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LAND USE DETERMINATION
BY REMOTE SENSOR ANALYSIS

by

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ABSTRACT

TITLE: Land Use Determination by Remote Sensor Analysis

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SUBJECT: Land use inventory by analysis of aerial photography and comparison of results with data from parcel file land records

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ABSTRACT: A land use analysis of 18 selected census tracts in the Metropolitan Washington area using aerial photography was undertaken in this study. A comparison of the results was made with comparable land use data from the Metropolitan Washington Council of Governments' Parcel File, and the results reported. Summary conclusions and recommendations for the use of photo-derived data in land use studies by COG are made in this document.

LAND USE DETERMINATION BY REMOTE
SENSOR ANALYSIS

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INTRODUCTION

This study represents an element of research within the broad framework of the USGS-sponsored 1970 Census Cities Project as a geographic application of the NASA Earth Resources Program.

Its purpose is to describe the results of a land-use analysis study which examined and evaluated land useage patterns in selected portions of the Washington metropolitan area using aerial photography and compared them with data available in the Metropolitan Washington Council of Governments' land use parcel file.

The work provides expanded photo-derived data on land use in this metropolitan area. It complements the urban studies work conducted in-house by the Geographic Applications Program, U.S. Geological Survey and the USGS-sponsored research by the Institute of Urban and Regional Research, University of Iowa, which together are developing sizeable blocks of photo-derived data on this region.

The Washington metropolitan area is experiencing almost unparalleled growth. The needs for providing reliable, detailed, uniform, and complete data to regional and local planners on a timely basis and in such forms for ready analysis to support rational community growth decisions are more pressing than ever. Decisions relative to the optimum utilization of land, for example, are made daily at local jurisdictional levels. The long-term beneficial or adverse effects of many

of these decisions are often not immediately apparent. In some cases, even the short range results have had serious consequences. Current data must necessarily provide the basis for sound planning judgements. The increased use of computer technology for local and regional applications for record keeping, tax and other service billing routines, as well as for planning studies, all place great premiums upon reliable and current data.

The use of data derived from aerial photography by local jurisdictions and regional planning organizations, except for map-updating and general survey purposes, is of relatively recent origin. Some of the problems attending its less than wide use at present have been due to the difficulties of data extraction, lack of understanding of photo data potential, the form of these data as compared with other data sources, and, to some extent, the costs involved for periodic survey. Particular benefits in this connection are anticipated from NASA's ERTS (Earth Resources Technology Satellite) and follow-on satellite-derived imagery of Metropolitan Washington. Periodic coverage is expected to provide much needed data on changes in growth, drainage, vegetation, open spaces, and other related aspects of regional concern. As a consequence, work needs to be done to smooth the interface between use of conventional data systems and those data derived from remote

sensing systems if the fullest benefits are to be achieved from their coordinated use. This report attempts to contribute toward establishing this interface.

1. THE DATA

Land use analysis of 53 selected census tracts within the Metropolitan Washington Council of Governments Region using large (1:13,000) and small (1:50,000) scale imagery has been undertaken by the Geographic Applications Program (GAP), USGS and by University of Iowa teams. The criteria for selection of these tracts were developed by the GAP, USGS staff and considered population density, land use, employment areas, size, location, and other factors. The tracts selected represent a variety of "livelihood" areas (residential, suburbanizing, and non-urban areas) in the Washington metropolitan area.

An early suggestion was made to this Project by GAP, USGS, to consider undertaking a land use analysis of census tracts on the Northern Virginia side of the metropolitan area. The data, as developed, would round out the scope of overall analysis in the area and help finish work started previously by the GAP team. This suggestion has proved to be sound because of the variety and usefulness of data obtained; the insights and familiarization gained by the COG team with land patterns of the Virginia suburbs; and because the inventorying of land use in the tracts analyzed has provided the detailed basis for a follow-up land use change detection study.

Eighteen census tracts in Fairfax and Arlington Counties

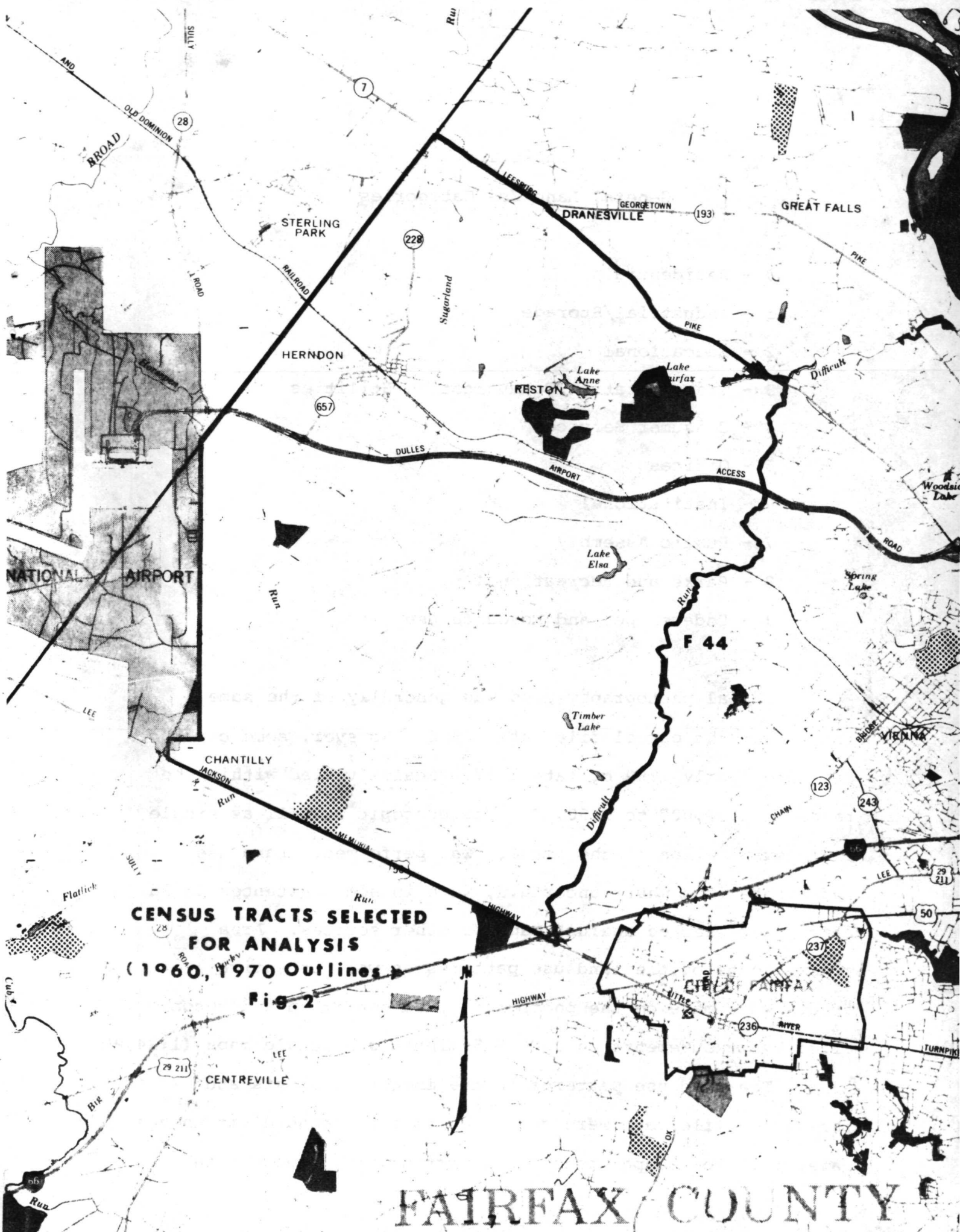
and the cities of Alexandria and Falls Church were selected for analysis (see Figures 1 and 2). Factors entering into the selection of the tracts were as follows: (1) Previous GAP sampling of 53 "livelihood" areas (residential, suburbanizing, and non-urban areas) in the Washington metropolitan area, (2) location and the nature of the tracts, (3) need for comparability of 1960 and 1970 census tract outlines as basis for COG parcel file data extraction and for subsequent land use change detection studies, (4) availability of aerial photography (1968 coverage) covering these tracts, and, to some extent, (5) likelihood of change or stability in the tracts selected.

The land use data for each census tract was obtained in print-out form from the Council of Governments' parcel file. These data were derived from local real estate assessment records of the 1968 period and improved by subsequent COG re-analysis. Designation of land useage is by a 2-digit code¹ utilizing the COG General Land Use Categories. In this code, the first digit describes the principal functional use category and the second digit, a second order of subordination. For example, "0" is Residential, "01" is Single-family, "02" is Multi-family, "03" is Rooming Houses and so forth. Industrial is "1", Educational is "2", and other first order functional categories are shown in Table 1.

1.

See Appendix: Metropolitan Washington Council of Governments General Land Use Categories.





**CENSUS TRACTS SELECTED
FOR ANALYSIS
(1960, 1970 Outlines)**
Fig. 2

FAIRFAX COUNTY

Table 1
General Land Use Categories

- 0 - Residential
- 1 - Industrial/Storage
- 2 - Educational
- 3 - Transportation/Communication/Utilities
- 4 - Consumer Services
- 5 - Offices
- 6 - Institutional
- 7 - Public Assembly
- 8 - Parks and Recreational
- 9 - Undeveloped and Resource Use

Aerial photography used was generally of the same vintage as the parcel file data; 1968. However, some coverage was dated early 1969 or late 1967. Scales varied within the range of 1:13,000 to 1:50,000. Stereoscopic as well as single frame examination of the imagery was performed. Land use interpretations, where uncertain, were in some instances field checked or checked against maps or other sources. Area measurements of the land use patterns as well as entire tracts were made on the photography and confirmed and reconciled by measurements on USGS 7.5-minute quadrangle maps (1:24,000).

The land use patterns in the imagery analysis and the parcel file data were described to the second digit useage category. For comparisons and reporting, the useage data

and their areas (expressed in acres) obtained from the parcel file and imagery analysis were summed within each census tract to the more general, first digit, land use category. These data are discussed in detail in the following section.

For ready orientation and geographic reference, the tracts analyzed in this study are shown in Figures 1 and 2.

2. THE ANALYSIS

Tables 2 through 6 contain the summation of data by census tract developed during this analysis. The table format, developed by the University of Iowa team in a previous study, has been used essentially without modification for convenient data comparisons. The columns for each indicated census tract contain the areas (in acres) of land use by categories (as expressed by the digits along the top row). Areas of land useage from the COG parcel file are given in the first line of data; corresponding areas of land useage as identified in the remote sensing analysis in the second. The numerical comparisons are given in lines 3 and 4. The percentage differences are expressed in terms of the remote sensing area data as the base for comparison.

In the following sections, data comparisons will be discussed first by census tract and secondly by major land use category.

