2.8	1.7	2.2	29.7	11.9	28.8	0.0	0.1	0.0	0.0
145	803500	8640	18.0	0.7	0.8	1.9	1.1	0.7	28.4	9.8	39.6	0.6	0.0	0.0	0.2
146	804700	234	83.8	1.7	0.0	6.8	0.0	0.0	6.0	0.4	1.3	0.0	0.0	0.0	0.0
147	804600	212	80.2	2.8	0.0	9.0	0.5	0.0	7.1	0.5	0.0	0.0	0.0	0.0	0.0
148	804500	60	63.3	0.0	5.0	13.3	1.7	0.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0
149	804800	124	58.9	0.8	0.0	11.3	9.7	0.0	15.3	0.0	4.0	0.0	0.0	0.0	0.0
150	804900	261	70.9	1.1	0.0	4.2	1.5	0.0	12.3	1.5	8.4	0.0	0.0	0.0	0.0
151	805000	431	61.7	0.0	2.3	7.9	4.9	0.0	19.0	3.5	0.7	0.0	0.0	0.0	0.0
152	805100	307	64.5	0.3	1.0	7.5	3.9	0.0	19.2	2.9	0.7	0.0	0.0	0.0	0.0
153	806200	314	69.7	1.3	0.6	1.6	0.3	0.0	18.5	1.9	5.7	0.0	0.3	0.0	0.0
154	806100	230	75.7	1.3	0.0	3.0	0.9	0.0	12.6	0.4	5.2	0.9	0.0	0.0	0.0
155	806000	201	80.6	0.0	1.0	7.5	2.0	0.0	6.0	1.0	2.0	0.0	0.0	0.0	0.0
156	805900	503	43.1	0.0	1.0	10.1	8.0	0.0	22.5	4.2	11.1	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
157	805800	335	78.5	0.0	1.8	2.7	1.5	0.3	14.6	0.0	0.6	0.0	0.0	0.0	0.0
158	805901	101	73.3	3.0	0.0	0.0	0.0	0.0	9.9	3.0	8.9	2.0	0.0	0.0	0.0
159	805801	186	78.5	0.0	0.0	3.2	3.2	0.0	15.1	0.0	0.0	0.0	0.0	0.0	0.0
160	805200	240	75.0	0.4	1.7	5.4	5.4	0.4	8.3	0.8	2.5	0.0	0.0	0.0	0.0
161	805201	187	67.9	0.0	0.0	2.7	5.3	0.0	17.6	3.7	2.7	0.0	0.0	0.0	0.0
162	805300	188	72.3	1.1	0.0	2.1	2.1	0.0	1.6	3.7	17.0	0.0	0.0	0.0	0.0
163	701700	177	71.8	9.0	0.6	7.9	1.1	0.0	3.4	0.0	6.2	0.0	0.0	0.0	0.0
164	701800	354	66.1	5.9	0.3	5.9	1.4	0.0	7.3	3.4	9.6	0.0	0.0	0.0	0.0
165	702500	258	26.0	5.8	1.9	48.4	15.5	0.0	1.9	0.0	0.4	0.0	0.0	0.0	0.0
166	702401	211	53.6	4.7	0.0	22.7	3.3	0.0	9.0	2.8	3.8	0.0	0.0	0.0	0.0
167	702400	207	79.7	1.9	0.0	1.9	0.5	0.0	5.3	0.5	10.1	0.0	0.0	0.0	0.0
168	702600	78	61.5	10.3	0.0	21.8	0.0	0.0	5.1	1.3	0.0	0.0	0.0	0.0	0.0
169	702601	95	67.4	4.2	2.1	12.6	0.0	0.0	10.5	1.1	2.1	0.0	0.0	0.0	0.0
170	702800	336	72.6	2.1	0.3	6.5	1.8	0.0	11.0	1.5	4.2	0.0	0.0	0.0	0.0
171	805500	246	65.0	0.8	0.0	5.7	1.2	0.0	19.1	2.4	5.7	0.0	0.0	0.0	0.0
172	805400	206	75.7	0.0	0.0	1.9	3.4	0.0	7.8	1.5	9.7	0.0	0.0	0.0	0.0
173	805600	189	40.7	0.5	0.5	16.4	17.5	0.0	22.8	0.0	1.6	0.0	0.0	0.0	0.0
174	805700	274	81.8	0.0	0.0	2.9	4.4	0.0	10.2	0.0	0.7	0.0	0.0	0.0	0.0
175	701701	116	51.7	3.4	0.0	1.7	0.9	0.0	6.9	0.0	35.3	0.0	0.0	0.0	0.0
176	701701	19	63.2	0.0	15.8	0.0	5.3	0.0	15.8	0.0	0.0	0.0	0.0	0.0	0.0
177	701900	118	66.1	15.3	0.8	4.2	0.0	0.0	4.2	1.7	7.6	0.0	0.0	0.0	0.0
178	702000	178	71.3	2.2	0.6	1.7	1.7	0.0	12.4	5.1	5.1	0.0	0.0	0.0	0.0
179	702300	129	57.4	9.3	0.0	13.2	3.9	0.0	3.1	0.0	13.2	0.0	0.0	0.0	0.0
180	702301	143	74.1	3.5	0.0	0.0	0.7	0.0	7.7	2.8	11.2	0.0	0.0	0.0	0.0
181	702200	346	84.4	0.0	0.0	0.3	0.6	0.0	6.4	2.6	5.8	0.0	0.0	0.0	0.0
182	702100	357	70.3	0.3	0.6	2.0	1.1	0.0	17.1	5.3	3.4	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
183	702101	348	74.4	0.9	1.1	3.4	1.4	0.0	8.0	3.4	7.2	0.0	0.0	0.0	0.0
184	703209	358	76.5	0.0	0.0	0.6	0.3	0.0	12.3	2.0	8.4	0.0	0.0	0.0	0.0
185	702900	550	69.6	0.4	0.0	4.5	3.5	0.0	9.1	1.8	11.1	0.0	0.0	0.0	0.0
186	703000	186	48.9	0.0	0.0	0.0	0.0	12.4	22.6	3.8	12.4	0.0	0.0	0.0	0.0
187	703001	227	59.9	0.0	0.4	1.3	1.3	0.0	22.5	7.0	7.5	0.0	0.0	0.0	0.0
188	703100	377	77.5	0.0	0.0	0.0	1.1	0.0	9.0	2.7	9.8	0.0	0.0	0.0	0.0
189	703900	323	71.5	0.3	0.3	1.5	1.5	0.0	13.6	6.8	4.3	0.0	0.0	0.0	0.0
190	703901	469	69.5	0.0	0.0	3.6	5.5	0.0	14.5	4.5	2.3	0.0	0.0	0.0	0.0
191	703208	403	52.9	0.0	0.0	2.2	1.2	0.2	24.1	6.0	13.4	0.0	0.0	0.0	0.0
192	702700	725	46.6	3.7	0.4	4.6	1.0	0.1	16.7	2.8	24.1	0.0	0.0	0.0	0.0
193	705200	347	83.0	0.3	0.0	0.0	0.0	0.3	4.9	1.7	9.8	0.0	0.0	0.0	0.0
194	705300	213	65.7	2.3	0.9	2.8	0.9	0.5	5.6	1.4	19.2	0.5	0.0	0.0	0.0
195	705600	360	75.6	1.7	0.3	8.1	1.1	0.0	5.6	1.4	6.4	0.0	0.0	0.0	0.0
196	705500	554	62.5	0.9	0.0	5.1	2.0	7.0	9.6	3.4	9.4	0.2	0.0	0.0	0.0
197	705400	439	44.6	1.8	0.0	3.4	0.7	4.1	20.0	4.3	20.7	0.2	0.0	0.0	0.0
198	705100	771	66.9	1.0	0.3	0.6	0.5	1.0	11.8	4.9	12.7	0.1	0.0	0.0	0.0
199	704801	226	40.3	13.3	0.4	25.7	4.0	3.5	10.6	0.9	1.3	0.0	0.0	0.0	0.0
200	704800	156	41.0	7.1	1.3	42.3	5.1	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0
201	705000	466	50.2	1.5	0.0	2.1	1.7	10.1	20.4	5.4	8.6	0.0	0.0	0.0	0.0
202	704700	415	77.8	0.5	0.0	0.0	0.0	0.2	2.2	2.7	16.6	0.0	0.0	0.0	0.0
203	705902	644	71.0	0.0	0.5	0.6	0.2	0.9	13.8	3.9	9.2	0.0	0.0	0.0	0.0
204	705700	413	80.4	0.0	0.0	3.4	1.2	0.0	4.4	1.5	9.2	0.0	0.0	0.0	0.0
205	705701	558	66.3	1.4	0.0	5.0	0.9	0.0	8.1	2.2	14.3	1.6	0.0	0.0	0.2
206	705800	1992	36.6	2.7	0.0	2.2	0.1	0.0	3.9	2.6	27.2	22.1	0.0	0.0	2.6
207	705901	768	60.4	0.4	0.0	0.3	0.0	0.3	8.5	4.4	25.8	0.0	0.0	0.0	0.0
