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## USE OF ERTS-1 DATA FOR REGIONAL PLANNING IN THE METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS - A SHORT BRIEF

Harry J. Mallon, *Director, Remote Sensing Project, Metropolitan Washington Council of Governments*

### ABSTRACT

Land use and land use activity changes over discrete intervals of time represent basic data requirements in regional planning studies. This paper reports on two examples of land use analysis required by the Council of Governments' transportation planning staff. Both were undertaken utilizing remote sensing imagery analysis. One study using large scale aircraft imagery developed a high degree of analytical detail and functional identification. The other, to support further detailed data base evaluation, utilizing ERTS-1 and small scale aircraft imagery, developed data identifying in more general detail major activity changes within the metropolitan region.

### Introduction.

"Urban policy planning is a complex process of analysis, intervening in and managing the political conflict that is inextricably related to urban change. Research is needed into the structure of public policy making, characteristics of urban policy formulation and implementation, strategies and techniques of change-program management. New methods, new techniques and concepts of planning must be developed. If planners are to be effective policy analysts and change managers, they must receive cognitive inputs and skills for dealing with a complex policy making system ...."<sup>1</sup>

It would be presumptive to claim that the substance of this brief paper would meet the requirements pointed to in the referenced quotation. However, it will address itself to one of the basic ingredients necessary to support correct policy analysis and decision making, namely; current and uniform information on urban change, its early recognition, classification, and quantification, and will offer several examples of the introduction of imagery analysis techniques - using aircraft and ERTS-1 data - into the change analysis process.

## Data Development.

An integral element of the Metropolitan Washington Council of Governments is its Transportation Department. The department functions under the Council's Director, as the staff for the metropolitan area's Transportation Planning Board and other related Council of Governments' policy and technical committees. Its principal function is to data and studies, to prepared plans, and to develop strategies for use by the Board, other planning groups, and the elected officials of the metropolitan region to assist them in dealing with the transportation problems and needs of the region.

As would be expected, certain classes of information such as residential and housing data (location and type), population densities, location of accessible employment areas, transportation routes, route densities, and changes in these with respect to existing data bases, represent critical needs for survey and study, growth projections, and planning purposes.

In November 1972, the Remote Sensing Project was requested by the Transportation Department to provide data at two distinct levels of degree and detail in support of current studies. Both tasks were required in fairly short periods of time: two to three weeks.

The first was to develop from appropriate imagery, land use and related quantified data for comparative use with an existing 1968 data base, on two rapidly growing districts in Loudoun County, Virginia. Then, as an extension of this, the analysis was to be repeated on the same districts for the years 1970 and 1972.

Specific information required included: the delineation and measurement of land use ( to the second order of detail in the COG Land Use Classification Table, i.e., within a commercial classification, say, to identify offices, shopping centers, stores, filling stations, etc.; and in area, to the size, say, of a filling station); to plot these delineations on an appropriate scale map; to identify housing units by types; to estimate the numbers of corresponding dwelling units; and to determine the mileages of public rights-of-way by types (2,3,4 lane undivided and divided roads).

The second task was to prepare from imagery analysis, a generalized land use change map over the same periods of time for the entire metropolitan Washington region.

The data for the first task were developed from commercially available aerial photography using conventional stereoscopic imagery analysis supported

by field visits where needed. Photographic scales of about 1:30,000 were used, and because 1968 imagery of the region was not available (not an unusual situation) the analyses were performed only for the 1970 and 1972 periods. The land use data developed for these two periods are shown on the maps in Figures 1 and 2 respectively. Most of the developed area, it will be noted, is residential, the hatched areas of the same color representing new construction. As can be seen from the uncolored portions, these two districts are essentially rural or undeveloped in character, although in process of rapid and current change. The large residential areas in the lower central portion of the maps constitute the new communities of Sterling Park and Sugar Land Run Estates.

An interesting point of the analysis, possibly worthy of mention, is a method utilized for estimating the number of dwelling units in the garden-type, multi-family buildings in these areas. A composite floorspace figure in square feet was computed from the measured ground areas of the buildings and their heights in stories. Allowing for stair-wells and other non-residential building useage, a conversion figure of about 1500 - 1600 square feet per unit was used to convert floor space areas to corresponding numbers of dwelling units. For one garden apartment group, 370 dwelling units were estimated from the imagery, a figure which compares fairly well with the number of 380 units provided by the building management. Recognizing that wide variations are possible in the use of such factors, it was nevertheless interesting to note the fair agreement with data in other sources <sup>2</sup> for similar housing types.