Figures 3-7 depict and illustrate land use delineations on census tracts R-29, R-30, F-6, A-3, A-15, FC-1, and FC-2,

TABLE 2

LAND USE COMPARISONS

Land Use Categories*

(Area data expressed in acres)

Census Tract	Data Source	0	1	2	3	4	5	6	7	8	9	Total Tract Acres
		Residential	Industrial	Educational	Trans./Comm./Utilities	Consumer Services	Offices	Institutional	Public Assembly	Recreational	Un-developed	
R-2	COG	520.9	0.1	37.3	0.2	13.2	11.2	0.0	9.9	18.9	25.9	639.1
	R.S.	699.4	0.0	34.0	0.0	15.9	4.1	0.0	8.1	17.8	20.7	800.0
	Diff.	-178.5	+0.1	+3.3	+0.2	-2.7	+7.1	0.0	+1.8	+1.1	+5.2	-160.9
	%Diff.	25.5	-	9.7	-	17.2	173.0	0.0	22.2	6.2	25.2	20.1
R-10	"	168.1	0.0	19.7	0.5	4.7	0.0	0.0	1.9	6.1	4.8	205.8
		211.5	0.7	19.3	0.0	7.4	1.1	0.0	2.1	2.5	7.7	252.4
		-43.4	-0.7	+0.4	+0.5	-2.7	-1.1	0.0	-0.2	+3.6	-2.9	-46.6
		20.6	100.0	2.1	-	36.5	100.0	0.0	9.5	144.5	37.7	18.5
R-18	"	218.5	0.0	2.2	4.6	27.4	7.5	0.6	2.7	4.7	15.3	283.5
		310.9	0.0	3.8	33.7	26.6	11.6	0.0	1.4	4.8	7.5	400.3
		-92.4	0.0	-1.6	-29.1	+0.8	-4.1	+0.6	+1.3	-0.1	+7.8	-116.8
		28.9	0.0	42.1	86.4	3.1	35.4	-	92.8	2.1	105.5	29.1
R-22	"	118.8	0.0	9.0	0.0	7.3	0.0	0.0	1.9	0.0	5.3	142.3
		152.4	0.0	9.6	0.0	6.2	0.0	0.0	1.9	30.7	12.5	213.3
		-33.6	0.0	-0.6	0.0	+1.1	0.0	0.0	0.0	-30.7	-7.2	-71.0
		22.0	0.0	0.2	0.0	17.7	0.0	0.0	0.0	100.0	57.6	33.3
*Metropolitan Washington Council of Governments Land Use Categories		1. COG Land Use Parcel File						2. Remote Sensing				

TABLE 3

LAND USE COMPARISONS

Land Use Categories*

(Area data expressed in acres)

Census Tract	Data Source	0	1	2	3	4	5	6	7	8	9	Total Tract Acres
		Residential	Industrial	Educational	Trans./Comm. & Utilities	Consumer Services	Offices	Institutional	Public Assembly	Recreational	Un-developed	
R-25	COG	106.3	0.0	12.7	3.8	11.8	1.1	0.0	1.3	1.8	20.1	158.9
	R.S.	143.0	0.0	15.9	10.2	21.3	3.7	39.6	1.4	3.0	9.5	247.6
	Diff.	-36.7	0.0	-3.2	-6.4	-9.5	-2.6	-39.6	-0.1	-1.2	+10.6	-88.7
	%Diff.	25.6	0.0	20.1	62.7	46.8	70.3	100.0	7.1	40.0	111.8	35.8
R-29		136.4	49.7	9.8	5.9	26.7	0.9	0.0	2.0	29.9	33.2	288.5
	"	153.1	43.9	10.2	18.9	58.1	0.0	0.0	2.6	24.6	37.0	348.4
		-16.7	+5.8	-0.4	-13.0	-31.4	+0.9	0.0	-0.6	+0.7	-3.8	-59.9
		10.9	13.2	39.2	68.8	54.0	-	0.0	23.1	2.8	10.3	17.2
R-30		130.6	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.8
	"	152.6	0.0	8.0	22.3	0.0	0.0	0.0	0.0	10.6	9.5	203.0
		-22.0	0.0	+0.2	-22.3	0.0	0.0	0.0	0.0	-10.6	-9.5	-64.2
		14.4	0.0	2.5	100.0	0.0	0.0	0.0	0.0	100.0	100.0	31.7
R-34		19.8	30.4	0.0	0.2	5.5	35.5	2350.0	0.0	0.0	8.2	2499.1
	"	5.1	107.1	0.0	1190.9	3.4	43.9	811.0	31.1	38.9	511.9	2743.3
		+14.7	-76.7	0.0	-1190.7	+2.1	-8.4	+1539.0	-31.1	-38.9	-503.7	-294.2
		289.0	71.6	0.0	99.9	61.8	19.2	189.5	100.0	100.0	98.5	10.7
*Metropolitan Washington Council of Governments Land Use Categories		1. COG Land Use Parcel File										2. Remote Sensing

TABLE 4

LAND USE COMPARISONS

Land Use Categories* (Area data expressed in acres)												
Census Tract	Data Source	0	1	2	3 Trans./ Comm./& Utilities	4 Consumer Services	5 Offices	6 Institu- tional	7 Public Assembly	8 Recrea- tional	9 Un- developed	Total Tract Acres
F-6	COG ¹	1094.0	0.0	41.2	26.8	67.5	0.4	0.0	99.8	565.2	757.1	2652.
	R.S. ²	1771.4	0.0	63.8	23.6	26.0	0.0	0.0	125.2	101.9	1497.2	3609
	Diff.	-677.4	0.0	-22.6	+3.2	+41.5	+0.4	0.0	-25.4	+463.3	-740.1	-975.
	%Diff.	38.2	0.0	35.5	13.6	159.8	-	0.0	20.3	456.0	49.5	27.
F-11	"	842.9	0.0	47.1	20.7	22.2	0.5	0.0	24.6	25.8	452.2	1436.
		1023.4	0.0	40.4	15.6	23.8	1.0	161.0	8.3	14.5	456.0	1744.
		-179.1	0.0	+6.7	+5.1	-1.6	-0.5	-161.0	+16.3	+11.3	-3.8	-307.
		17.5	0.0	16.6	32.7	6.7	50.0	100.0	196.5	78.0	0.8	17.
F-17		768.9	0.0	37.3	0.0	65.0	8.1	5.8	8.9	0.0	14.3	908.
		734.2	0.0	42.1	0.0	61.1	1.0	1.0	6.7	0.0	81.0	927.
		+34.7	0.0	-4.8	0.0	+3.9	+7.1	+4.8	+2.2	0.0	-66.7	18.
		4.7	0.0	11.4	0.0	6.4	710.0	480.0	32.9	0.0	82.4	2.
F-44		2100.9	463.1	75.7	88.5	70.9	46.2	2504.1	38.5	455.1	23,403.8	29,246.
		1982.1	110.1	79.2	707.7	18.3	17.5	14.3	15.9	807.4	27,231.8	30,984.
		+118.8	+353.0	-3.5	-619.2	+52.6	+28.7	+2489.8	+22.6	-362.3	-3828.0	-1737.
		5.9	318.0	4.4	87.3	288.0	163.5	17,400.0	142.2	44.9	14.1	5

Metropolitan Washington Council
of Governments Land Use Categories

1. COG Land Use Parcel File

2. Remote Sensing

TABLE 5

LAND USE COMPARISONS

Land Use Categories*

(Area data expressed in acres)

Census Tract	Data Source	0.	1	2	3	4	5	6	7	8	9	Total Tract Acres
		Residential	Industrial	Educational	Trans./Comm./& Utilities	Consumer Services	Offices	Institutional	Public Assembly	Recreational	Un-developed	
A-1	COG	354.9	6.5	0.0	0.0	2.7	0.0	3.1	0.0	0.0	439.2	1006.3
	R.S.	512.8	8.6	22.9	57.1	9.8	3.4	5.7	7.6	0.0	565.3	1193.2
	Diff.	-157.3	-2.1	-22.9	-57.1	-7.1	-3.4	-2.6	-7.6	0.0	-126.1	-186.9
	%Diff.	30.7	24.4	100.0	100.0	72.5	100.0	45.6	100.0	0.0	22.3	15.7
A-3		283.4	0.0	0.0	0.0	32.3	0.5	0.0	0.0	5.6	191.1	534.7
	"	342.1	0.0	49.4	50.3	63.1	1.0	0.0	0.3	14.7	179.2	700.1
		-58.7	0.0	-49.4	-50.3	-30.8	-0.5	0.0	-0.3	-9.1	+11.9	-165.4
		17.2	0.0	100.0	100.0	48.8	50.0	0.0	100.0	61.9	6.6	23.6
A-4		139.6	68.5	0.0	1.9	26.0	0.0	0.0	0.0	2.3	671.5	964.1
	"	115.4	162.2	3.8	29.1	38.4	2.8	104.1	0.0	7.5	551.0	1014.2
		+24.2	-93.7	-3.8	-27.2	-12.4	-2.8	-104.1	0.0	-5.2	+120.5	-50.1
		20.9	57.7	100.0	93.5	32.3	100.0	100.0	0.0	69.3	21.9	4.9
A-15		174.9	0.0	0.0	0.0	1.2	0.1	0.0	0.0	0.0	53.9	230.1
	"	246.3	0.0	4.9	2.8	3.4	1.5	15.3	7.3	1.9	22.5	305.9
		-71.4	0.0	-4.9	-2.8	-2.2	-1.4	-15.3	-7.3	-1.9	+30.4	-75.8
		28.9	0.0	100.0	100.0	64.6	93.3	100.0	100.0	100.0	135.0	24.8

Metropolitan Washington Council
of Governments Land Use Categories

1. COG Land Use Parcel File

2. Remote Sensing

TABLE 6

LAND USE COMPARISONS

Land Use Categories*

(Area data expressed in acres)

Census Tract	Data Source	0	1	2	3	4	5	6	7	8	9	Total Tract Acres
		Residential	Industrial	Educational	Trans./Comm./Utilities	Consumer Services	Offices	Institutional	Public Assembly	Recreational	Un-developed	
FC-1	COG	188.3	2.0	3.9	4.8	28.7	10.5	3.0	5.7	2.0	17.8	273.2
	R.S.	259.4	0.0	0.0	17.7	44.6	10.5	0.0	12.9	0.0	9.6	354.1
	Diff.	-71.1	+2.0	+3.9	-12.9	-15.9	0.0	+3.0	-7.2	+2.0	+8.2	-81.1
	%Diff.	27.5	-	-	72.8	35.6	0.0	-	55.8	-	85.5	23.1
FC-2		287.5	1.1	5.8	5.3	25.9	13.5	0.0	4.0	5.8	14.1	368.1
		406.0	0.0	4.7	4.7	30.5	4.7	0.0	4.8	4.8	4.8	462.1
		-118.5	+1.1	+1.1	+0.6	-4.6	+8.8	0.0	-0.8	+1.0	+9.3	-93.1
		29.2	-	23.4	12.8	15.1	187.5	0.0	16.7	20.8	193.5	20.1

1/ 6.4 acres unassigned

2/ 5.7 acres unassigned

*Metropolitan Washington Council of Governments Land Use Categories

1. COG Land Use Parcel File

2. Remote Sensing

as determined in this analysis. Varying scales of photography and requirements for modicking and reproduction precluded similar illustrations for all tracts analyzed.