208	705900	1131	46.5	0.4	0.1	0.1	0.0	0.8	21.0	7.3	24.0	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
209	704600	406	78.1	0.7	0.0	1.0	0.0	0.2	3.9	0.7	15.3	0.0	0.0	0.0	0.0
210	704900	487	45.6	3.7	0.4	6.6	0.4	6.0	28.1	2.5	6.4	0.4	0.0	0.0	0.0
211	704501	474	59.7	0.4	0.8	0.0	0.0	0.8	11.2	1.7	25.3	0.0	0.0	0.0	0.0
212	704502	355	77.2	0.0	0.6	0.0	0.0	0.6	12.1	3.4	6.2	0.0	0.0	0.0	0.0
213	704401	645	68.2	0.5	0.9	0.8	0.8	0.0	16.0	3.9	9.0	0.0	0.0	0.0	0.0
214	704500	481	65.5	0.4	0.0	0.2	0.4	0.6	17.5	4.6	10.8	0.0	0.0	0.0	0.0
215	704400	475	62.9	0.2	1.7	1.9	0.8	0.2	14.3	9.7	8.0	0.2	0.0	0.0	0.0
216	704300	428	71.7	0.5	0.0	0.2	0.0	0.0	3.5	4.2	19.9	0.0	0.0	0.0	0.0
217	701206	1105	48.5	0.0	0.4	0.4	0.4	1.5	26.3	5.9	16.7	0.0	0.0	0.0	0.0
218	706000	4784	27.5	0.1	0.4	0.8	0.2	2.2	28.3	11.5	28.8	0.1	0.0	0.0	0.0
219	704100	790	70.4	0.5	0.0	0.8	0.3	0.1	11.0	5.1	11.9	0.0	0.0	0.0	0.0
220	704200	252	66.7	1.2	0.0	12.7	5.6	0.0	10.3	2.0	1.6	0.0	0.0	0.0	0.0
221	704000	468	71.4	1.7	0.0	0.4	0.0	0.0	5.1	6.6	14.7	0.0	0.0	0.0	0.0
222	703601	264	68.9	1.1	0.8	1.5	0.4	0.0	10.6	6.4	10.2	0.0	0.0	0.0	0.0
223	703800	263	48.7	0.4	0.0	22.8	16.3	0.0	6.5	4.2	1.1	0.0	0.0	0.0	0.0
224	703600	367	77.7	0.0	0.3	1.1	0.8	0.5	13.4	1.6	4.6	0.0	0.0	0.0	0.0
225	703501	333	69.7	1.2	0.0	0.6	0.6	0.0	9.0	2.7	16.2	0.0	0.0	0.0	0.0
226	701202	890	29.7	0.0	0.2	0.8	0.1	6.6	25.6	9.6	27.4	0.0	0.0	0.0	0.0
227	701201	354	59.6	0.0	0.0	5.6	4.2	1.1	10.2	12.4	6.8	0.0	0.0	0.0	0.0
228	701200	509	62.3	1.2	0.4	5.5	4.7	0.0	14.5	2.4	9.0	0.0	0.0	0.0	0.0
229	703500	474	59.3	0.0	0.2	0.0	0.0	1.1	13.9	7.2	18.4	0.0	0.0	0.0	0.0
230	701203	1012	28.9	1.5	0.5	14.0	8.3	1.7	23.2	3.8	18.1	0.1	0.0	0.0	0.0
231	706001	11293	13.0	1.3	0.5	1.5	0.1	3.1	25.5	8.8	39.4	6.5	0.0	0.0	0.3
232	407600	9375	11.6	0.3	0.1	0.2	0.0	3.3	16.4	8.1	58.9	1.1	0.0	0.0	0.1
233	407700	561	20.0	0.4	0.0	2.9	0.0	0.7	12.5	7.8	55.6	0.2	0.0	0.0	0.0
234	600900	6343	16.6	0.2	0.0	0.6	1.1	3.0	17.6	8.8	50.5	1.4	0.0	0.0	0.2

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
235	601000	1137	24.2	0.0	0.0	0.0	0.0	0.0	13.5	15.7	46.6	0.0	0.0	0.0	0.0
236	601100	3313	34.7	0.3	0.7	3.0	1.1	0.8	20.0	6.6	32.8	0.0	0.0	0.0	0.0
237	407800	10935	14.1	0.1	0.1	0.1	0.1	1.8	30.3	12.6	40.6	0.2	0.0	0.0	0.1
238	408900	2691	14.0	0.3	0.0	0.3	0.1	1.3	26.8	15.8	41.2	0.2	0.0	0.0	0.0
239	409000	1126	28.2	0.2	0.1	2.0	1.0	0.0	21.5	12.5	34.5	0.0	0.0	0.0	0.0
240	409100	1208	35.2	0.6	4.6	3.6	1.2	0.0	25.0	7.5	22.4	0.0	0.0	0.0	0.0
241	409200	9282	18.2	0.2	1.2	1.0	0.5	3.6	26.8	10.0	38.0	0.5	0.0	0.0	0.0
242	409400	12621	13.8	0.0	0.4	0.3	0.4	0.9	31.0	9.8	43.0	0.3	0.0	0.0	0.0
243	410300	4648	25.8	0.0	1.3	0.4	0.4	0.8	16.5	7.6	47.0	0.0	0.0	0.0	0.0
244	410500	2294	17.0	0.2	0.0	0.3	0.0	0.2	11.2	12.6	58.3	0.1	0.0	0.0	0.2
245	410400	248	37.5	2.8	1.6	27.4	8.5	0.0	15.3	4.8	2.0	0.0	0.0	0.0	0.0
246	409500	4178	20.5	0.0	0.0	0.1	0.0	0.3	21.0	10.8	47.2	0.0	0.0	0.0	0.0
247	409300	4488	24.6	0.2	0.4	0.7	0.2	1.5	28.8	11.3	32.2	0.1	0.0	0.0	0.0
248	409600	570	40.9	0.2	1.6	1.1	1.2	18.8	20.9	5.6	9.8	0.0	0.0	0.0	0.0
249	409700	350	56.6	1.4	0.0	1.1	0.9	0.9	22.9	9.7	6.6	0.0	0.0	0.0	0.0
250	410000	1113	20.0	0.0	0.6	1.1	0.4	0.4	36.7	24.1	16.4	0.1	0.0	0.0	0.0
251	409900	917	65.0	0.0	0.1	2.4	0.1	0.0	19.5	9.2	3.7	0.0	0.0	0.0	0.0
252	409800	582	49.0	0.9	0.7	6.2	1.2	0.0	20.3	8.1	13.7	0.0	0.0	0.0	0.0
253	410100	552	63.0	0.0	0.0	1.4	0.4	0.4	17.0	6.2	11.6	0.0	0.0	0.0	0.0
254	406600	1240	29.8	0.0	1.3	1.2	0.6	0.0	15.2	15.1	36.9	0.0	0.0	0.0	0.0
255	407900	2176	27.2	0.2	1.2	4.0	2.1	0.1	17.1	9.1	38.9	0.0	0.0	0.0	0.0
256	406700	740	37.2	0.0	0.4	0.8	1.5	0.3	22.4	15.9	21.5	0.0	0.0	0.0	0.0
257	408600	794	56.5	0.0	1.9	1.4	0.8	0.1	27.1	5.5	6.7	0.0	0.0	0.0	0.0
258	408300	1129	45.0	0.4	1.9	3.3	1.0	0.2	20.4	9.9	17.7	0.1	0.0	0.0	0.1
259	408700	435	31.3	0.0	0.0	0.5	0.0	0.0	22.8	14.9	30.6	0.0	0.0	0.0	0.0
260	408400	443	58.0	0.2	0.0	1.6	0.0	0.0	28.9	7.2	4.1	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
261	408500	758	57.5	0.1	0.4	2.0	0.3	0.0	26.6	6.3	6.7	0.0	0.0	0.0	0.0
262	408800	934	54.3	0.1	0.0	0.2	0.0	0.0	16.2	8.6	20.2	0.4	0.0	0.0	0.0
263	408000	859	48.1	0.3	0.0	1.0	0.2	1.5	26.2	7.9	14.7	0.0	0.0	0.0	0.0
264	408100	1258	37.6	0.3	0.0	1.7	0.2	1.2	28.5	13.7	16.7	0.2	0.0	0.0	0.0
265	408200	736	47.3	0.1	0.0	0.4	0.1	0.3	16.3	10.3	25.1	0.0	0.0	0.0	0.0
266	100300	1002	68.1	0.2	0.1	0.1	0.0	3.0	11.6	3.8	13.2	0.0	0.0	0.0	0.0
267	100400	861	62.6	0.3	0.0	0.0	0.0	0.2	3.0	5.2	28.5	0.1	0.0	0.0	0.0
268	100500	422	67.1	1.2	0.0	2.1	2.8	0.0	9.5	3.1	14.2	0.0	0.0	0.0	0.0
269	100200	684	80.0	1.0	0.0	1.5	0.1	0.0	7.2	4.4	5.8	0.0	0.0	0.0	0.0