The detailed analyses undertaken during the first of these two tasks and briefly described herein were important and necessary preliminary foundation stones for what was to be accomplished in the second task, namely; a region-wide land use activity change analysis. This task undertook to pin-point and to plot graphically those areas in the region which, during stated time periods, developed major growth/change patterns. This information would be used to provide data in support of transportation studies describing and structuring regional change, its impact, and also to evaluate the currentness of existing data from other sources on those areas experiencing the major changes.

Specifically, the task was to produce land use activity change maps at a regional scale of 1:96,000 for the periods 1970 and 1972. As stated previously, the time constraints were close: two to three weeks. This was much too short to plan for complete, new, large scale aerial photo coverage of the region's approximately 2500 square miles of area, even if the budget could have supported it (which it couldn't). What was available to the Project then for the analysis were two principal sources of imagery. For 1970, the excellent CARETS Mission of September 1970, flown in color IR by NASA for the USGS, was on hand on loan from the USGS. For the 1972 data, the ERTS-1 MSS black and white and color composited imagery of September 23rd and October 11th 1972 were available, having been recently purchased from the EROS Data Center at Sioux Falls, South Dakota.

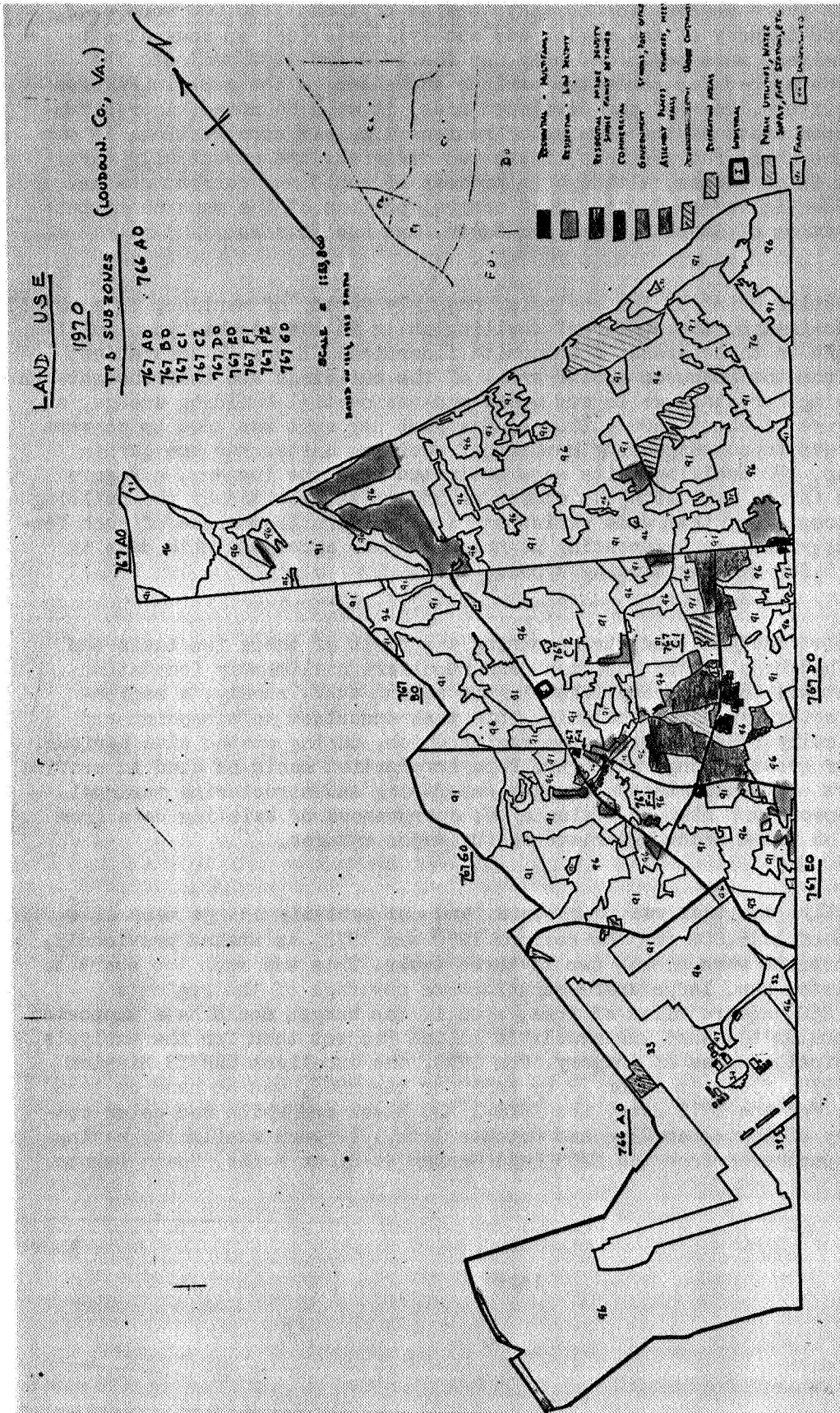


Figure 1. Land Use in TPB Districts 766 and 767, Loudoun County, Va., based upon 1970 imagery analysis.