ANALYSIS BY CENSUS TRACTS

Arlington County

Tract R-2. This is a fairly settled community. Data from the COG parcel file and remote sensing sources are in close agreement. No major land classification problems were noted. The total tract area as measured on the photos and map is about 20 percent in excess of that reported in the COG parcel file. This represents a reasonable figure to attribute to areas occupied by streets and roads (not otherwise categorized in the Transportation category column - 3). The percentage is roughly equal to the corresponding difference within the Residential - 0 category. The comparative data for Consumer Services - 4 and Offices - 5 are at some variance. This would be expected from the nature of such similar functional building types.

Tract R-10. Both sets of data are in fairly close agreement, closer than expected. Streets and roads would be expected to contribute somewhat more acreage to the tract than is apparent. In the residential category the difference seems to be normal. In all categories, reported land use is essentially as observed in the photography. About 7 acres more of Offices - 5 useage are reported in the parcel file records than in the photo-derived data.

Tract R-18. The Transportation - 3 category has considerably more acreage visible in the photography than is listed in the parcel file data. Here, specifically, the rights-of-way occupied by Fort Myer Drive and Washington Boulevard contribute considerable amounts of visible land useage to this category. Additional amounts of transportation land useage reported in the remote sensing column are from commercial parking lots adjacent to shopping centers. The parcel file area data suggests that perhaps these lots are included with the Consumer Services - 4 (commercial activities, etc.).

Tract R-22. Except for a large park area of approximately 3 acres along Four Mile Run (which the parcel file data does not record) and a difference of 11 acres in open space (essentially along the same flood plain), both sets of data are in fairly close agreement. Educational - 2, Consumer Services - 4, and Public Assembly - 7, are within 1 percent of each other.

Tract R-25. Of the nine categories of land useage described within this tract, the principal differences between the data sets are in the Public Assembly - 7, Transportation - 3, Consumer Services - 4 and Undeveloped Land - 9. In the first case, 40 acres, which are part of Defense Department installations south of Fort Myer and west of the Pentagon, are not carried in the parcel file data. These are carried in the remote sensing data as Military Installations (category 68). In the Transportation category - 3, most of the difference in the two data sets is due to the land used as highway rights-of-way along Washington Boulevard and the large interchange

at Columbia Pike and the Washington Boulevard, as well as to additional parking areas in the tract. About 10 acres of additional commercial land useage under Consumer Services - 4 are reported in the photo-derived data than are shown in the parcel file records. About ten acres more of open space are recorded in the photo-derived data than listed in the parcel file set.

Tract R-29. See Figure 3. Both data sets, in nearly all land use categories, are in fair agreement with each other. Two categories, Transportation -3 and Consumers Services - 4, both contain more acreage in the remote sensing data than in the parcel file. The differences are 13 and 35 acres respectively. This is a relatively small census tract in the Shirlington area so that these differences represent about 4 and 10 percent respectively of the total measured tract area.

Tract R-30. See Figure 3. Recreational - 8, Undeveloped - 9, and Transportation - 3 categories represent the three principal items of difference between the two data sources. The differences are respectively: about 11, 10 and 22 acres for which there are no corresponding data in the parcel file. The transportation land use data from the remote sensing source is almost entirely attributable to Interstate Route 95 passing along the edge of this tract. Playground and open space account for the differences in the other two categories.

LAND USE PATTERNS

CENSUS TRACTS R-29 and R-30

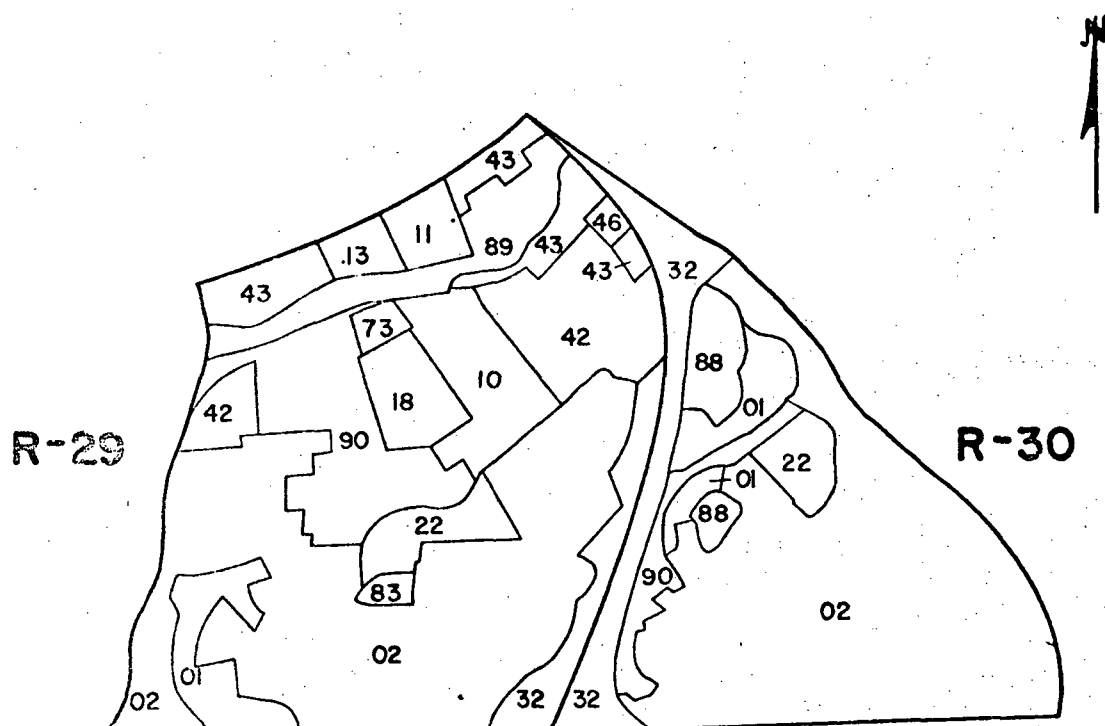


Figure 3

Tract 34. This is the largest census tract in Arlington County - about 2700 acres and the second largest among those selected for analysis in this study. The tract embraces National Airport, the Pentagon, Arlington National Cemetery, Fort Myer, the surrounding road and highway systems, part of the large railroad yard system along the west side of the Potomac River, and the surrounding commercial, industrial, and open spaces in that area. Except for the three categories, Residential - 0, Consumer Services - 4, and Offices - 5, for which the results from the two data sources are in fairly close agreement, none of the data for the balance of the categories compare well. The total tract area figures from both sources are, however, reasonably close, about 11 percent of each other. The Institutional category - 6 represents the greatest difference between the two data sets - about 1500 acres. Both the parcel file and the remote sensing data report the Federal military installations in this tract as being in the Military Category - 68. However, in addition, the area embraced by National Airport seems also to have been included in the military category within the parcel file as there is no indication that it has been included within the Transportation - 3 category. The photo analysis does not delineate the military installations and categorize them entirely as such. Within areas of Fort Myer and Arlington National Cemetery, for example, additional visible

functional uses are identified and reported, such as unused areas and national monuments (Amphitheater, the Iwo Jima Monument, open space, etc.). These designations diminish the total area of military land useage in the remote sensing data, and, of course increases the relative variation between the two data sources. Similarly, the large Pentagon parking areas and its heating and sewage plants have been classified in the remote sensing data within the appropriate Transportation and Utilities - 3 category. Within this tract the Institutional - 6 category has apparently been used in parcel file source data to lump all Federally owned lands regardless of specific functional use. The Transportation category - 3 also contains significant differences of land use acreage (about 1200) between the two data sources. The parcel file reports less than one acre of such useage. The photo-derived data within this category contain the acreage of National Airport (about 727), highway and road rights-of-way (about 300) and the balance of about 160 acres devoted to large parking areas around the Pentagon and National Airport. Other principal differences in the data sets include: 31 and 39 acres respectively in the Public Assembly - 7 and Recreational - 8 categories for which no acreage is recorded in the parcel file. In the Undeveloped category - 9, about 510 acres are observed as open spaces in the remote sensing data while about 9 are recorded in parcel file records. A large wildlife sanctuary consisting of about 150 acres is observed in the photo data and is so reported.

Fairfax County

Tract F-6. See Figure 4. The total tract areas from the two data sources differ by about 950 acres. About 320 acres of these are water areas within the tract (portions of Dogue and Little Hunting Creeks). It is not possible at this point to explain the balance of the difference in the total areas. In the Residential category - 0, there are about 677 acres more in the photo-derived data than in that from the parcel file. This is in excess of what has been the observed difference between the sets. About 40 acres used for a mobile home park are observed in the photography and are not included in the parcel file data. On the other hand, while not affecting the difference between the two residential area figures, there are about 17 acres of multi-family housing reported in the parcel file data while the photo-derived analysis reports none. About 40 more acres of Consumer Services - 4; are reported in the parcel file than in the remote sensing data. With respect to the Educational category - 7, there is a difference of about 22 acres. This is high on the remote sensing side. The difference is probably attributable to outline delineation differences because all the school areas within this tract have been accounted for in both data sets. Comparisons between the Recreational - 8, Public Assembly - 7, and Undeveloped - 9 categories are interesting. Much of the difference between the two data sources is due to the classification of Mount