270	100100	450	82.4	0.0	0.0	0.2	0.0	8.9	4.7	2.4	1.1	0.0	0.0	0.0	0.0
271	101100	517	63.2	0.2	0.2	3.9	1.9	0.0	17.4	5.2	7.9	0.0	0.0	0.0	0.0
272	500100	308	58.4	1.9	0.0	14.6	3.9	0.0	10.1	4.9	5.8	0.0	0.0	0.0	0.3
273	500200	377	72.7	0.0	0.3	1.3	1.3	0.0	14.1	4.5	5.8	0.0	0.0	0.0	0.0
274	500300	378	60.3	3.4	0.8	13.2	4.5	0.0	11.1	1.6	5.0	0.0	0.0	0.0	0.0
275	406900	742	36.8	0.3	1.1	1.1	0.3	9.6	30.1	10.4	10.4	0.0	0.0	0.0	0.1
276	407000	502	42.0	0.4	0.2	4.6	1.4	0.2	18.9	4.8	27.5	0.0	0.0	0.0	0.0
277	407100	280	66.4	0.4	1.4	1.8	0.7	0.0	15.4	5.4	8.6	0.0	0.0	0.0	0.0
278	407200	337	76.9	1.8	0.0	4.5	1.2	0.3	8.0	4.5	3.0	0.0	0.0	0.0	0.0
279	1600	604	53.0	0.8	0.0	0.2	0.0	0.0	2.2	0.2	43.7	0.0	0.0	0.0	0.0
280	1800	116	44.8	2.6	0.9	6.0	3.4	0.0	13.8	0.9	27.6	0.0	0.0	0.0	0.0
281	1700	297	62.6	17.5	0.0	12.8	2.7	0.0	3.7	0.3	0.3	0.0	0.0	0.0	0.0
282	1500	1079	53.1	0.3	0.0	0.1	0.0	0.0	3.6	1.9	41.0	0.0	0.0	0.0	0.0
283	1100	415	62.2	7.0	0.0	12.5	0.7	0.0	9.4	1.4	6.7	0.0	0.0	0.0	0.0
284	1000	555	87.4	2.2	0.0	2.5	0.0	0.0	4.1	0.9	2.9	0.0	0.0	0.0	0.0
285	900	1078	53.4	4.5	0.0	4.3	0.1	0.0	5.2	1.5	25.7	4.5	0.0	0.0	0.8
286	800	1106	40.8	2.3	0.2	2.5	0.1	0.2	7.7	4.0	27.3	13.6	0.0	0.0	1.4

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
287	1001	198	54.0	5.6	0.0	6.6	0.5	0.0	12.1	5.1	15.7	0.5	0.0	0.0	0.0
288	1200	263	74.5	9.1	0.0	3.4	0.0	0.0	3.4	0.8	8.7	0.0	0.0	0.0	0.0
289	200	409	24.7	15.4	0.0	13.2	1.0	0.0	14.2	1.2	7.1	22.0	0.0	0.0	1.2
290	300	234	31.6	2.6	0.0	4.3	1.7	2.1	9.8	8.1	39.7	0.0	0.0	0.0	0.0
291	700	182	42.9	18.7	0.0	2.7	0.5	0.0	7.7	1.1	25.3	1.1	0.0	0.0	0.0
292	400	334	48.2	8.7	0.0	5.1	0.3	0.3	16.5	5.4	15.3	0.3	0.0	0.0	0.0
293	600	322	60.6	8.4	0.0	3.1	0.0	0.3	7.5	2.2	16.8	1.2	0.0	0.0	0.0
294	100	533	20.6	24.0	0.0	17.3	1.9	0.0	7.9	2.3	13.5	11.4	0.0	0.0	1.1
295	4100	195	38.5	29.7	0.0	0.0	0.0	0.0	0.5	1.0	30.3	0.0	0.0	0.0	0.0
296	500	337	49.6	20.2	0.0	5.0	0.0	0.0	7.7	1.5	15.7	0.3	0.0	0.0	0.0
297	1300	928	38.0	6.3	0.1	2.8	0.3	0.3	4.7	4.5	42.8	0.0	0.0	0.0	0.1
298	1801	365	35.9	13.2	0.0	0.0	0.0	2.5	19.2	3.6	25.5	0.3	0.0	0.0	0.0
299	2000	419	42.0	17.9	0.0	2.9	0.2	0.0	4.1	1.7	31.3	0.0	0.0	0.0	0.0
300	1900	388	54.4	24.0	0.0	8.5	1.3	0.0	8.8	0.8	2.3	0.0	0.0	0.0	0.0
301	2100	139	21.6	64.7	0.0	10.8	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0
302	2101	151	32.5	41.7	0.0	23.8	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
303	9504	194	61.3	8.8	0.0	13.4	2.6	0.0	10.3	0.0	3.6	0.0	0.0	0.0	0.0
304	9505	239	57.3	5.4	0.4	9.6	1.3	0.0	15.9	1.3	8.8	0.0	0.0	0.0	0.0
305	2600	345	38.3	0.6	0.0	1.4	0.0	0.0	3.8	3.8	52.2	0.0	0.0	0.0	0.0
306	2700	106	15.1	42.5	0.0	1.9	0.0	0.0	2.8	0.0	36.8	0.0	0.0	0.0	0.9
307	2701	120	25.8	57.5	0.0	0.8	0.0	0.0	5.8	0.0	9.2	0.8	0.0	0.0	0.0
308	3900	80	15.0	43.8	0.0	5.0	0.0	0.0	6.3	1.3	17.5	10.0	0.0	0.0	1.3
309	4000	93	10.8	52.7	0.0	18.3	0.0	0.0	4.3	0.0	9.7	3.2	0.0	0.0	1.1
310	4201	48	0.0	50.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
311	5500	138	19.6	26.8	0.7	42.0	0.7	0.0	8.0	0.7	0.7	0.0	0.0	0.0	0.7
312	3800	71	0.0	28.2	0.0	63.4	1.4	0.0	5.6	0.0	0.0	1.4	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
313	4200	49	0.0	28.6	0.0	65.3	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0
314	5300	71	1.4	39.4	0.0	57.7	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
315	5301	55	0.0	3.6	0.0	90.9	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0
316	2500	137	45.3	32.8	0.0	12.4	0.0	0.0	4.4	0.7	4.4	0.0	0.0	0.0	0.0
317	2200	101	22.8	67.3	0.0	7.9	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
318	2201	124	30.6	50.0	0.0	0.0	0.0	0.0	18.5	0.0	0.8	0.0	0.0	0.0	0.0
319	2400	127	7.9	68.5	0.0	15.0	0.8	0.0	7.1	0.0	0.0	0.8	0.0	0.0	0.0
320	2300	92	12.0	85.9	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
321	2501	116	22.4	64.7	0.0	5.2	0.0	0.0	2.6	0.0	4.3	0.9	0.0	0.0	0.0
322	2800	92	0.0	62.0	0.0	32.6	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0
323	2900	64	0.0	62.5	0.0	35.9	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0
324	3000	40	0.0	40.0	0.0	50.0	7.5	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0
325	3100	66	0.0	59.1	0.0	39.4	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
326	3200	113	1.8	47.8	0.0	46.0	3.5	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0
327	3700	62	22.6	46.8	0.0	25.8	0.0	0.0	1.6	0.0	3.2	0.0	0.0	0.0	0.0
328	3600	68	0.0	42.6	0.0	50.0	5.9	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
329	3500	77	2.6	32.5	0.0	54.5	1.3	0.0	9.1	0.0	0.0	0.0	0.0	0.0	0.0
330	3400	234	11.5	22.2	0.4	41.0	3.4	0.0	8.1	0.0	0.0	13.2	0.0	0.0	0.0