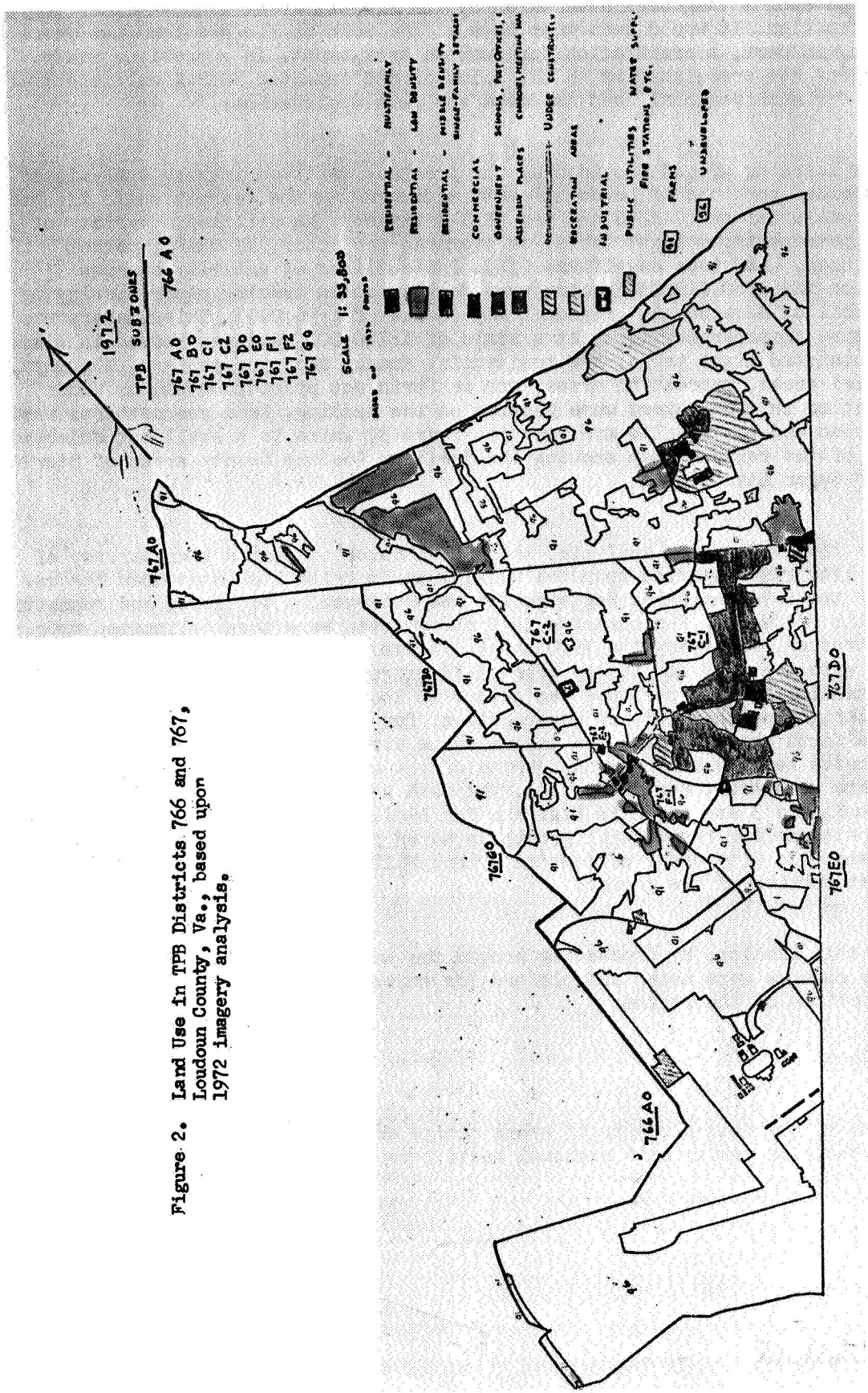


Figure 2. Land Use in TPB Districts 766 and 767, Loudoun County, Va., based upon 1972 imagery analysis.