LAND USE PATTERNS

CENSUS TRACT F-6

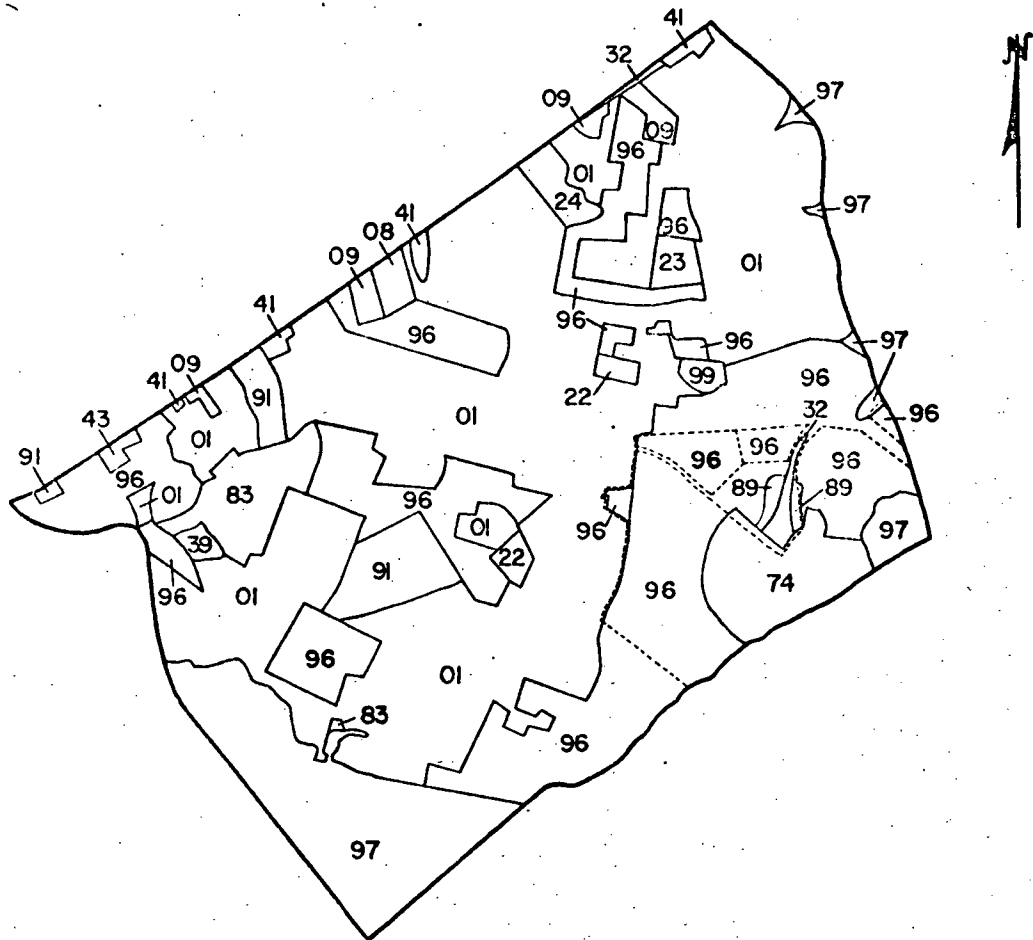


Figure 4

----- MOUNT VERNON
PROPERTY LINE

Vernon. The parcel file classified the tract as Recreational - 8, while the photo-derived data categorized it as an Historic Site (74) under Public Assembly - 7. The outlined area of Mount Vernon is delineated on the sketch by the dotted line; it consists of about 500 acres (488 acres in parcel file records). The outline of the site delineated by remote sensing analysis describes what appears to be the public visitation areas of the tract (125 acres) as well as those areas categorized as open and undeveloped land and road and highway rights-of-way. The principal differences between the data sets in this respect are due to those useage areas described by visible outlines and those described by ownership outlines.

Tract F-11. The data from the two data sources are in fairly close agreement. Residential acreage is higher in the photo-derived data by a figure (17%) well within the usual range. The major difference noted is in the Institutional category - 6, in which a large cemetery comprising some 160 acres is reported from the imagery, but is not reported in the parcel file. More acreage is occupied by churches and parks as reported in the parcel file data than in that from the photography; about 16 and 11 acres respectively. There is most likely more church-owned property listed in the parcel file than is visible and reportable from the imagery.

Tract F-17. The total areas as well as the useage delineations from the two data sources do not appear to differ too much for this tract, except in two instances. The Residential category - 0 seems to contain a considerable difference. There is less residential area in both the single and multi-family residential categories in the photo-derived data than reported in the parcel file data records. This is unusual. There are four sizeable enclaves of multi-family residential occupancy in this tract. The bulk of the tract except for a commercial fringe is almost (80 percent) entirely single-family residential in character - much of it built around Lake Barcroft. Yet parcel file records indicate an excess of multi-family occupancy than is visible in the imagery - about 50-50 distribution of single - and multi-family useage patterns. Educational - 2 and other categories are reasonably close. The Undeveloped category - 9 represents another large point of difference (about 67 acres) between the data sets. However, about 33 acres of this is the water area of Lake Barcroft.

Tract F-44. This census tract is the largest of those sampled in this analysis - with an area of approximately 30,000 acres. The tract is bounded by Dulles International Airport, the Loudoun - Fairfax County line, Virginia State Route 7 (Leesburg Pike), U.S. Highway 50, and Difficult Run. It contains much open area, considerable farm land, recreational facilities, and has a growing residential character. Reston falls within the tract. As with the other large tract, R-34 in Arlington County, many land useage activities were observed, as were considerable differences in land use designations between the two data sources. Its analysis presented the most problems. The photography was flown at different altitudes with different focal lengths and orientations. Mosaicking the photos was difficult. About 12 photographic prints covered the tract. Some of which were provided by USGS, the balance were purchased. The total area measurements of the tract were preformed on the photography with appropriate scale conversions. For control, (as with all other census tracts) comparable measurements were made on 6 USGS 1:24,000 scale 7.5-minute quadrangle maps. The total tract area as measured on the photo prints was 30,984 acres. The area as measured on the USGS maps was 30,350 acres. This difference of about 600 parts in 30,000 or 1 part in 50 was considered to be acceptable; the photo-derived data, therefore, were used without adjustments. The tract area from the parcel file records is approximately 29,250 acres. This degree of agreement is unusual, perhaps too close (6 percent). The usual differences in the two data

sets attributable to roads and highways (and other increments of land frequently not included in parcel data), has generally been higher. With the exception of the Educational Category - 2, in which there is good agreement between the two data sets (3.5 acres in about 80 acres all total), the other categories of land useage, as reported in the parcel file and remote sensing sources, differ substantially. Remote sensing data reports less (by about 120 acres) of Residential - 0 land useage than does the parcel file. However, single-family dwelling acreage was high by 25 acres in the remote sensing data, but multi-family acreage was about 145 acres lower than the parcel file records. The latter difference seems most unusual in such a rural/suburban area. It suggests doubling up by multi-family occupancy in otherwise single-family-type dwellings. The number of multi-family structures within this census tract is largely concentrated in the Reston area, and most of these have been accounted for in the analysis. The largest differences in the two data sets are shown in the Undeveloped - 9 and the Institutional - 6 categories. In the former, the photo-derived data was high by about 3800 acres; (though the agricultural acreage in both data sets was very close). In the latter, the parcel file data was high by about 2500 acres. Inquiry into the parcel file records reveals a parcel of about 2500 acres in Fairfax County east of and adjacent to the Dulles International Airport which has been categorized as Institutional - "Government Services", (Category 60) and is land probably

dedicated to future service use for the Airport. At present it is visibly being used as farm land, residential, or is open land - and is so described and categorized in the photo-derived data. Another large difference between the data sources (about 620 acres) is noted in the Transportation category - 3. The tract is dissected by several large rights-of-way: The Dulles Access Highway, the abandoned Old Dominion Railroad line, and several power and pipeline routes. Only 89 acres of this useage category are reported in the parcel file. In both the Industrial - 1 and the Recreational - 8 categories there are differences of about 350 and 360 acres respectively, with the parcel file being high in the first case, and the photo-derived data being high in the second. It would appear that more land was dedicated for industrial use than was actually in such use at the time of photography. With respect to Recreational - 8 useage, the bulk of the difference is attributable to two large areas not being included in the parcel file data. One of which is the County-owned park, Lake Fairfax, and the other, the privately owned International Town and Country Club. Consumer Services - 4, Offices - 5 and Public Assembly - 7 (churches, etc.) account for the balance of the differences between the data sources; about 53, 29 and 23 acres respectively.

Alexandria

Tract A-1. The total area from parcel file records for this tract is about a thousand acres. Of this, about 200 acres are not accounted for in terms of specific land useage categorizations. The rest of the data from the two sources may be compared as follows, keeping in mind that the areas of categorized land useage from the parcel file data will be somewhat less (in unknown amounts) than actual. Within the Residential category - 0, there are about 75 acres more of single-and multi-family residential useage in the remote sensing data than in the parcel file sources. In both cases, this would represent an average of 29 per cent difference, which is not unusual for this category. About 23 acres of Educational - 2 category are observed in the imagery, while none is reported in the parcel file data; fifty-seven acres of Transportation - 3 land useage are observed in the photography - mostly Interstate Route 95 right-of-way. None of this is reported in the parcel file data. The other principal difference in the two data sources is in the Undeveloped category - 9; about 126 acres. Other smaller area differences include churches, a cemetery, shopping centers and industrial warehouse areas amounting to about 25 acres not all described in the parcel file data.

Tract A-3. See Figure 5. In this tract there are about 22 acres of the total land useage (535 acres) not assigned to specific use categories in the parcel file records. The parcel file data lists no schools, while the photo-derived

LAND USE PATTERNS

CENSUS TRACT

A-3

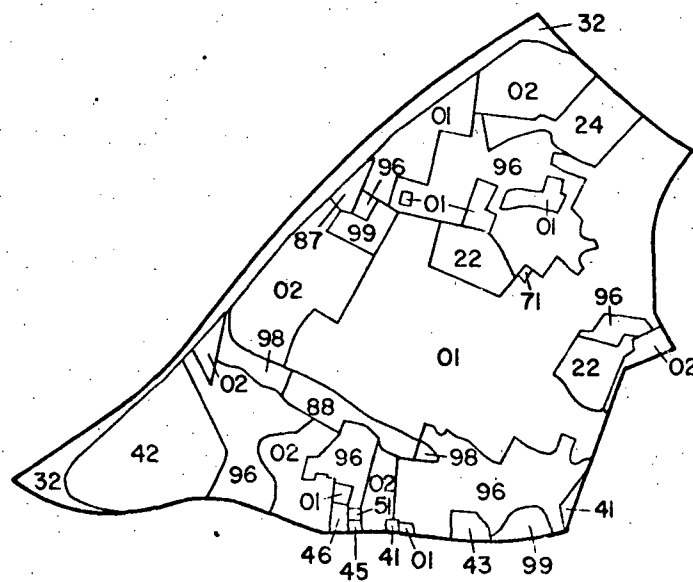


Figure 5.

data reports about 50 acres of educational useage (3 schools); one of which is Hammond High School). About 50 acres of Interstate Route 95 right-of-way are reported in the imagery source data, in the parcel file; none. The photo and parcel file records differ substantially on the large Landmark Shopping Center - 52 and 32 acres respectively. An additional 10 acres of commercial useage ~~are reported in the imagery~~ data. About 12 acres more of undeveloped land are reported in the parcel file records than are reported in the photo-derived data.