331	3300	90	10.0	51.1	0.0	13.3	1.1	0.0	20.0	0.0	0.0	4.4	0.0	0.0	0.0
332	4300	57	3.5	64.9	0.0	29.8	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
333	4400	64	0.0	37.5	0.0	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
334	4500	46	0.0	54.3	0.0	43.5	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
335	5200	76	1.3	38.2	0.0	59.2	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
336	5000	100	0.0	27.0	0.0	70.0	0.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0
337	4900	62	0.0	43.5	0.0	46.8	0.0	0.0	4.8	0.0	0.0	4.8	0.0	0.0	0.0
338	4800	60	0.0	48.3	0.0	48.3	1.7	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
339	5400	61	6.6	8.2	0.0	83.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
340	5401	76	1.3	5.3	0.0	89.5	2.6	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
341	5201	33	0.0	6.1	0.0	87.9	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	0.0
342	5100	72	5.6	5.6	0.0	84.7	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0
343	4901	50	0.0	26.0	0.0	74.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
344	4801	60	0.0	30.0	0.0	65.0	3.3	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0
345	5600	228	15.4	10.1	2.6	28.9	3.5	0.0	6.6	0.0	1.8	29.8	0.0	0.0	1.3
346	5700	168	25.6	7.1	0.0	48.2	2.4	0.0	8.3	1.8	0.0	6.5	0.0	0.0	0.0
347	5701	190	33.2	4.7	0.0	27.9	2.6	3.7	26.8	0.0	0.0	1.1	0.0	0.0	0.0
348	5800	343	9.3	2.3	1.5	69.1	4.4	2.3	9.6	0.3	0.0	1.2	0.0	0.0	0.0
349	5900	192	9.9	4.7	6.3	57.3	9.9	0.5	10.4	1.0	0.0	0.0	0.0	0.0	0.0
350	01	416	32.2	8.2	2.6	4.6	1.2	10.6	30.0	2.6	6.7	1.2	0.0	0.0	0.0
351	9500	341	50.4	3.5	0.9	2.1	0.6	0.0	24.3	7.9	10.0	0.3	0.0	0.0	0.0
352	9501	380	48.9	6.6	4.5	14.5	5.8	0.0	14.7	1.3	3.7	0.0	0.0	0.0	0.0
353	9502	284	72.5	6.3	0.0	0.4	0.7	1.4	10.6	2.1	6.0	0.0	0.0	0.0	0.0
354	9200	332	43.1	20.2	0.0	8.1	0.6	0.0	21.1	3.3	3.3	0.3	0.0	0.0	0.0
355	9300	320	57.5	18.8	0.0	17.2	1.6	0.0	3.8	0.0	1.3	0.0	0.0	0.0	0.0
356	9400	337	79.2	12.5	0.0	1.5	0.0	0.0	5.9	0.6	0.3	0.0	0.0	0.0	0.0
357	3301	56	0.0	42.9	0.0	57.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
358	4600	87	5.7	58.6	0.0	31.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0
359	8700	184	6.5	35.3	0.0	46.7	3.3	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0
360	4700	145	0.0	4.8	1.4	81.4	9.7	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0
361	8600	137	0.0	1.5	0.0	75.9	21.2	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
362	8500	109	0.0	41.3	0.0	54.1	0.9	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0
363	9101	380	14.2	12.6	1.8	45.3	14.7	0.0	11.1	0.0	0.0	0.3	0.0	0.0	0.0
364	9100	298	68.5	13.1	0.0	5.4	1.7	0.0	9.4	1.3	0.7	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
365	8800	418	18.4	21.8	1.2	34.9	3.6	0.0	16.3	1.2	2.4	0.2	0.0	0.0	0.0
366	9000	709	21.9	3.7	2.0	27.5	4.5	0.1	23.4	9.7	6.6	0.6	0.0	0.0	0.0
367	8801	120	15.0	54.2	0.0	21.7	3.3	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0
368	8900	528	23.7	4.4	0.9	9.5	0.6	2.5	33.0	8.5	14.2	2.8	0.0	0.0	0.0
369	8300	81	4.9	40.7	0.0	48.1	4.9	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
370	8301	56	7.1	64.3	0.0	26.8	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
371	8400	93	0.0	66.7	0.0	30.1	1.1	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0
372	8200	143	22.4	26.6	3.5	23.1	14.0	0.0	8.4	0.7	0.0	0.0	1.4	0.0	0.0
373	8100	63	0.0	81.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
374	8000	78	0.0	67.9	0.0	29.5	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
375	8001	127	12.6	63.0	0.0	11.8	2.4	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0
376	7900	262	76.0	0.0	0.0	2.3	0.0	0.0	13.4	1.1	7.3	0.0	0.0	0.0	0.0
377	7901	208	20.7	9.1	2.4	22.6	3.4	0.0	21.6	0.5	0.0	19.7	0.0	0.0	0.0
378	8901	234	57.3	0.9	0.9	9.8	4.7	0.0	17.5	4.3	4.7	0.0	0.0	0.0	0.0
379	7800	725	20.4	3.3	1.7	18.1	2.3	0.3	34.1	5.1	4.7	9.9	0.0	0.0	0.1
380	7801	242	45.0	13.2	0.4	19.4	1.7	0.8	7.0	1.2	0.8	10.3	0.0	0.0	0.0
381	7802	236	40.3	16.9	0.0	16.9	2.5	0.0	9.7	4.2	8.9	0.4	0.0	0.0	0.0
382	7803	191	71.7	4.7	0.0	3.1	1.0	0.5	17.8	0.0	1.0	0.0	0.0	0.0	0.0
383	7804	254	65.7	13.4	0.0	11.4	2.8	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0
384	7806	110	60.0	0.0	1.8	6.4	3.6	0.0	25.5	1.8	0.9	0.0	0.0	0.0	0.0
385	7807	190	64.2	1.1	0.5	5.3	4.7	0.0	22.6	1.6	0.0	0.0	0.0	0.0	0.0
386	7704	263	50.6	1.1	1.5	12.5	9.1	0.0	22.1	2.3	0.8	0.0	0.0	0.0	0.0
387	7705	163	68.7	1.8	0.0	2.5	1.8	0.0	11.7	6.1	7.4	0.0	0.0	0.0	0.0
388	7706	161	64.0	0.6	1.2	6.2	1.2	0.0	6.8	1.2	18.6	0.0	0.0	0.0	0.0
389	7702	219	39.3	7.8	0.0	5.9	0.9	0.0	28.8	4.1	13.2	0.0	0.0	0.0	0.0
