

**URBANIZATION EFFECTS ON HABITAT CHANGE IN
ST. TAMMANY PARISH, 1982 – 2000**

(Final Report)

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INTRODUCTION

St. Tammany Parish (Figure 1) encompasses one of the most diverse ranges of natural habitats in the State of Louisiana. The parish is divided by the Pleistocene Terrace, which acts as a geographic division between pine terraces and bottomland hardwoods to the north and coastal wetland habitats to the south. Nearshore Lake environments in the south generally consist of multiple submerged bars with submersed aquatic vegetation. The Pearl River's swamp and fresh marsh environments form the boundary of St. Tammany Parish to the east. Central St. Tammany is dominated by a series of rivers flowing north-south with sandy point bars. Western St. Tammany is a more typical fluvial system controlled by the Tchefuncte River. This fluvial character continues through Tangipahoa Parish to the west.

The North Shore is unique in that it offers this highly diverse range of habitats in a relatively small area. While the coastal wetlands of St. Tammany are productive and constitute a valuable resource to nature, man has already impacted them. The population of St. Tammany Parish has grown considerably in the last few decades (Table 1), and has considerable potential for continued urbanization. In an effort to assess the impact of urbanization on St. Tammany Parish, habitat classifications for two time periods were compared and a habitat change analysis was performed.

Table 1 Population Growth Rates for St. Tammany Parish

<u>Year</u>	<u>Population</u>	<u>Percent Change</u>
1970	63,585	-
1980	110,869	+74.4
1990	144,508	+30.3
1999	188,053	+30.1