Tract A-4. This tract consists of a large variety of activities; manufacturing, warehousing, sand and gravel pits, railroad and highway rights-of-way, undeveloped areas, and clusters of residential useage. As with census tracts A-1 and A-3, there are 54 unassigned (uncategorized) acres in the parcel file data for this tract (tract total of 764.1 acres). Therefore, the following comparisons between useage categories in the two data sources are a little less valid. The total tract area figures for both data sets are closer than usual - about 5 percent difference. In addition, the residential useage area is less in the photo-derived data than that from the parcel file. There are other substantial differences between the two data sources. No Institutional-- 6 useage is reported in the parcel file data, yet the U.S. Army's Cameron Station is situated within this tract. About 104 acres were so reported in the photo-derived data. It is possible that this acreage could have been listed under

another category in the parcel file. The only one sufficiently large in area to accomodate this acreage would be the Undeveloped - 9 category. About 94 more acres of Industrial - 1 land useage and about 30 acres more of Transportation - 3 useage are reported in the imagery data than in the parcel file data. In the latter case, only 1.9 acres of railroad right-of-way are reported in the parcel file data. Small amounts of Educational - 2, and Office - 5 useage are reported in the photo-derived data; none are reported in the parcel file data. The largest difference - about 120 acres - is noted between the two data sets in the Undeveloped - 9 category.

Tract A-15. See Figure 6. This tract is in a well developed and mature residential area, consisting primarily of single-family residences. The total tract areas from both data sets compare rather well. The Residential - 0 data also compares well. There are several differences however. The photo-derived data reports a cemetery, a school, several churches and a small park (about 30 acres in all) for which there are no comparable data in the parcel file. The difference between the parcel file and the photo-derived acreages for the Undeveloped category - 9 is about 30 acres (the larger amount being in the parcel file data.

LAND USE PATTERNS

CENSUS TRACT A-15

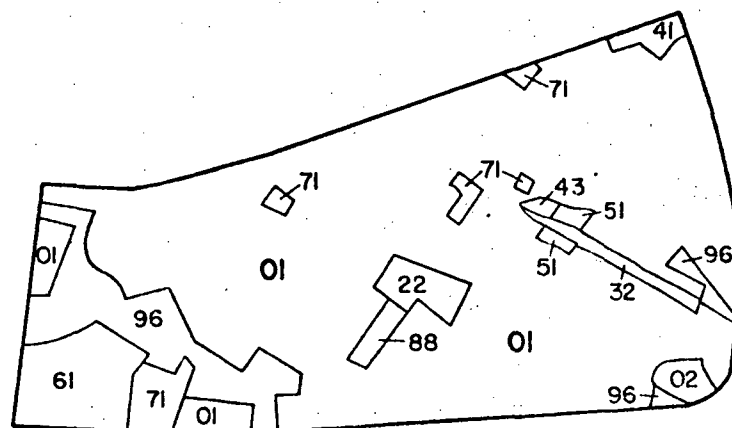


Figure 6

LAND USE PATTERNS

CENSUS TRACTS FC-1 and FC-2

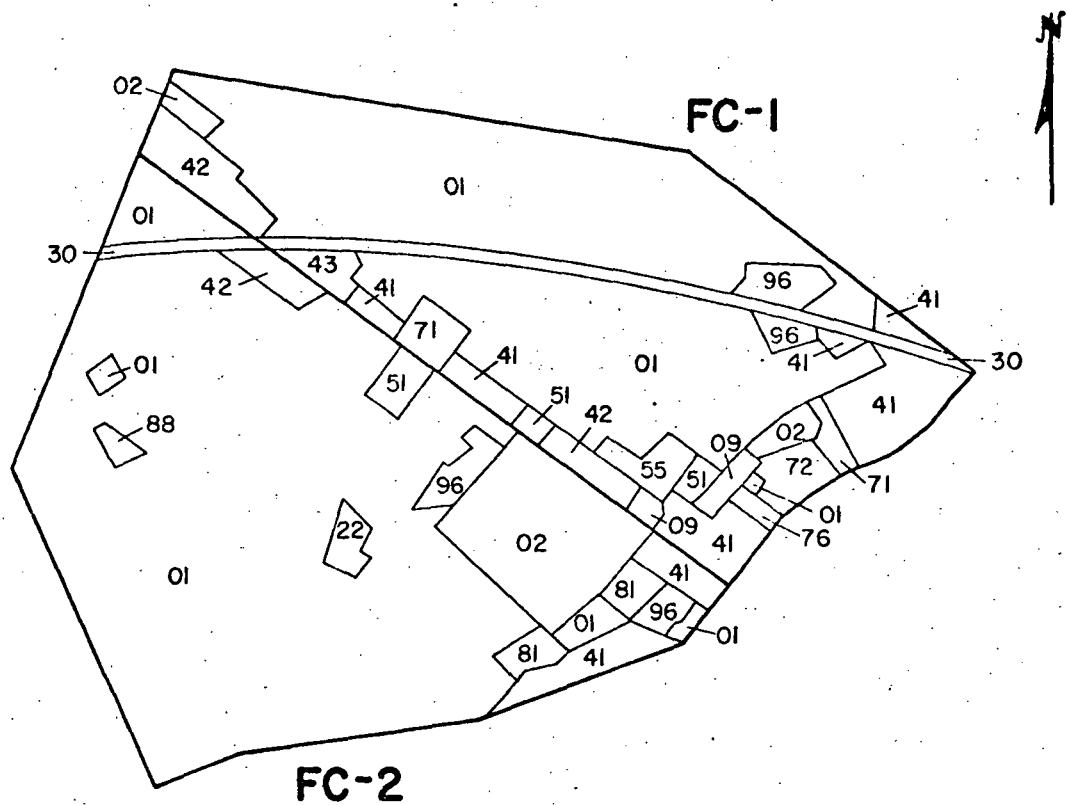


Figure 7

FC-1. See Figure 7. Within this tract, the Residential - 0 acreage from both data sources seem to compare well, though somewhat more transient housing (hotels, motels, and tourist accommodations) - 09, is reported in the imagery-derived data than from the parcel file sources. No photo-derived acreage is reported in the Industrial/Storage - 1, Educational -2, Institutional -6, and Undeveloped and Resource Use - 9 Categories. Small areas for these categories are reported in the parcel file data. Three categories: Offices - 5, Transportation - 3, and Public Assembly -7 present the greatest differences in the two sources of data. In the second of these, the right-of-way of the abandoned Old Dominion Railroad contributes to the bulk of the difference.

FC-2. See Figure 7. The residential acreages from both data sources are in good agreement. No useage data for Industrial - 1 and Public Assembly - 7 are reported in the photo-derived data. For the Transportation category - 3, areas from both data sources are in close agreement, though different types of useage are being described. In the photo-derived data, the abandoned railroad right-of-way contributes to the bulk of the acreage, while for the parcel file data, auto parking lots represent the useage. For the remaining categories, differences in the two data sets are slight, except for Offices - 5 and Undeveloped and Resource Use - 9. In these two categories, parcel file areas were higher, being almost double the areas from the photo measurements.

ANALYSIS BY LAND USE CATEGORIES

The following section describes the analysis in terms of the principal categories of land use. Figures 8 to 18 are graphs on which are plotted the comparable land use acreage data for all tracts. from remote sensing and parcel file sources as shown in Tables 2 to 6. Figure 8 plots the total tract acreages from both sources; Figures 9 to 18 plot the acreage data for each land use category. In a few instances, points falling off scale or because of clustering were omitted.

Residential - 0. In all but four of the tracts analyzed, there was a fairly consistent relationship between the acreage data from both data sources. The photo-derived data were consistently higher (with the exceptions noted) by a range of 11-33 percent, with an average of about 22 percent. This is a reasonable figure to expect and would account for land occupied by streets and roads not otherwise categorized under the Transportation - 3 category. The four exceptions consist of the data from tracts F-44, R-34, A-4, and F-17. In these tracts, the parcel file data recorded more residential useage than was observed in the photography. In three of these tracts, F-44, R-34 and A-4, the differences between the total tract areas from parcel file data and photography were the least of all tracts analyzed (5-11 percent). The first two of these tracts are the largest sampled. They are very

heterogeneous in character but quite different from each other - the one rural, the other very built up. Classification differences and area delineations probably account for these anomalies - farm lands, open areas, and residential useage in the former case, and increments of residential useage not picked up in the imagery in the latter. With respect to tract F-17, an excess of multi-family land use in the parcel file data is suspected for the difference.

Industrial and Storage - 1.

The major differences in these data occurred within the same three tracts as noted in the foregoing paragraph; F-44, R-34, and A-4. In the first tract, the remote sensing data were low by about 350 acres, in the second two tracts, it was high by 77 and 94 acres respectively. In the first case, industrial land dedicated for such useage but not so utilized, at least at the time of photography, possibly accounts for much of this difference. This would include some undeveloped (as of 1968) "industrial park" areas in Reston. In the second two instances, parcel file data seemed a little lean in categorized industrial areas. The lower part of tract R-34 contains its industrial areas. During 1968, much of this area was in a change of status from industrial to high-rise office and residential complexes (part of Crystal City). The photo-derived data is probably high here.

Educational - 2.

In nearly all cases and with the exception of one jurisdiction, the data from both sources were generally in good agreement. One tract in Fairfax County (F-6) indicated a difference of about 23 acres between the two data sources. The same number of schools seem to be indicated, so the difference must be due to parcel delineation on the photography. Of interest is the observation that in the four tracts in Alexandria which were analyzed, the parcel file shows no land useage classified as educational. It is possible that some of this acreage is included in the parcel file's uncategorized acres for these tracts.

Transportation/Communication/Utilities - 3.

In all cases, the photo-derived data were higher than that provided by the parcel file. The principal reason is due to the utilization of this category by the photo analysis for the delineation of highway, pipeline and powerline rights-of-way as well as large parking areas. These areas in general are not contained in the parcel file records. This contributes to much of the difference in the total area figures between the parcel file records and the photo-derived data. One large categorization anomaly in the parcel file records was the classification of Washington National Airport under the Military Installations category - 68 (presumably, all Federal lands in that tract, R-34, were lumped under the Military category).

Consumer Services - 4.

Among the 15 tracts with acreage in this category, the photo-derived data in 9 tracts, accounted for about 110 acres more than parcel file records; while in the other 6 the parcel file data accounted for about 102 acres more than that from remote sensing sources. Algebraically, the two would seem to cancel out. However, the error is appreciable and much of it is due to the relative difficulty of photo-analysis to clearly distinguish the commercial type buildings and facilities. Shopping centers and certain service-type areas with large vehicle parking lots were more readily identifiable than were smaller shops and stores.

Offices - 5.

The parcel file and the photo-derived data were relatively close in this category. There does not seem to be a pattern of one data source or the other being consistently low or high. In most instances, where office buildings were recorded in the parcel file records, data from the photography recorded like useage. However, there are, inherent in this land use category, possibilities for photo interpretation errors, unless ground checked. Frequently office spaces, commercial useage (and sometimes residential) useages are combined in the same parcel of land. In these cases of multi-use parcels, the imagery-derived analysis, by itself, is somewhat constrained from

definite and too positive reporting. However, knowledge of the area, as was the case in several of these tracts, contributed to improved confidence levels in the photo analysis. However, for such newer areas as Crystal City, for example, consisting of large high-rise office building units, such reporting constraints can be minimized.