390	7700	395	34.9	14.9	0.0	6.3	0.0	2.5	16.5	1.5	2.8	20.0	0.0	0.0	0.5

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
391	7701	700	50.3	2.3	0.0	1.3	0.0	0.0	9.1	6.0	31.0	0.0	0.0	0.0	0.0
392	7600	268	31.7	14.9	0.4	18.3	1.1	4.1	15.3	0.7	0.0	13.4	0.0	0.0	0.0
393	7601	377	52.0	10.6	0.3	10.1	1.1	0.0	3.4	1.3	21.2	0.0	0.0	0.0	0.0
394	7602	242	81.4	1.2	0.4	4.1	1.2	0.0	5.0	1.7	5.0	0.0	0.0	0.0	0.0
395	6802	248	23.8	5.2	4.0	21.8	8.5	0.0	27.0	0.8	0.4	8.1	0.4	0.0	0.0
396	6800	55	10.9	63.6	0.0	23.6	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0
397	6801	59	6.8	54.2	0.0	27.1	3.4	0.0	5.1	0.0	0.0	3.4	0.0	0.0	0.0
398	7100	140	2.1	12.1	0.7	50.7	15.0	0.0	4.3	0.0	0.0	15.0	0.0	0.0	0.0
399	6900	101	5.0	31.7	0.0	51.5	5.9	0.0	5.0	0.0	0.0	1.0	0.0	0.0	0.0
400	6700	88	3.4	80.7	0.0	14.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
401	6600	69	2.9	56.5	1.4	30.4	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
402	7000	116	14.7	30.2	0.0	48.3	4.3	0.0	1.7	0.0	0.0	0.9	0.0	0.0	0.0
403	6500	145	15.2	29.7	2.1	31.0	11.7	0.0	9.7	0.0	0.0	0.7	0.0	0.0	0.0
404	7200	353	1.7	2.5	0.6	60.3	15.0	0.0	0.6	0.0	0.0	19.3	0.0	0.0	0.0
405	6400	173	10.4	4.0	0.0	56.6	9.2	2.3	12.1	0.0	0.0	5.2	0.0	0.0	0.0
406	6301	128	6.3	3.1	0.0	4.7	0.0	1.6	18.0	0.0	0.0	66.4	0.0	0.0	0.0
407	6300	113	8.0	4.4	0.0	35.4	4.4	8.0	3.5	0.0	0.0	36.3	0.0	0.0	0.0
408	6001	35	17.1	0.0	0.0	54.3	22.9	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0
409	6000	187	19.3	3.2	4.8	54.0	10.2	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0
410	6100	121	2.5	0.0	3.3	62.0	24.8	0.0	4.1	0.0	0.0	3.3	0.0	0.0	0.0
411	6200	1907	13.0	1.4	0.5	13.8	1.6	7.9	18.4	0.6	0.3	42.4	0.0	0.0	0.3
412	7501	165	42.4	1.8	0.6	7.3	6.1	0.0	20.6	6.7	14.5	0.0	0.0	0.0	0.0
413	7500	255	29.4	20.8	0.4	15.3	4.7	1.2	9.0	1.2	18.0	0.0	0.0	0.0	0.0
414	7401	289	43.6	2.1	0.3	11.8	5.5	0.0	16.6	8.7	11.4	0.0	0.0	0.0	0.0
415	7400	310	35.8	1.3	0.3	12.6	6.1	0.6	28.1	1.3	0.3	13.5	0.0	0.0	0.0
416	7404	165	52.7	0.0	1.2	7.9	1.2	0.0	21.8	1.2	13.9	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
417	7303	248	42.3	1.2	1.2	6.0	3.6	0.0	16.9	6.9	21.8	0.0	0.0	0.0	0.0
418	9600	346	49.7	4.3	0.0	4.9	2.6	0.9	20.5	4.3	12.4	0.3	0.0	0.0	0.0
419	7301	242	59.1	6.6	0.8	4.1	0.0	0.0	11.2	0.4	10.7	7.0	0.0	0.0	0.0
420	7302	218	62.4	0.9	1.4	5.5	2.3	0.0	17.9	6.0	3.7	0.0	0.0	0.0	0.0
421	9700	92	23.9	1.1	2.2	34.8	13.0	0.0	21.7	3.3	0.0	0.0	0.0	0.0	0.0
422	9800	128	50.0	9.4	0.8	11.7	6.3	0.0	17.2	3.1	1.6	0.0	0.0	0.0	0.0
423	7305	200	51.5	6.0	0.5	9.0	3.0	0.0	23.5	5.0	1.5	0.0	0.0	0.0	0.0
424	7306	310	66.5	1.9	0.0	1.6	1.0	0.3	15.8	5.5	7.4	0.0	0.0	0.0	0.0
425	7300	2068	11.8	0.5	3.1	8.8	4.4	0.7	18.7	0.1	0.1	51.5	0.0	0.0	0.0
426	7307	964	7.1	0.2	3.8	15.4	3.9	0.3	8.9	0.4	0.3	59.4	0.1	0.0	0.1
427	101000	238	81.9	1.3	0.0	1.7	0.0	0.0	5.0	5.9	4.2	0.0	0.0	0.0	0.0
428	100900	350	83.4	1.7	0.0	1.4	0.0	0.0	4.9	1.1	7.4	0.0	0.0	0.0	0.0
429	100800	79	82.3	0.0	0.0	5.1	1.3	0.0	8.9	1.3	1.3	0.0	0.0	0.0	0.0
430	100700	363	72.2	0.8	0.3	4.7	2.8	0.0	10.5	3.0	5.8	0.0	0.0	0.0	0.0
431	100600	200	87.0	0.0	0.0	3.0	1.0	0.0	2.0	2.5	4.5	0.0	0.0	0.0	0.0
432	101500	368	69.8	6.5	0.0	9.5	1.9	0.0	5.4	3.3	3.0	0.5	0.0	0.0	0.0
433	101600	346	45.4	9.2	0.3	15.3	2.0	0.0	11.0	2.3	14.2	0.3	0.0	0.0	0.0
434	101700	195	37.4	21.0	0.0	36.4	1.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0
435	101800	328	68.0	4.0	0.3	18.9	1.2	0.0	4.0	0.0	3.7	0.0	0.0	0.0	0.0
436	101900	225	72.9	1.8	0.0	7.6	4.9	0.0	6.7	4.0	2.2	0.0	0.0	0.0	0.0
437	102000	202	67.8	6.4	0.0	14.9	3.5	0.0	6.4	0.5	0.5	0.0	0.0	0.0	0.0
438	101400	305	53.1	0.7	0.7	26.6	3.9	0.0	5.6	5.9	3.6	0.0	0.0	0.0	0.0
439	101300	540	73.3	0.7	0.0	1.5	0.0	0.0	8.7	4.3	11.5	0.0	0.0	0.0	0.0
440	101200	335	70.1	0.0	0.0	3.0	0.0	0.0	9.6	4.8	12.5	0.0	0.0	0.0	0.0
441	404400	107	39.3	0.0	0.0	38.3	10.3	0.0	9.3	1.9	0.9	0.0	0.0	0.0	0.0
442	404700	382	68.3	0.0	0.0	1.3	0.3	0.0	8.6	7.1	14.4	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
443	404600	534	57.9	0.2	0.0	6.4	0.6	0.2	15.7	4.3	14.8	0.0	0.0	0.0	0.0
444	404500	209	89.5	0.0	0.0	1.0	0.0	0.0	8.1	1.4	0.0	0.0	0.0	0.0	0.0
445	407500	1009	44.9	0.4	0.0	3.1	1.1	0.0	10.8	5.6	34.1	0.0	0.0	0.0	0.0
446	404900	318	55.7	0.0	0.0	0.3	0.0	0.0	16.7	8.8	18.6	0.0	0.0	0.0	0.0
447	405700	706	33.3	0.1	0.0	3.1.	1.3	0.0	12.3	11.5	38.4	0.0	0.0	0.0	0.0
448	405800	422	64.7	0.2	0.0	1.9	0.7	0.0	16.6	6.9	9.0	0.0	0.0	0.0	0.0
449	405900	352	73.9	0.0	0.0	0.0	0.0	0.0	9.1	5.7	11.4	0.0	0.0	0.0	0.0
450	406000	502	42.4	0.4	1.8	12.2	2.4	0.2	17.1	10.0	13.5	0.0	0.0	0.0	0.0
451	405200	401	61.3	0.2	0.0	0.0	0.2	0.0	15.7	8.2	14.2	0.0	0.0	0.0	0.0
452	405000	454	51.3	0.0	0.0	0.0	0.0	0.0	15.9	10.6	22.2	0.0	0.0	0.0	0.0