Rarely had such a task been undertaken by the Project staff with a higher degree of anticipation. It would seem that some of the work of the previous two years had been, in part, a preparation for such an assignment. In a previous study, the Project had speculated as to the value of the expected ERTS-A multispectral returns for such regional land use data analysis applications. <sup>3</sup>

The learning ground provided by the previous detailed imagery analysis of the described portions of Loudoun County made smoother the transition to the much smaller scales of the CARETS and the ERTS-1 imagery. We utilized a variety of simple instruments: a light table, an overhead projector (VU GRAF), pocket stereoscopes, and tube magnifiers (7X). The outlines of activity changes visible on the 1970 CARETS imagery were delineated on tracing paper overlaying the Council of Governments' regional map (scale of 1:96,000). This imagery was in positive transparency form, at a scale of 1:120,000, and was viewed in stereo over a standard light table. New residential areas, shopping centers, highways, industrial areas, recreation areas, and so forth not present earlier or under construction in the imagery were plotted on the tracing. Land use patterns were color coded and the results are seen in Figure 3, which is a small but enlarged portion of the regional map showing the familiar Loudoun County areas of Sterling Park and Sugar Land Run.

For the 1972 change analysis, the ERTS-1 color composite transparency of October 11th was projected upon the wall, superimposing its image upon the results of the 1970 analysis. Registration was achieved by focussing and repositioning of the projector. The observed 1972 change data were then delineated upon a second tracing overlaying the 1970 sheet. It was necessary, of course, to work closely with the 1970 and the enlarged 1972 imagery to interpret cultural and other identities. As experience was gained in looking for distinctions in tonal values (bright patches for new construction, for example), and by continuous back and forth checking with the larger scale aircraft imagery, it was possible to delineate readily the prominent areas of new activity. Ground checks were made where necessary. For comparison, the same areas of Loudoun County seen above in Figure 3 are shown in Figure 4 for 1972. Figures 5 and 6 show similar change patterns for residential growth as noted for 1970 and 1972 in the Woodbridge and Dale City areas of eastern Prince William County, Virginia, in the southwest portion of the region.

In this fashion, by proceeding around the metropolitan area, similar activity changes were noted and plotted for areas in adjoining Maryland and other portions of the region.

### Conclusions.

Some of the data elements of urban change necessary for planner's study and related decision making on a regional basis seem to be at hand with the data