Institutional - 6.

For this category, the comparisons between the two data sources revealed some of the largest differences encountered during the analysis. The differences were areal in extent, due to classification (or no classification in some parcel file records), and to jurisdictional useage designations. In one large tract (R-34) in Arlington, for example, the large Federally-owned lands comprising Fort Myer, Arlington National Cemetery, the adjacent memorial monuments, the Pentagon complex, and the National Airport (with approximately 720 acres of transportation land use) are classified as Institutional in the parcel file records. The visible functional useages were described as such in the photo analysis. In Alexandria, about 104 acres of land occupied by Cameron Station do not seem to have been categorized. About 160 acres of cemetery land use in Fairfax County (F-11) were also not carried in the parcel file records. In another instance in tract F-44, in Fairfax County, about 2500 acres of multi-purpose agricultural, residential, and open land just east

of Dulles International Airport is described in the parcel file as Institutional - 60 (Government Services in local records). This is a piece of land which presumably has been dedicated for future use in support of the adjacent airport facility. It, however, does not have identifiable outlines on the imagery, and in the imagery analysis, is utilized for farming, residential, or is open land. The greatest differences in this category in comparison with imagery-derived use patterns, have been noted as a result of "block" classification of Federal lands without useage delineations; non-listing of Federal or other parcels (cemeteries, etc.); or identifying parcels by ownership or dedication rather than by useage.

Public Assembly - 7.

As with other categories, as noted, there seem to be jurisdictional differences in recording data which are reflected in the parcel file records. Churches fall within this category, and do not seem to be recorded in the parcel file data for the four sampled tracts within Alexandria. Other principal data differences between the two data sources seem to be largely definitional. One has been touched upon previously: namely the lumping of the Federal lands within tract R-34 (Arlington) into the Military Installations category - 68 in the parcel file data. Thus, all the large monumental structures and grounds within the Fort Myer and Arlington

National Cemetery complex are not carried within this category in the parcel file. The photo-derived area data for this category is, therefore, more descriptive. Similarly, the categorization of the Mount Vernon Estate seems to have been classified in the parcel file data within the Parks and Recreation category - 8. In the remote sensing analysis, this site was classified under Historical Sites - category 74. It would seem that there is equal merit in its being classified either way. The analysis of this tract posed some additional interesting questions. The open and wooded areas around Mount Vernon are relatively homogeneous to the limits of the bordering residential communities. However, the property outline of the estate is, as one would expect, materially different than that which is identifiable on the imagery. This ever-present limitation in imagery analysis is illustrated in Figure - 4, in which delineation of the Mount Vernon Estate property outlines and the photo-derived land use outlines are shown.

Parks and Recreational - 8.

In general, the land use acreage in this category is high in the photo-derived data. Considerable amounts (about 460) of this type of acreage are not listed in the parcel file data. Within the eight tracts analyzed in Arlington County, the comparative data on five were in good agreement (three were almost identical in extent); for the other

three, no data were provided in the parcel file records. The data on the Alexandria tracts were uniformly high for the photo-derived sources, although the total acreages involved were not excessive (16 acres). The data on the four Fairfax County tracts were the least compatible. In these, lack of corresponding data from parcel file records accounts for the major difference.

Undeveloped and Resources Use - 9.

The data comparisons for this category by tracts and by jurisdictions do not seem to have any pattern. This might be expected because of the nature of the many variables (including time of data collection) involved in the classification of land. This would be particularly true for delineations of land parcels in open country devoted to agriculture, woodlands, resources exploitation, unused land, etc. Perhaps this category is one for which general comparisons are less meaningful than for the other categories discussed in the foregoing, because the bases for classification are so different. The large tract, R-34, contained, in the photo-derived data, about 500 acres of open space (including a large wildlife sanctuary) not otherwise categorized. The parcel file records report only 8 acres of open land in that tract. Within the four tracts analyzed within Fairfax County, the remote sensing data recorded a total of about 5000 acres in excess of the parcel file records, of which about 2500 acres were classified by the latter as Institutional, while the bulk of the acreage

was observed in the imagery to be largely undeveloped or agricultural. For the four tracts analyzed within Alexandria, there is no apparent pattern. For three tracts, the parcel file data were high by about 160 acres, while for the fourth tract, the photo-derived area was high by about 120 acres. Water areas are assigned to this category in the remote sensing data, thus inflating the data for these areas above the levels provided by the parcel file, which rarely, if at all, reported water areas. In agricultural areas, farm ponds and reservoirs are reported as such in the imagery analysis, but are probably included in parcel file data along with the total farm acreage. Also, parks and recreational areas unless reliably identified as such from other supplemental information would ordinarily be classified in the photo-derived analyses as undeveloped or open land.

TOTAL TRACT ACREAGE
PARCEL FILE DATA

2000

1000

PLOT OF TOTAL LAND USE
FOR ALL CENSUS TRACTS

FIGURE 8

30,984.3
29,246.8

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

3500

3000

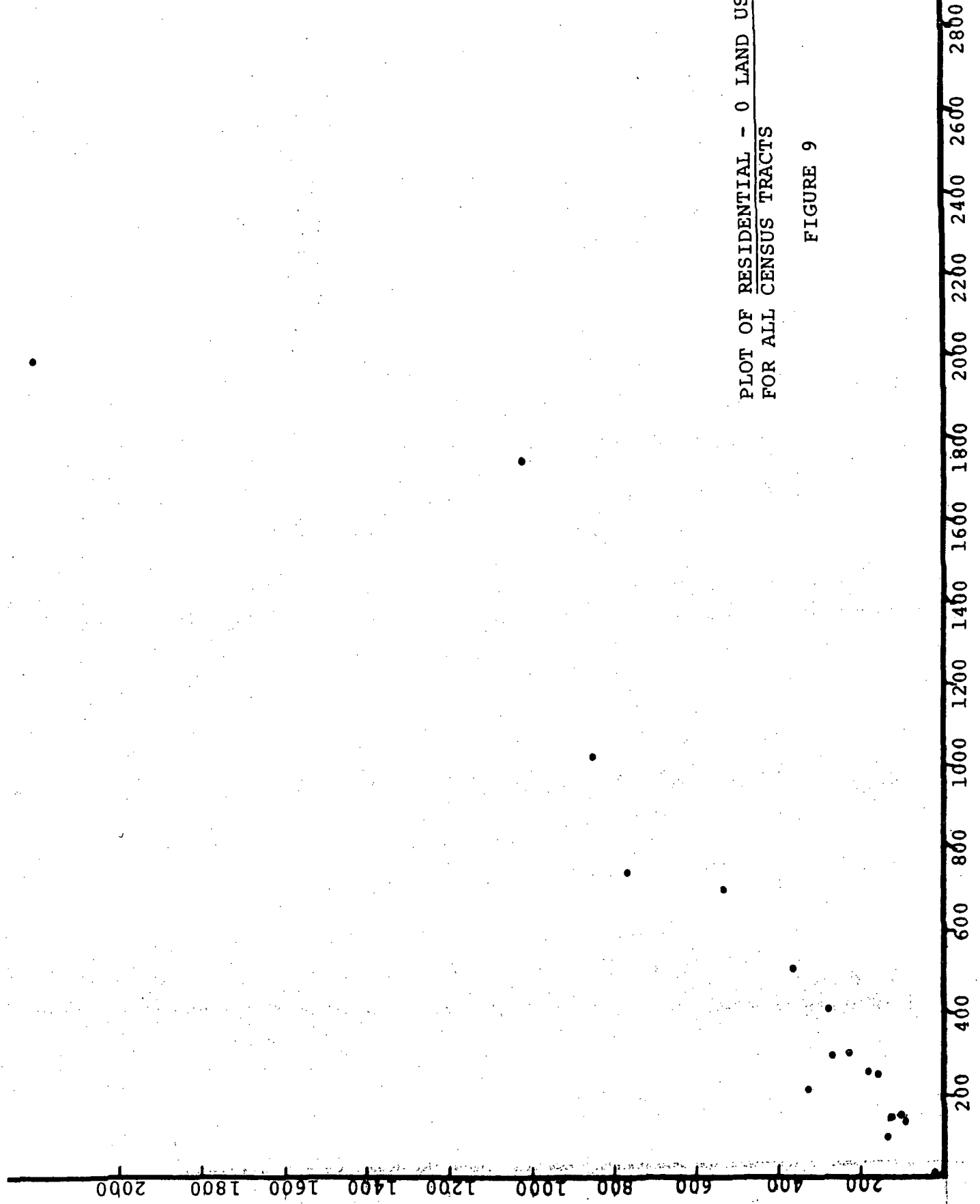
2500

2000

1500

1000

500



PLOT OF RESIDENTIAL - 0 LAND USE
FOR ALL CENSUS TRACTS

FIGURE 9

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

TOTAL TRACT ACREAGE
PARCEL FILE DATA

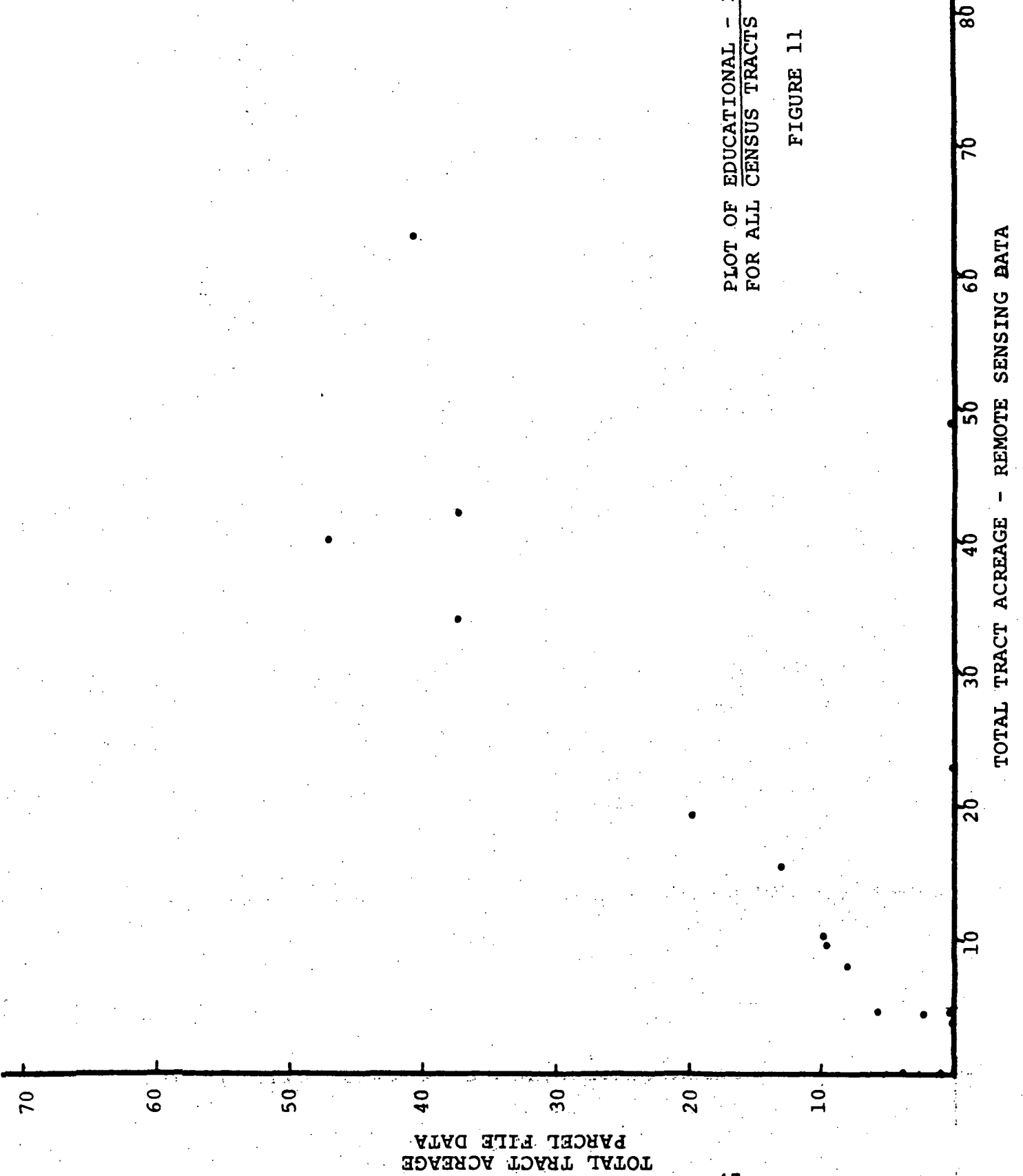
PLOT OF INDUSTRIAL - 1 LAND USE
FOR ALL CENSUS TRACTS