453	405100	407	61.9	0.7	0.5	0.7	0.2	0.0	21.4	7.6	6.1	0.7	0.0	0.0	0.0
454	405500	603	26.0	0.0	2.0	3.6	0.7	15.1	32.3	8.0	12.3	0.0	0.0	0.0	0.0
455	405400	509	52.7	0.0	0.8	1.8	0.4	0.4	30.6	7.7	5.7	0.0	0.0	0.0	0.0
456	405300	554	36.5	0.5	6.1	6.7	4.5	0.0	15.7	8.8	20.6	0.2	0.2	0.0	0.2
457	200102	236	40.7	0.8	0.8	9.7	3.8	0.0	30.1	8.1	5.9	0.0	0.0	0.0	0.0
458	200302	177	19.8	1.1	1.1	45.8	10.7	0.0	17.5	1.1	2.8	0.0	0.0	0.0	0.0
459	200301	342	59.4	0.6	0.9	5.3	2.0	0.0	17.5	7.0	7.3	0.0	0.0	0.0	0.0
460	200103	203	17.7	0.0	1.5	3.4	2.0	0.0	30.5	15.3	29.6	0.0	0.0	0.0	0.0
461	200300	96	24.0	0.0	0.0	28.1	11.5	0.0	26.0	5.2	5.2	0.0	0.0	0.0	0.0
462	200101	237	50.6	0.0	3.4	3.4	2.1	0.0	15.6	3.8	21.1	0.0	0.0	0.0	0.0
463	200104	47	14.9	0.0	0.0	29.8	12.8	0.0	19.1	4.3	19.1	0.0	0.0	0.0	0.0
464	200100	290	41.7	1.7	7.9	8.3	3.1	0.0	16.2	3.1	17.9	0.0	0.0	0.0	0.0
465	999998	666	41.3	1.2	3.6	6.2	4.5	0.6	21.8	8.7	12.2	0.0	0.0	0.0	0.0
466	103000	196	53.6	2.0	0.0	24.0	3.6	0.0	15.3	0.0	1.5	0.0	0.0	0.0	0.0
467	200500	107	68.2	0.0	0.9	4.7	0.9	0.0	15.9	7.5	1.9	0.0	0.0	0.0	0.0
468	200600	446	45.7	6.5	2.5	13.0	2.5	0.0	18.4	3.1	8.3	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
469	200801	207	51.7	1.9	0.5	11.1	1.9	0.5	18.8	10.1	2.4	1.0	0.0	0.0	0.0
470	200800	398	64.6	0.0	0.0	1.0	0.3	0.3	17.3	7.5	9.0	0.0	0.0	0.0	0.0
471	200700	552	22.3	8.0	2.9	34.2	5.1	0.0	24.5	1.3	0.9	0.2	0.2	0.0	0.5
472	202001	151	31.8	5.3	0.7	25.2	3.3	1.3	19.9	0.0	0.0	11.9	0.0	0.0	0.7
473	202000	101	17.8	29.7	0.0	49.5	1.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
474	201900	159	10.7	22.6	0.0	60.4	2.5	1.3	1.9	0.0	0.6	0.0	0.0	0.0	0.0
475	201500	260	79.6	0.8	0.0	0.0	0.0	1.2	9.6	3.8	5.0	0.0	0.0	0.0	0.0
476	201600	203	29.1	23.2	3.0	35.0	2.5	0.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0
477	201800	217	24.4	21.7	0.0	41.9	7.8	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0
478	201700	715	22.5	9.8	0.3	42.5	3.2	0.0	9.7	1.3	1.8	8.5	0.0	0.0	0.4
479	200900	449	74.2	0.7	0.0	7.1	0.9	0.0	7.3	2.9	6.9	0.0	0.0	0.0	0.0
480	201400	236	86.4	0.0	0.0	1.7	0.0	0.0	2.1	3.4	6.4	0.0	0.0	0.0	0.0
481	201300	229	78.2	3.5	0.0	12.7	1.7	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0
482	201000	159	66.7	1.9	0.0	15.1	5.7	0.0	6.3	0.0	4.4	0.0	0.0	0.0	0.0
483	201100	346	64.7	1.4	0.0	7.8	1.2	0.0	2.9	1.4	20.2	0.3	0.0	0.0	0.0
484	201201	97	77.3	0.0	0.0	12.4	1.0	0.0	4.1	2.1	3.1	0.0	0.0	0.0	0.0
485	201200	229	56.3	4.4	0.0	22.3	2.2	0.0	11.8	1.3	1.7	0.0	0.0	0.0	0.0
486	404800	641	50.1	0.9	2.2	18.1	7.2	0.0	14.4	3.3	3.9	0.0	0.0	0.0	0.0
487	102100	239	56.5	1.3	1.3	4.2	0.4	0.0	13.4	3.8	19.2	0.0	0.0	0.0	0.0
488	102200	189	64.0	1.6	1.1	3.7	0.5	0.0	9.5	5.3	14.3	0.0	0.0	0.0	0.0
489	102800	393	59.3	2.8	1.0	9.7	1.5	0.0	12.2	4.1	9.4	0.0	0.0	0.0	0.0
490	102900	313	55.0	2.2	0.0	13.4	7.7	0.0	12.5	1.6	7.7	0.0	0.0	0.0	0.0
491	102700	143	57.3	3.5	0.7	13.3	3.5	0.0	20.3	1.4	0.0	0.0	0.0	0.0	0.0
492	102300	431	67.7	1.2	0.2	6.0	2.3	0.0	9.7	3.9	8.8	0.0	0.0	0.0	0.0
493	102600	182	74.2	0.5	0.0	8.8	2.7	0.0	9.3	2.2	2.2	0.0	0.0	0.0	0.0
494	103100	238	64.7	0.0	0.0	11.3	6.7	0.4	12.6	0.8	3.4	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
495	102400	219	67.6	0.5	6.8	2.7	4.1	0.0	16.0	0.9	0.0	0.0	1.4	0.0	0.0
496	102500	135	63.7	3.0	0.0	8.1	5.2	0.0	15.6	3.0	1.5	0.0	0.0	0.0	0.0
497	103200	424	45.0	2.1	0.2	11.1	2.1	5.4	24.8	7.1	2.1	0.0	0.0	0.0	0.0
498	103800	200	48.5	0.5	0.0	18.0	6.0	3.5	18.0	3.0	2.5	0.0	0.0	0.0	0.0
499	103300	53	64.2	11.3	0.0	5.7	0.0	9.4	9.4	0.0	0.0	0.0	0.0	0.0	0.0
500	103700	369	54.7	1.9	0.0	7.9	2.4	2.4	13.0	6.2	10.6	0.3	0.0	0.0	0.5
501	103500	187	10.7	1.1	0.0	0.0	0.0	0.0	10.2	10.2	67.9	0.0	0.0	0.0	0.0
502	103600	191	91.6	0.5	0.0	3.7	0.5	0.0	2.1	0.5	1.0	0.0	0.0	0.0	0.0
503	103400	2357	24.0	3.8	1.9	29.3	7.9	1.3	27.6	0.8	0.8	2.2	0.0	0.0	0.3
504	410700	135	21.5	0.0	0.0	0.0	0.0	0.0	16.3	19.3	43.0	0.0	0.0	0.0	0.0
505	901200	34	5.9	2.9	0.0	0.0	0.0	0.0	0.0	5.9	85.3	0.0	0.0	0.0	0.0
506	410600	13174	10.7	0.2	0.4	0.1	0.0	1.8	14.1	14.2	57.4	0.5	0.0	0.1	0.7
507	901200	19505	10.7	0.3	2.8	0.4	0.1	0.0	10.8	11.4	57.6	3.9	0.0	0.3	1.9
508	900400	708	18.2	0.4	1.1	1.0	1.0	2.1	30.9	13.4	28.7	0.0	0.0	0.0	3.1
509	900300	1156	31.8	0.6	1.0	2.7	1.2	0.8	16.4	5.6	38.4	1.3	0.0	0.0	0.2
510	900200	1006	55.4	1.2	2.6	3.8	1.7	0.0	17.3	1.5	15.2	1.4	0.0	0.0	0.0
511	900500	286	49.7	0.0	0.3	1.0	0.0	0.0	9.1	4.5	35.3	0.0	0.0	0.0	0.0
512	900600	106	30.2	0.0	0.0	18.9	13.2	0.0	35.8	0.9	0.9	0.0	0.0	0.0	0.0
513	900100	1590	17.1	0.8	0.6	2.8	1.8	0.6	13.0	6.9	33.6	21.8	0.0	0.0	1.0
514	402900	106	4.7	0.0	11.3	14.2	15.1	0.0	30.2	0.9	18.9	1.9	0.0	0.0	2.8