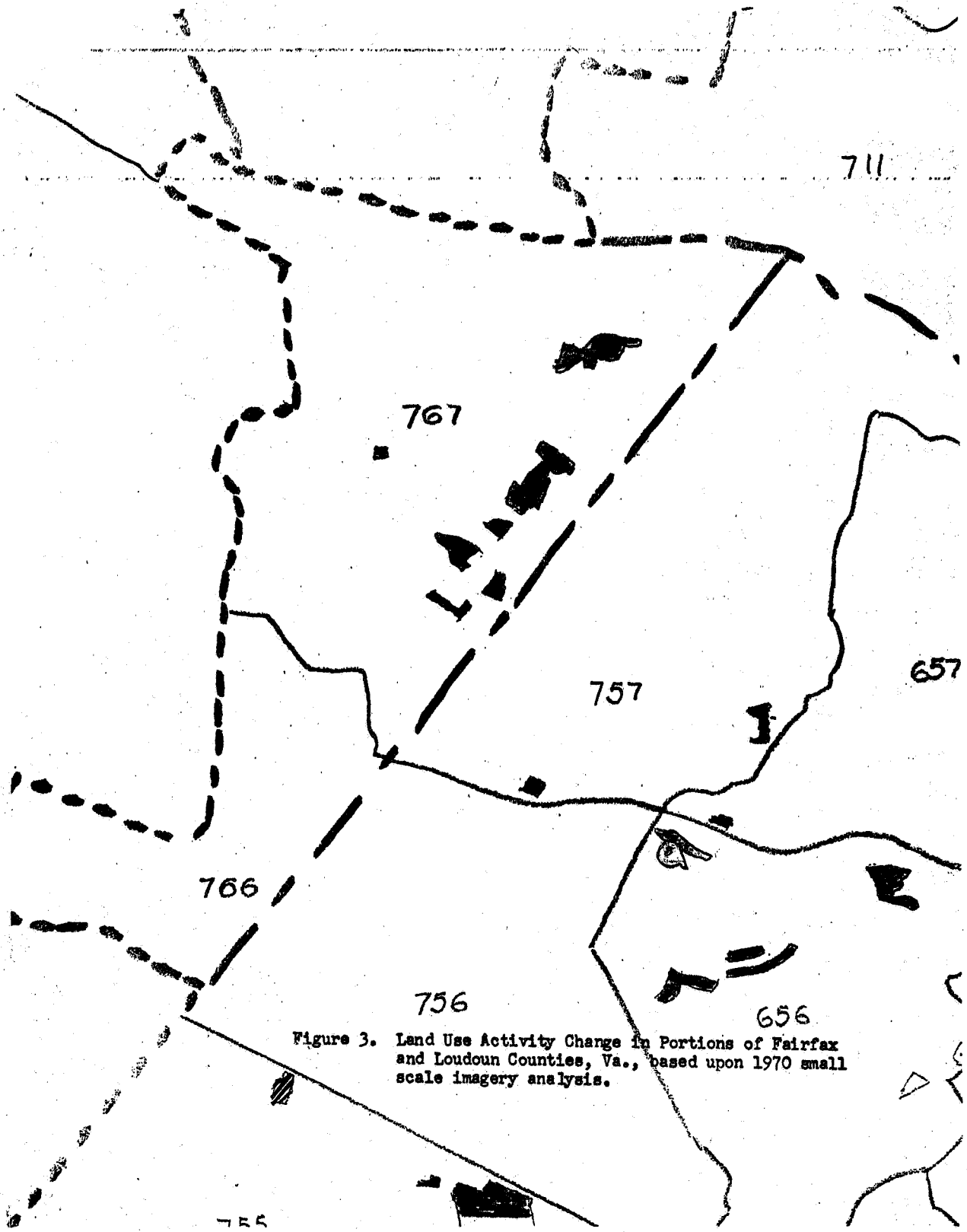


Figure 3. Land Use Activity Change in Portions of Fairfax and Loudoun Counties, Va., based upon 1970 small scale imagery analysis.