FIGURE 10

400
300
200
100
0

100 200 300 400 500

TOTAL TRACT ACREAGE - REMOTE SENSING DATA



PLOT OF EDUCATIONAL - 2 LAND USE
FOR ALL CENSUS TRACTS

FIGURE 11

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

50

40

30

20

10

10

20

30

40

50

60

70

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

PLOT OF TRANSPORTATION, COMMUNICATION,
AND UTILITIES - 3 LAND USE FOR ALL
CENSUS TRACTS

FIGURE 12

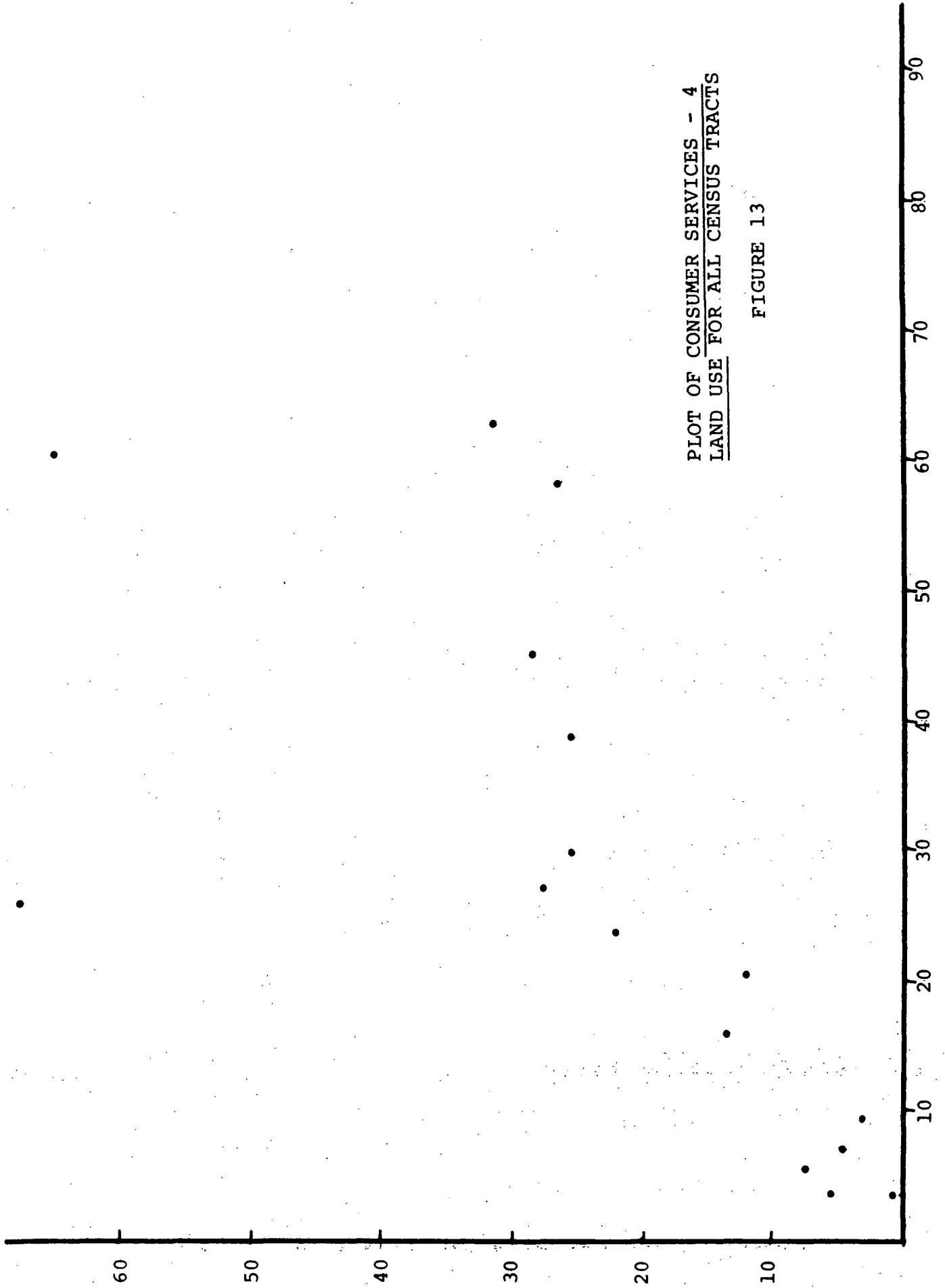
1190.9	→
0.2	↑
707.7	→
88.5	↑

TOTAL TRACT ACREAGE
PARCEL FILE DATA

PLOT OF CONSUMER SERVICES - 4
LAND USE FOR ALL CENSUS TRACTS

FIGURE 13

TOTAL TRACT ACREAGE - REMOTE SENSING DATA



TOTAL TRACT ACREAGE
PARCEL FILE DATA

45

40

30

20

10

PLOT OF OFFICES - 5 LAND USE
FOR ALL CENSUS TRACTS

FIGURE 14

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

50

40

30

20

10

2504.1 ↑
14.3 →

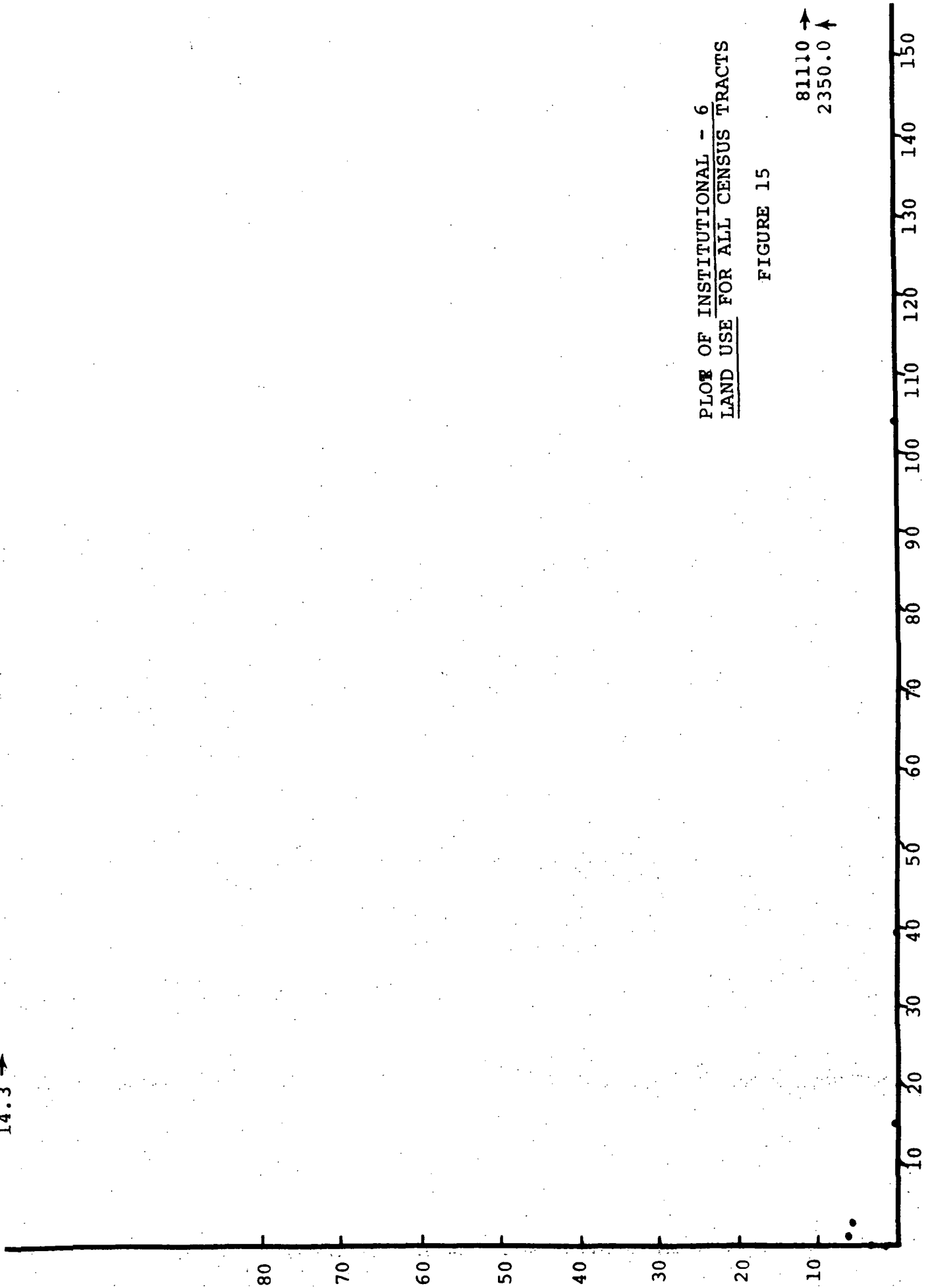
TOTAL TRACT ACREAGE
PARCEL FILE DATA

15 -
PLOT OF INSTITUTIONAL - 6
LAND USE FOR ALL CENSUS TRACTS

FIGURE 15

81110 →
2350.0 ↑

TOTAL TRACT ACREAGE - REMOTE SENSING DATA



40

30

20

10

10

20

30

40

50

PLOT OF PUBLIC ASSEMBLY - 7
LAND USE FOR ALL CENSUS TRACTS

FIGURE 16

125.2 →
99.0 ↑

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

TOTAL TRACT ACREAGE
PARCEL FILE DATA

807.4 →
445.1 ↑

FIGURE 17

101.9 →
565.2 ↑

TOTAL TRACT ACREAGE - REMOTE SENSING DATA

file records. The excess was due largely to the areas occupied by streets and roads within residential areas not being included in the residential land parcels, and being included in the photo-derived residential acreage.