515	404100	15982	7.7	0.1	0.1	0.1	0.0	0.4	9.4	10.9	68.5	2.2	0.0	0.0	0.7
516	402800	2872	9.5	0.2	1.9	1.3	0.5	3.4	38.0	9.5	33.3	1.7	0.0	0.2	0.3
517	402900	2616	22.1	2.6	1.4	1.3	0.6	0.2	17.8	5.1	47.7	0.6	0.0	0.0	0.6
518	401300	6385	8.3	0.4	0.4	4.3	0.1	0.2	9.2	10.5	52.7	12.5	0.0	0.0	1.4
519	401200	5423	14.2	0.6	1.5	3.1	1.5	0.7	12.7	6.0	34.5	24.3	0.1	0.0	0.6
520	999998	6679	5.5	0.2	0.9	4.8	0.2	0.0	7.7	3.8	36.2	40.2	0.0	0.0	0.4

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
521	801301	7936	9.5	0.4	0.4	4.0	0.2	0.1	9.3	8.1	44.8	22.2	0.0	0.0	1.0
522	403000	769	23.9	0.0	0.0	0.4	0.9	0.0	9.9	12.6	52.0	0.3	0.0	0.0	0.0
523	311100	453	51.0	1.8	0.0	7.9	2.2	0.0	11.9	7.1	17.2	0.0	0.0	0.0	0.9
524	310800	691	48.5	0.3	0.0	4.9	2.6	0.0	29.1	7.4	7.2	0.0	0.0	0.0	0.0
525	406800	1938	32.2	0.3	2.0	3.3	1.7	0.1	32.0	8.3	20.2	0.0	0.0	0.0	0.0
526	407400	1139	28.1	2.4	1.2	7.1	2.5	0.1	14.8	4.4	38.6	0.2	0.4	0.0	0.2
527	407300	1347	44.2	0.2	0.1	1.2	0.7	0.1	11.4	7.1	34.9	0.1	0.0	0.0	0.0
528	310900	743	46.2	1.1	2.6	5.5	4.8	0.1	21.3	6.5	11.6	0.0	0.4	0.0	0.0
529	311000	1029	31.5	0.5	5.2	6.4	2.8	5.2	18.0	11.7	18.7	0.1	0.1	0.0	0.0
530	311200	469	49.5	1.9	0.9	5.8	0.9	0.4	18.8	10.0	11.9	0.0	0.0	0.0	0.0
531	403100	1572	28.2	0.2	0.6	1.1	0.6	3.2	22.4	9.1	34.3	0.0	0.0	0.0	0.3
532	403200	3416	25.4	0.1	3.8	1.0	0.6	0.5	21.1	7.3	39.1	0.2	0.0	0.0	0.9
533	403700	3632	11.8	0.1	3.2	0.6	0.4	1.0	18.1	6.8	56.9	0.1	0.0	0.3	0.6
534	406100	2395	52.9	0.1	0.8	0.8	0.4	0.1	15.2	9.2	20.3	0.1	0.0	0.0	0.0
535	405600	717	47.7	0.4	0.1	0.3	0.0	0.0	13.9	9.2	28.3	0.0	0.0	0.0	0.0
536	406200	248	36.3	0.4	0.0	0.8	2.4	0.0	37.9	5.2	16.9	0.0	0.0	0.0	0.0
537	406300	504	59.1	0.6	0.4	2.6	0.8	0.0	24.0	3.8	8.7	0.0	0.0	0.0	0.0
538	406400	1156	41.2	0.2	0.5	2.2	1.8	0.3	22.1	11.2	20.6	0.0	0.0	0.0	0.0
539	406500	1247	54.4	0.5	0.3	4.2	1.3	0.0	15.3	3.8	16.7	3.4	0.0	0.0	0.2
540	403300	284	66.5	0.0	0.0	2.5	1.1	0.0	8.5	6.0	12.0	3.5	0.0	0.0	0.0
541	403400	766	66.6	0.0	0.3	1.6	0.8	0.0	11.7	6.5	12.5	0.0	0.0	0.0	0.0
542	403500	1336	43.2	0.5	4.4	9.4	3.1	0.0	17.1	6.4	15.1	0.6	0.1	0.0	0.0
543	403800	936	58.8	0.6	4.5	1.3	1.8	0.1	18.1	4.7	10.1	0.0	0.0	0.0	0.0
544	403900	572	48.8	0.9	0.0	0.9	0.3	0.0	7.3	5.8	35.3	0.7	0.0	0.0	0.0
545	404000	578	73.2	0.3	0.2	7.3	2.4	0.0	14.4	0.2	2.1	0.0	0.0	0.0	0.0
546	404200	5880	20.2	0.1	4.0	1.1	0.5	1.3	16.0	6.0	49.8	0.1	0.0	0.0	0.8

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
547	404300	1581	23.9	0.1	6.2	2.4	1.2	0.0	19.5	4.7	41.9	0.0	0.0	0.0	0.0
548	402302	848	24.3	5.5	4.6	5.5	3.7	0.0	19.9	1.7	32.8	1.4	0.1	0.0	0.5
549	402000	1282	38.8	2.4	8.9	9.0	1.5	0.0	23.4	3.8	11.9	0.1	0.1	0.0	0.0
550	401400	797	49.8	2.0	3.5	6.3	2.8	0.0	16.1	1.4	17.7	0.0	0.5	0.0	0.0
551	403600	623	34.8	2.4	1.8	13.2	2.1	0.0	10.6	4.7	30.2	0.3	0.0	0.0	0.0
552	200400	809	13.1	4.8	11.1	27.9	9.1	0.0	20.3	3.1	9.6	0.1	0.5	0.0	0.2
553	401500	967	37.5	2.8	0.7	3.0	0.7	0.0	11.7	6.7	36.3	0.2	0.3	0.0	0.0
554	401600	1081	45.1	0.6	0.2	1.9	0.7	0.3	17.2	7.8	26.2	0.0	0.0	0.0	0.0
555	401700	590	61.9	0.0	0.0	1.2	1.0	0.2	23.4	6.8	5.6	0.0	0.0	0.0	0.0
556	401800	262	57.3	1.1	0.0	0.4	0.4	0.0	19.8	8.8	12.2	0.0	0.0	0.0	0.0
557	401900	405	56.8	3.2	0.2	12.1	4.0	0.0	11.4	4.9	6.2	0.5	0.0	0.0	0.7
558	402100	1817	25.2	0.2	4.7	2.1	0.9	0.1	24.5	13.1	28.8	0.3	0.0	0.0	0.0
559	402200	624	49.5	0.2	0.6	0.6	0.5	1.8	22.3	7.5	17.0	0.0	0.0	0.0	0.0
560	402301	2408	20.3	0.5	5.2	1.6	0.5	0.0	23.2	6.2	42.4	0.0	0.0	0.0	0.2
561	402300	31	16.1	0.0	0.0	3.2	9.7	0.0	61.3	9.7	0.0	0.0	0.0	0.0	0.0
562	402600	3165	15.2	0.2	2.9	2.6	0.9	2.8	22.8	5.7	46.2	0.1	0.0	0.0	0.6
563	402400	2108	15.2	0.1	2.1	1.1	0.4	0.2	18.3	5.5	56.9	0.0	0.0	0.0	0.1
564	400100	516	43.8	0.0	2.1	7.9	5.8	0.0	23.1	7.2	10.1	0.0	0.0	0.0	0.0
565	400300	458	62.9	0.0	0.9	1.5	1.5	0.4	14.8	5.5	12.4	0.0	0.0	0.0	0.0
566	400200	1168	27.7	2.3	0.6	4.4	0.4	6.3	13.1	3.6	7.4	31.6	0.0	0.0	2.7
567	402700	1095	33.7	0.2	1.7	2.1	1.1	0.0	27.5	6.0	27.5	0.0	0.0	0.0	0.2
568	402500	641	31.7	0.2	5.3	3.3	6.9	0.0	28.9	4.1	19.8	0.0	0.0	0.0	0.0
569	400500	836	40.3	0.1	0.5	5.0	6.0	0.6	28.1	9.3	10.0	0.0	0.0	0.0	0.0
570	401100	1603	26.2	1.0	3.7	3.1	0.9	0.7	27.1	4.5	15.5	14.2	0.0	0.5	2.6
571	400700	757	48.5	0.1	0.5	3.0	3.3	0.0	29.7	7.3	7.5	0.0	0.0	0.0	0.0
572	400800	1045	42.9	0.3	2.1	0.6	0.9	0.2	17.9	9.2	25.2	0.8	0.0	0.0	0.1

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
573	400900	790	59.5	1.3	0.4	3.8	0.6	0.0	13.4	2.8	7.8	9.5	0.0	0.0	0.9
574	400600	903	46.7	0.6	0.1	1.0	1.3	0.9	24.3	9.0	14.4	0.3	0.0	0.0	1.4
575	401000	763	63.4	0.0	0.0	0.5	0.0	1.3	23.9	3.4	7.5	0.0	0.0	0.0	0.0