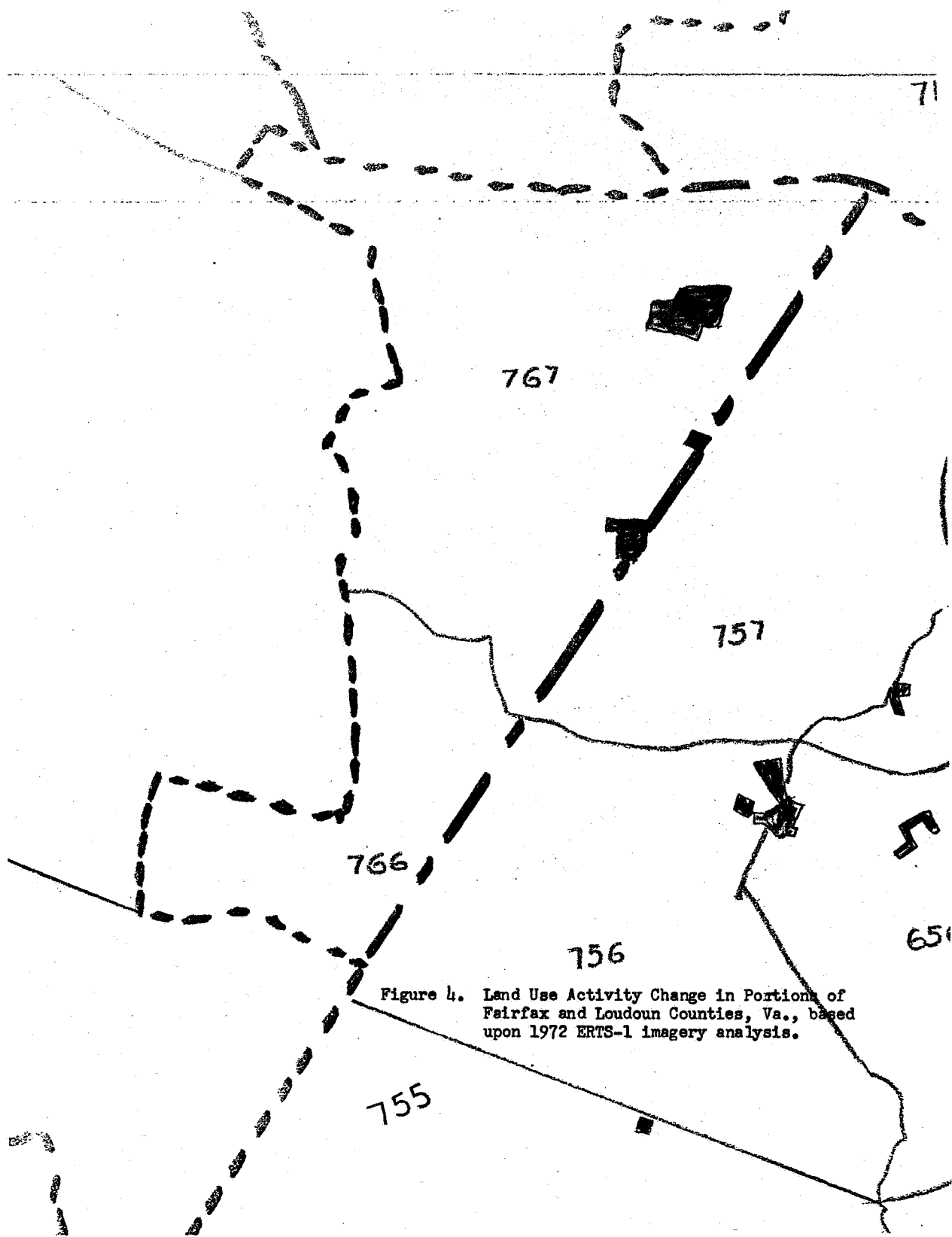


Figure 4. Land Use Activity Change in Portions of Fairfax and Loudoun Counties, Va., based upon 1972 ERTS-1 imagery analysis.



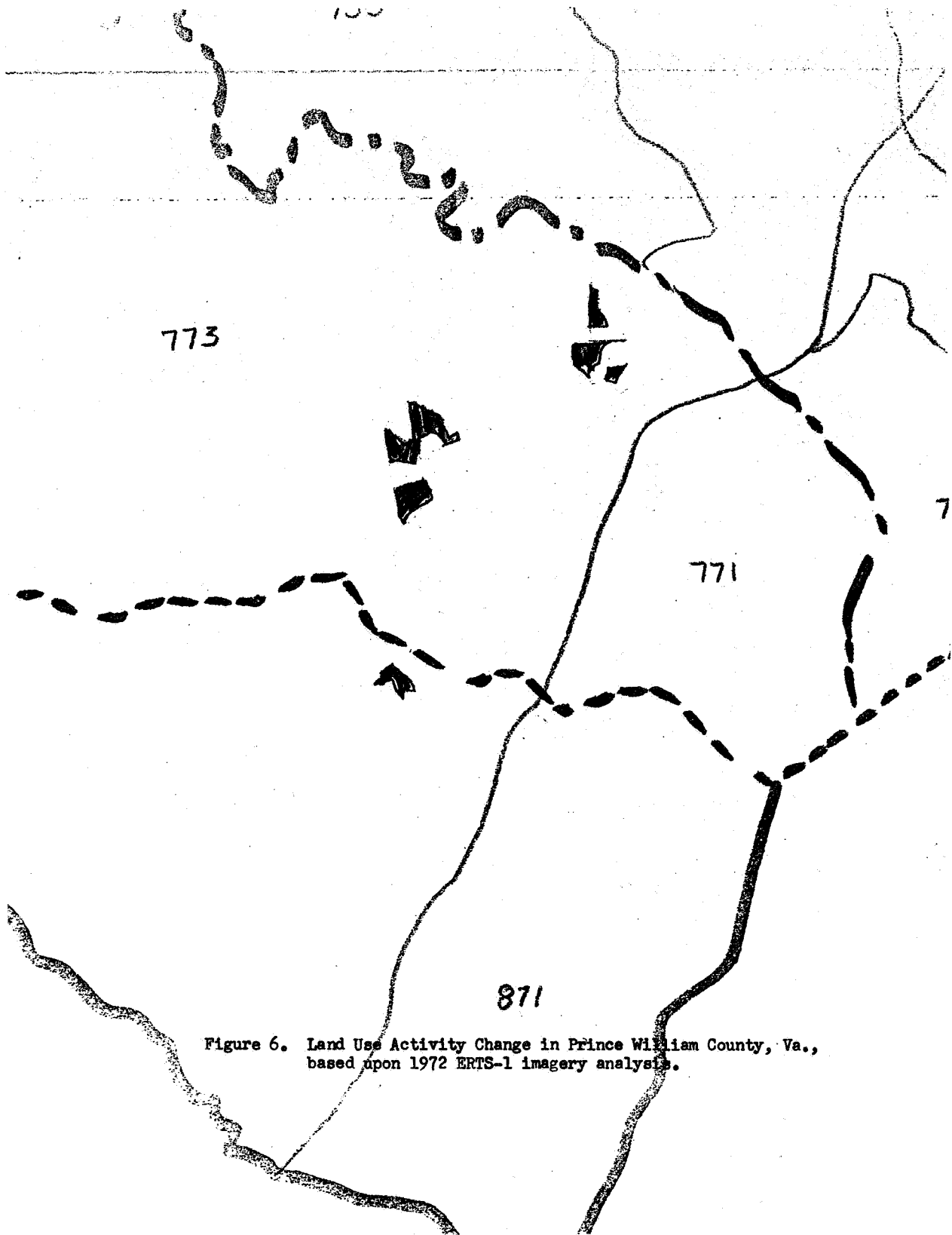


Figure 6. Land Use Activity Change in Prince William County, Va., based upon 1972 ERTS-1 imagery analysis.