For similar reasons, the large discrepancies in the Transportation/Communication/Utilities category were due to the almost total absence of highway, rail, power and pipeline rights-of-way in the parcel file records.

Within the Industrial, Educational, Institutional, Parks and Recreational, Public Assembly, and Undeveloped and Resource Uses categories, the differences were attributable largely to omissions of acreage from the parcel file data; to "lump" categorization as with large tracts of different types of Federal lands being classified under a single use category; and to ownership or dedication categorization rather than by current useage.

Imagery interpretation was probably the weakest in the analysis of the Consumer Services, Offices, and the Undeveloped and Resource Uses categories. Certain types of industries were difficult to distinguish from office buildings. Field checking in many of these instances was generally helpful.

Classification anomalies were noted in the analysis. Parcel file source data from public tax and land records were found to omit several types of non-tax bearing properties. Thousands of acres of land useage, including Federal lands, churches, cemeteries, schools, highway and rail rights-of-way

and water areas were so excluded.

For the classification analyst, the coding of the Public Assembly - 7 and Parks and Recreation - 8 categories presented difficulties because of overlaps and inconsistencies. Is Mount Vernon, for example, an Historical Site - 74, or is it a Park - 88? Similar definitional problems were encountered in the Offices - 5 and Institutional - 6 categories. Is the Pentagon, for example, a Military Installation - 68, or is it a Federal Government Office Building - 54? Would the Forrestal Building in L'Enfant Plaza be a Military or Federal Office Building? While these may be isolated instances, they are examples of the classification dilemma sometimes faced by the classification analyst. Too frequently the classification systems are based upon ownership criteria and do not always provide (where there are differences) for use and activity designations. Land use areas need to be accurately categorized and mapped, as this information provides basic inputs to regional and other studies. As large aggregations of the data are made, the differences described in this report would, of course, be reflected in the studies upon which the data were based.

Jurisdictional differences were also noted. Some jurisdictions carried educational properties, public schools, for example, on the records, others did not. Variations were noted in classifying institutional and governmental land holdings.

Lastly, the comparative analysis using both data sources required frequent consultations between the COG Data Systems Office and the remote sensing team. These discussions and their results were totally informative and fruitful and, in many instances resulted in illuminating an area in both photo and parcel file data which required additional research or corrective analysis. This aspect of the analysis represented the most significant and promising element in this study, because it demonstrated the beginning of an analytical correlation between two bodies of data which, standing alone, are subject to sizeable error. For instance, for the twenty-five hundred acres of land in Fairfax County previously noted as classified "Institutional" in the parcel file, there was no visible photographic evidence of such useage. Parcel file data provided the location and, the photo analysis the inference that the land, presently observed to be in every-day use for farming, and residential purposes or else undeveloped, has been dedicated as government land for future use by the Dulles International Airport.

This process of timely correlation of photo-derived data with COG land use and other data files to provide validity checks on information inventories is worth further investigation and application. Specifically, this would require the initiation of procedures for the aggregation of parcel file and remote sensing data into an improved and more reliable data base.

4. RECOMMENDATIONS

1. Examine the Metropolitan Washington Council of Governments' General Land Use Category codes with a view to provide for:
(a) modification or adjustments to the classification levels and
(b) additional digital fields to accomodate imagery-derived updating and verification as to current land useage, activity, multiple use, etc. in addition to ownership identification.
2. Initiate in-house procedures for verification and validity checking of land use classification records by correlation with remote sensor-derived data (field-checked as required) prior to entry into the Council of Governments' computerized data bases. Such procedures should probably be initially directed to verification of data in the parcel file and the development of a new improved data aggregation. With expectancy of synoptic and repetitive imagery and related data from ERTS-A (Earth Resources Technology Satellite) becoming available to COG in 1972, procedures should become operative by that time.
3. Encourage, possibly through COG computer modelling and prediction programs and studies, increased uniformity among the region's jurisdictions in the recording and reporting of land use data, (including untaxed and public land areas).

4. Examine available remote sensing technology and data read-out equipment for possible utilization in facilitating computerization of land use data analysis, measurement and correlation procedures. This examination should include assessment of the possible effectiveness of utilization of such equipment at all appropriate levels of need (local and/or regional).

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METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

GENERAL LAND USE CATEGORIES

- 0 - Residential
- 1 - Industrial/Storage
- 2 - Educational
- 3 - Transportation/Communication/Utilities
- 4 - Consumer Services
- 5 - Offices
- 6 - Institutional
- 7 - Public Assembly
- 8 - Parks and Recreational
- 9 - Undeveloped and Resource Use

The COG generalized land use code as proposed by Data Systems has several important new properties:

- 1 - It is hierarchial
- 2 - Education is now a separate category
- 3 - It corresponds closely with URA/BPR and the RMIS Code #1

Use of the most general level of coding (i.e. ending in 0) is permitted for cases when the information is so general as to not allow more specific coding as well as for cases where the information is so specific that no two digit equivalence has been made. An appropriate error message will normally be generated for each assignment to the one digit level of coding.

Blanks will be inserted where a conversion can not be made to either a one or two digit level.

CODE #1

COG GENERALIZED LAND USE CODE

0 Residential

- 01 Single Family (including detached, semi-detached, triple-attached and row, plus individual mobile homes)
- 02 Multi-Family (two or more dwellings in a single building, including apartments and residential hotels)
- 03 Rooming and Boarding Houses
- 04 Membership Lodgings
- 05 Residence Halls and Dormitories
- 06 Retirement Homes, Orphanages and Religious Quarters
- 07 Seasonal Housing (including summer cottages and farm labor camps)
- 08 Mobile Home Parks or Courts
- 09 Hotels, Motels and Tourist Accommodations
- 00 Residential, NEC

1 Industrial/Storage

- 11 Manufacturing and Processing
- 12 Research and Testing
- 13 Wholesale, Warehousing and Solid Storage
- 15 Contract Construction
- 16 Vehicle Storage - Truck Parking
- 17 Vehicle Storage - Taxi Parking
- 18 Vehicle Storage - Bus Parking
- 19 Refuse Disposal
- 10 Industrial/Storage, NEC

2 Educational

- 21 Nursery Schools
- 22 Elementary Schools (Grades 1 - 6)

CODE #1 (Cont.)

- 23. Combination of Nursery and Elementary Schools (pre-school through 6)
- 24. Secondary Schools (Grades 7 - 12)
- 25. Colleges and Universities
- 26. Commercial Schools
- 20. Educational, NEC

3 Transportation/Communication/Utilities

- 31. Railroad/Rail Rapid Transit Rights of Way (includes terminals)
- 32. Street and Highway Rights-of-Way
- 33. Airports
- 34. Auto Parking
- 35. Bus/Taxi Terminals
- 36. Radio/Television and Telephone/Telegraph Communications
- 37. Electric Utility
- 38. Gas Utility
- 39. Water/Sewer Utility
- 30. Transportation/Communication/Utilities (includes marinas, pipelines, etc.), NEC

4 Consumer Services

- 41. Stores
- 42. Shopping Centers
- 43. Gas Stations, Auto Repair, Automobile Dealers and Auto and Truck Rentals
- 44. Repair Services (not auto repair)
- 45. Personal Services
- 46. Eating and Drinking
- 47. Medical and Dental Clinics, Centers, and Laboratory Services
- 40. Consumer Services, NEC

CODE #1 (Cont.)

5 Offices

- 51 Commercial Offices
- 52 Professional and Trade Associations
- 53 Institutional Offices
- 54 Federal Government Offices
- 55 State and Local Government Offices
- 56 Foreign Governments and International Organizations
including embassies, chanceries, etc.
- 50 Offices, NEC

6 Institutional Services

- 61 Cemeteries
- 62 Hospitals
- 63 Nursing Homes
- 64 Other Health Facilities (except those coded under 47)
- 65 Police Stations
- 66 Fire and Rescue Stations
- 67 Correctional Institutions
- 68 Military Installations
- 69 Welfare and Charitable Services
- 60 Institutional Services, NEC

7 Public Assembly

- 71 Churches, Synagogues, and other places of worship
- 72 Civic, social and fraternal associations
- 73 Libraries
- 74 Permanent exhibitions, including museums, art galleries,
monuments, planetaria, aquariums, and urban historic sites
- 75 Sports and miscellaneous assembly including stadiums,
auditoriums, recreation halls, etc.
- 76 Entertainment assembly including theaters

CODE #1 (Cont.)

70 Public Assembly, NEC

8 Parks and Recreation

- 81 Indoor recreation, including recreation centers, indoor swimming, gymnasiums, ice and roller skating rinks, bowling, and penny arcades
- 82 Outdoor Amusements, including fairgrounds, race tracks, go-cart tracks, miniature golf, golf driving ranges, and amusement parks
- 83 Private Outdoor Recreation, including tennis, swimming, country clubs, and yachting clubs, limited to members and guests
- 84 Commercial Outdoor Recreation, including resorts, riding academies, ski runs, organized camps, and marinas
- 85 Public Golf Courses
- 86 Play lots, playgrounds and playfields
- 87 Outdoor Courts and pools open to the public (tennis, basketball, swimming, etc.)
- 88 Parks - Leisure and ornamental
- 89 Parks - general recreation, including individual camping and picnicking as well as areas for the enjoyment of nature, including zoos, botanical gardens, arboretums and national parks
- 80 Parks and Recreation, NEC

9 Undeveloped and Resource Uses

- 91 Agriculture and Related Activities
- 92 Forestry Activities and Related Services
- 93 Mining Activities and Related Services
- 94 Permanent Conservation Areas
- 95 Other Resource Production and Extraction
- 96 Undeveloped and Unused Land Area
- 97 Water Areas
- 98 Vacant Floor Areas
- 99 Under Construction
- 90 Undeveloped and Resource Uses, NEC

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16. Abstracts A land use analysis of 18 selected census tracts in the Metropolitan Washington area using aerial photography was undertaken in this study. A comparison of the results was made with comparable land use data from the Metropolitan Washington Council of Governments' Parcel File, and the results reported. Summary conclusions and recommendations for the use of photo-derived data in land use studies by COG are made in this document.					
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