576	400400	898	49.4	0.3	0.0	1.2	0.0	0.1	14.5	7.8	17.4	7.2	0.0	0.0	2.0
577	801402	4361	10.0	0.3	0.8	2.9	0.7	0.3	10.9	5.5	17.7	50.1	0.0	0.0	0.9
578	801302	5527	18.5	0.8	0.4	1.6	0.2	0.6	14.6	7.1	27.8	27.8	0.0	0.0	0.6
579	801403	421	43.7	0.0	0.0	0.7	0.7	0.0	15.9	10.7	28.3	0.0	0.0	0.0	0.0
580	801404	576	42.7	0.0	2.6	5.2	6.6	0.3	27.3	6.9	8.3	0.0	0.0	0.0	0.0
581	801500	242	70.7	0.0	0.0	2.1	0.0	0.8	17.4	0.0	8.7	0.0	0.0	0.0	0.4
582	801600	161	46.6	1.2	0.0	21.1	13.0	0.0	11.2	5.6	1.2	0.0	0.0	0.0	0.0
583	801702	764	47.0	0.0	1.3	2.4	3.1	0.1	18.3	10.1	17.7	0.0	0.0	0.0	0.0
584	801703	527	39.3	1.1	4.4	3.2	2.3	0.0	18.4	10.4	20.9	0.0	0.0	0.0	0.0
585	801704	650	24.8	0.3	1.7	2.8	2.2	0.0	20.5	13.8	34.0	0.0	0.0	0.0	0.0
586	801802	500	34.6	0.0	3.2	1.0	1.0	1.4	23.8	9.6	25.4	0.0	0.0	0.0	0.0
587	801803	174	72.4	0.0	0.0	1.1	3.4	6.3	10.9	1.7	4.0	0.0	0.0	0.0	0.0
588	801801	237	75.9	0.0	2.1	6.8	5.9	0.0	8.4	0.4	0.0	0.0	0.4	0.0	0.0
589	801800	163	46.6	0.0	7.4	2.5	4.3	0.0	26.4	4.3	8.6	0.0	0.0	0.0	0.0
590	801804	158	69.0	0.0	0.6	3.2	0.0	0.6	17.7	7.6	1.3	0.0	0.0	0.0	0.0
591	802500	381	73.2	0.5	0.8	1.6	0.0	0.5	8.4	5.2	9.7	0.0	0.0	0.0	0.0
592	802600	225	70.2	5.8	0.4	9.8	4.0	0.0	7.1	1.3	1.3	0.0	0.0	0.0	0.0
593	802700	312	69.2	1.0	0.0	5.1	4.2	0.0	14.4	3.2	2.9	0.0	0.0	0.0	0.0
594	802800	2008	33.7	0.3	2.2	1.9	1.5	0.1	21.8	12.3	26.1	0.0	0.0	0.0	0.0
595	802401	602	38.7	0.8	4.0	5.3	4.7	0.0	29.9	5.8	10.8	0.0	0.0	0.0	0.0
596	802301	58	55.2	0.0	3.4	0.0	8.6	0.0	24.1	3.4	5.2	0.0	0.0	0.0	0.0
597	802300	410	74.1	0.0	1.0	3.7	1.0	0.0	13.4	3.9	2.9	0.0	0.0	0.0	0.0
598	802201	1569	41.0	0.1	2.3	1.8	2.1	0.0	17.8	8.5	26.3	0.0	0.0	0.0	0.0

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
599	802102	427	55.7	0.5	4.4	6.1	2.8	0.0	14.1	7.5	8.9	0.0	0.0	0.0	0.0
600	802200	1122	12.6	0.1	5.7	1.2	2.0	0.0	32.9	12.5	33.1	0.0	0.1	0.0	0.0
601	802100	532	25.4	0.0	7.5	4.3	2.1	0.0	22.7	8.6	29.3	0.0	0.0	0.0	0.0
602	802101	567	22.6	0.2	18.3	1.4	1.8	0.2	37.0	7.1	11.5	0.0	0.0	0.0	0.0
603	802001	108	40.7	0.9	0.0	25.0	18.5	0.0	14.8	0.0	0.0	0.0	0.0	0.0	0.0
604	802400	1055	43.3	0.3	0.3	2.7	0.9	0.6	29.0	8.2	14.8	0.0	0.0	0.0	0.0
605	802000	372	44.9	0.0	3.0	1.6	4.3	0.5	23.9	9.1	12.6	0.0	0.0	0.0	0.0
606	801901	1215	26.6	0.2	13.4	10.0	10.6	0.0	17.3	3.8	17.9	0.0	0.2	0.0	0.0
607	801902	1368	35.5	0.1	9.1	2.7	2.8	0.0	19.4	4.0	26.2	0.1	0.1	0.0	0.0
608	801701	281	27.8	0.0	8.2	1.4	3.6	0.4	29.2	11.4	18.1	0.0	0.0	0.0	0.0
609	801700	463	39.1	0.2	2.6	1.3	0.9	1.3	22.0	14.3	18.4	0.0	0.0	0.0	0.0
610	801900	953	58.6	0.1	1.7	0.7	0.8	0.5	20.3	8.5	8.8	0.0	0.0	0.0	0.0
611	801401	1510	26.2	0.1	1.8	3.5	1.1	2.9	28.9	17.8	17.7	0.0	0.0	0.0	0.0
612	801400	2187	24.5	0.1	1.1	0.6	0.6	1.0	18.6	11.0	42.6	0.0	0.0	0.0	0.0
613	801303	4149	20.6	0.1	0.7	0.5	0.3	0.2	16.7	17.2	43.7	0.0	0.0	0.0	0.0
614	801203	1707	34.8	0.1	4.2	0.4	0.7	0.5	26.8	11.7	20.8	0.0	0.0	0.0	0.0
615	801903	792	46.3	0.3	0.6	1.8	2.8	0.0	25.9	7.7	14.4	0.1	0.0	0.0	0.1
616	801202	1821	22.1	0.0	7.0	1.9	1.1	0.1	28.1	7.6	32.0	0.0	0.2	0.0	0.0
617	801201	1643	30.6	0.0	2.2	0.5	0.5	0.7	29.8	9.7	25.9	0.0	0.1	0.0	0.0
618	801200	3946	22.0	0.1	1.5	0.4	0.3	0.4	24.7	8.7	41.8	0.2	0.0	0.0	0.0
619	801100	473	12.7	0.0	0.0	0.2	0.6	0.6	24.3	32.6	29.0	0.0	0.0	0.0	0.0
620	801204	2796	16.1	0.1	2.6	0.4	0.4	0.6	24.4	13.2	42.3	0.0	0.0	0.0	0.0
621	801101	3557	21.1	0.3	8.4	4.3	3.6	4.3	39.2	6.5	7.8	0.1	4.2	0.0	0.0
622	801102	296	29.1	0.3	6.4	10.1	6.4	0.0	23.6	7.4	15.9	0.0	0.7	0.0	0.0
623	800700	16822	16.5	0.0	1.6	0.3	0.2	0.5	26.6	14.3	40.0	0.0	0.0	0.0	0.0
624	800600	10728	14.9	0.4	0.4	1.0	0.5	0.4	20.6	10.2	50.6	0.3	0.0	0.0	0.7

Table C3. Washington, D.C. Census Tract Results (cont'd.)

Tract No.	Tract ID	No. of Pixels	Percent of Area Classified Into												
			RSDS	RSDM	DISTRB	CM/IND	PKLOT	OPEN	AGRI	WDLND	TREES	WATER	RNWY	CLOUD	SHADOW
625	800800	13951	13.9	0.0	0.6	0.1	0.0	0.4	26.4	12.0	46.4	0.1	0.0	0.0	0.1
626	800900	736	6.4	0.0	0.7	0.0	0.1	0.0	24.3	9.0	59.5	0.0	0.0	0.0	0.0
627	801000	23965	12.1	0.2	1.3	0.4	0.2	0.2	17.0	8.3	60.3	0.1	0.0	0.0	0.1
628	999998	202	25.2	0.0	1.0	1.0	1.0	0.0	18.8	11.4	40.1	1.5	0.0	0.0	0.0
629	999998	1534	5.4	0.2	0.3	16.4	0.3	0.2	9.9	5.2	52.9	7.9	0.0	0.0	1.3
630	801300	11558	12.9	0.0	0.8	0.0	0.1	0.8	18.0	13.1	54.1	0.0	0.0	0.0	0.1
631	740300	150	34.0	3.3	0.7	10.0	3.3	1.3	36.0	6.0	5.3	0.0	0.0	0.0	0.0
632	701205	69	7.2	43.5	0.0	43.5	2.9	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0
633	9900	16	62.5	0.0	0.0	0.0	18.8	0.0	18.8	0.0	0.0	0.0	0.0	0.0	0.0
634	1400	276	19.6	6.5	1.1	25.7	2.9	10.1	27.2	0.4	0.0	6.5	0.0	0.0	0.0
TOTAL		1663246	16.6	0.6	1.2	18.2	0.5	1.0	18.4	6.1	27.0	9.3	0.0	0.3	0.7