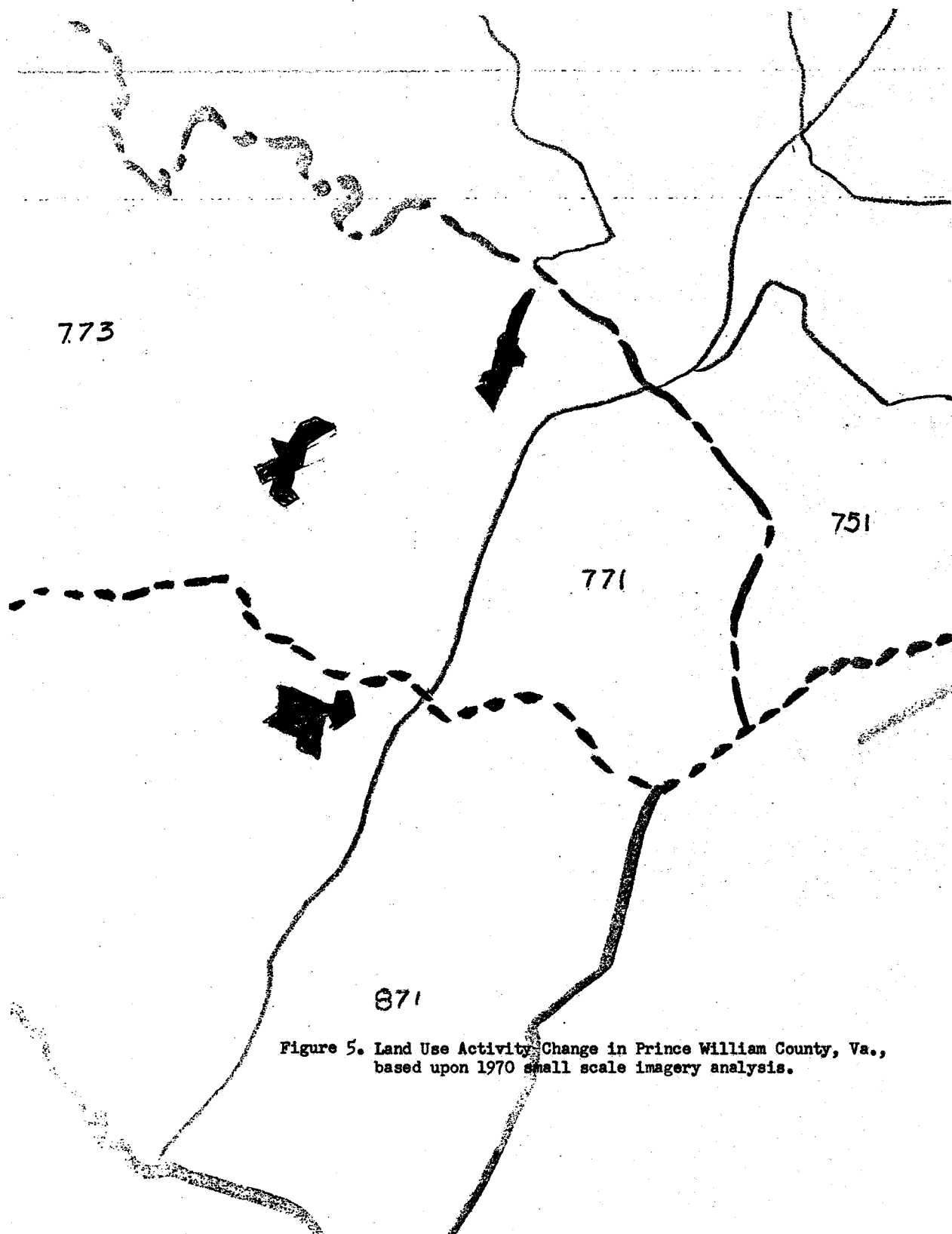


Figure 5. Land Use Activity Change in Prince William County, Va., based upon 1970 small scale imagery analysis.

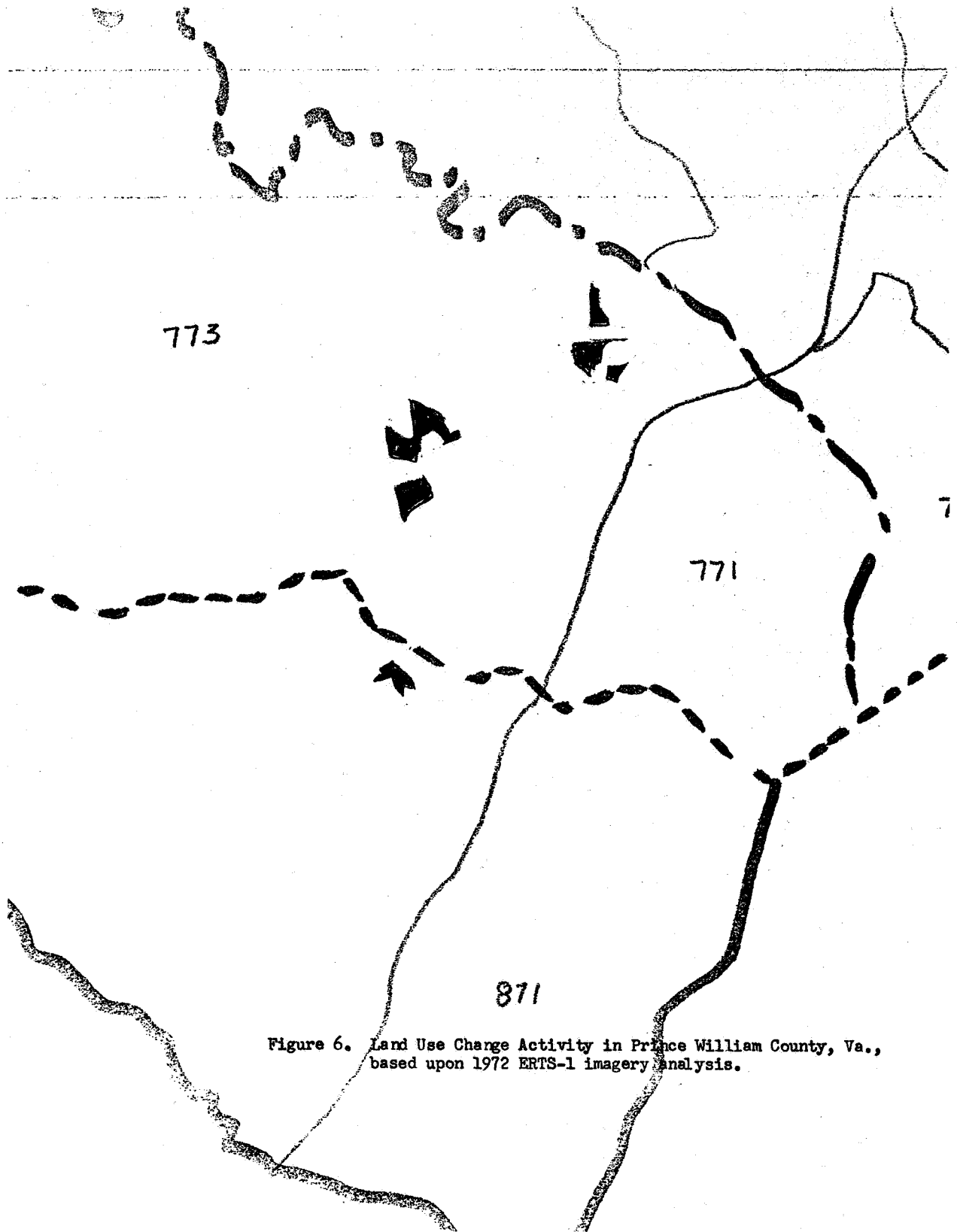


Figure 6. Land Use Change Activity in Prince William County, Va., based upon 1972 ERTS-1 imagery analysis.

made possible by manipulative analysis of the ERTS-1 imagery. It is timely, sequential, and uniform. This appears to be the case on the basis of the relatively simple and preliminary analysis described in the foregoing. It is particularly pleasant to offer this conclusion since it gives credence to several experimental designs for ERTS-A data utilization made in an earlier Project study<sup>4</sup>, with respect to regional land use, transportation, and general overall planning studies within the metropolitan area.

#### References.

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4. Mallon, H.J. and Howard, J.Y., 1972, Proposed Experimental Programs for Testing Remote Sensing Applications in the Metropolitan Washington Area, Technical Report No. 7, February 1972; prepared under terms of Contract No. 44-08-0001-12708 for the U.S. Geological Survey.