Source: New Directions 2025 St. Tammany Parish Comprehensive Plan, 2000

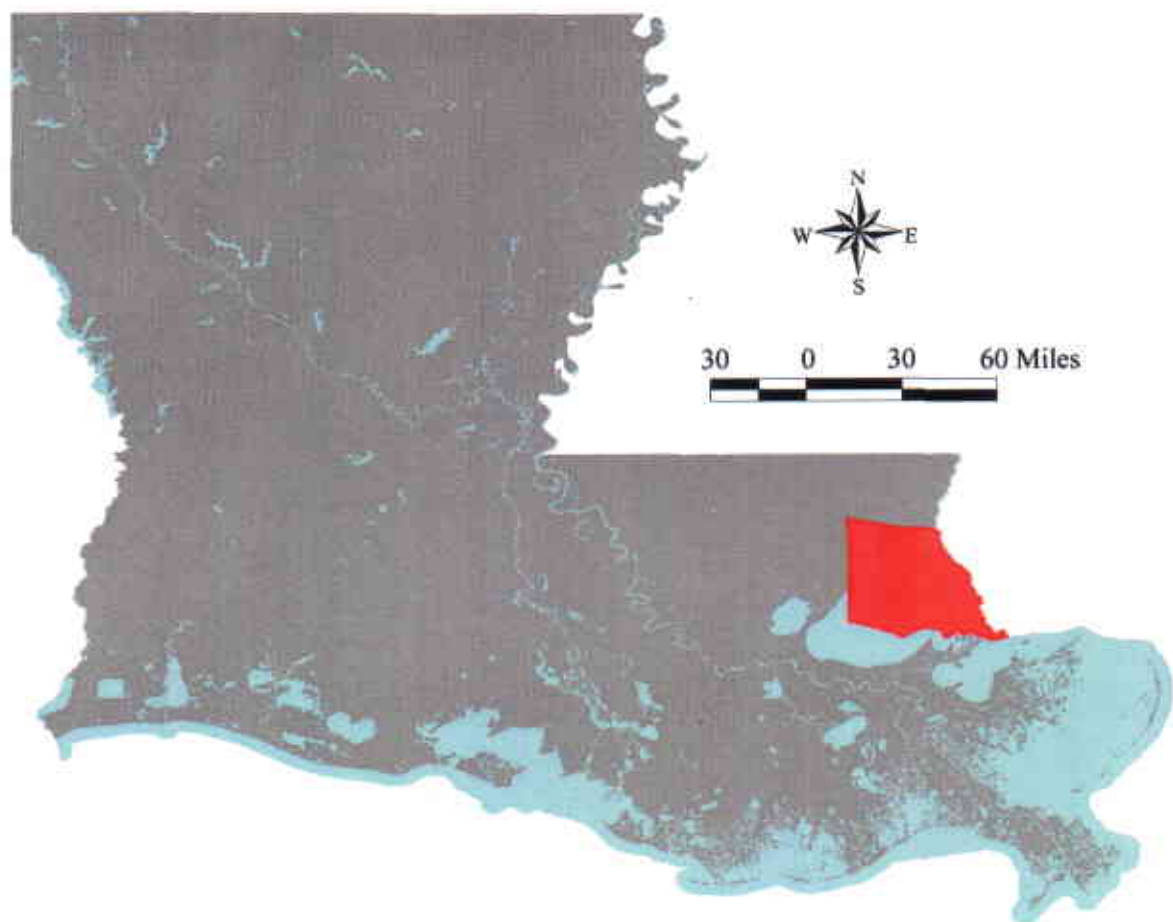


Figure 1 Location of St. Tammany Parish

METHODOLOGY

Urbanization effects on habitat change in St. Tammany Parish were determined by performing a habitat classification on two Landsat images (1982 and 2000), and analyzing an existing habitat classification (1992). The Landsat 4 satellite collected the first image on December 5, 1982, and Landsat 7 ETM collected the 2000 image on December 24, 2000. The final data set, subsetting from the "Lake Pontchartrain Basin Land Use / Land Cover" map, was classified by the USGS National Wetlands Research Center using three Landsat 5 scenes collected in Winter, 1992.

During this project, inherent problems were discovered in the 1992 data set. The data set was an older pre-classified data set that was projected to a Universal Transverse Mercator reference system with no datum, spheroid or zone information. The image was re-projected to add the missing referencing information, however there still remained a shift between this data set and the two geo-referenced images. A shift between the 1992 data set and either of the two Landsat images will cause inaccurate habitat change detection due to the offset. Also, no information could be obtained on the source imagery of the 1992 data set or the methodology for the classification scheme. Without this information, it is difficult to accurately interpret the habitat change detection for the 1992 time period. For these reasons, the 1992 data was removed from the habitat analysis.

To begin the habitat analysis process (Figure 2), the 1982 and 2000 Landsat images were imported into Erdas Imagine's image (img) file format. Once in img format, the Landsat scene was subsetting to match the political boundary of St. Tammany Parish. Next, the scene was analyzed for potential ground truthing sites. Ground truthing was performed at the beginning of the study to assist in the habitat classification. Specific habitat classes were visually identified on the imagery to begin the development of a habitat signature library. A signature is a set of data, spectral and parametric, that uniquely defines a class. Signatures for the habitat classes are collected in a signature library and are used in the classification process. Imagine's area of interest tools were used to define individual spectral signatures for each land cover class. By calculating multivariate statistics (i.e. mean, standard deviation, and covariance matrices), and by including ground truth data, separability, the statistical measure of distance between two signatures, was tested to ensure the uniqueness of each signature (Erdas, 1999). If separability conditions were met, the signature was incorporated into a signature library. If separability conditions were not met, the signature was compared to ground truth data to assess its validity and either merged with a similar signature of the same land cover class or the signature was deleted.

Once the signature library was developed and finalized, a supervised classification was performed on the 1982 and 2000 Landsat images and a habitat map was produced. For each habitat classification, a maximum likelihood parametric decision rule was used in the

supervised classification. This decision rule includes the variability of the habitat classes by incorporating the covariance matrix into the classification procedure, resulting in a pixel being assigned to the habitat class for which the weighted distance is lowest (Erdas, 1999). A change detection analysis was then performed using the habitat maps from both time periods. A matrix analysis was used to mark the change from one time period to another. The result was a unique class for every combination of classes for the 1982-2000 time period.

The habitat classification was based on discernible spectral differences and by recognizable spatial and textural patterns inherent to the Landsat imagery. A field verification process was used to assist in the identification of habitats in the imagery. The seven-class habitat scheme follows a simplified Anderson Level I classification (Anderson et al., 1976) structure and is defined below:

Marsh: any unforested, vegetated area normally subject to inundation by flood or tidal action at any time, sufficient to support wetland-dependent emergent vegetation.

Wetland Forest: any forested area normally subject to inundation through part of the growing season, or with permanent or near-permanent standing water.

Upland Forest: any forested area that is not normally subject to inundation during the growing season or is only periodically influenced by flooding.

Shrub/Scrub: any area dominated by shrubs or small trees under 20 feet tall, either within an upland area or a marsh area.

Agricultural/Grassland/Barren: a general category including row and cover crops, tilled or untilled fields with exposed or partially exposed soil, fallow fields, pasture land, or exposed soil landscape.

Urban: any area of man-made structures and associated disturbances where vegetation cover is minimal, or man-made structures and associated disturbances where vegetation cover is sufficient to contain urban features.

Water: any area of open water surfaces including natural or man-made structures.

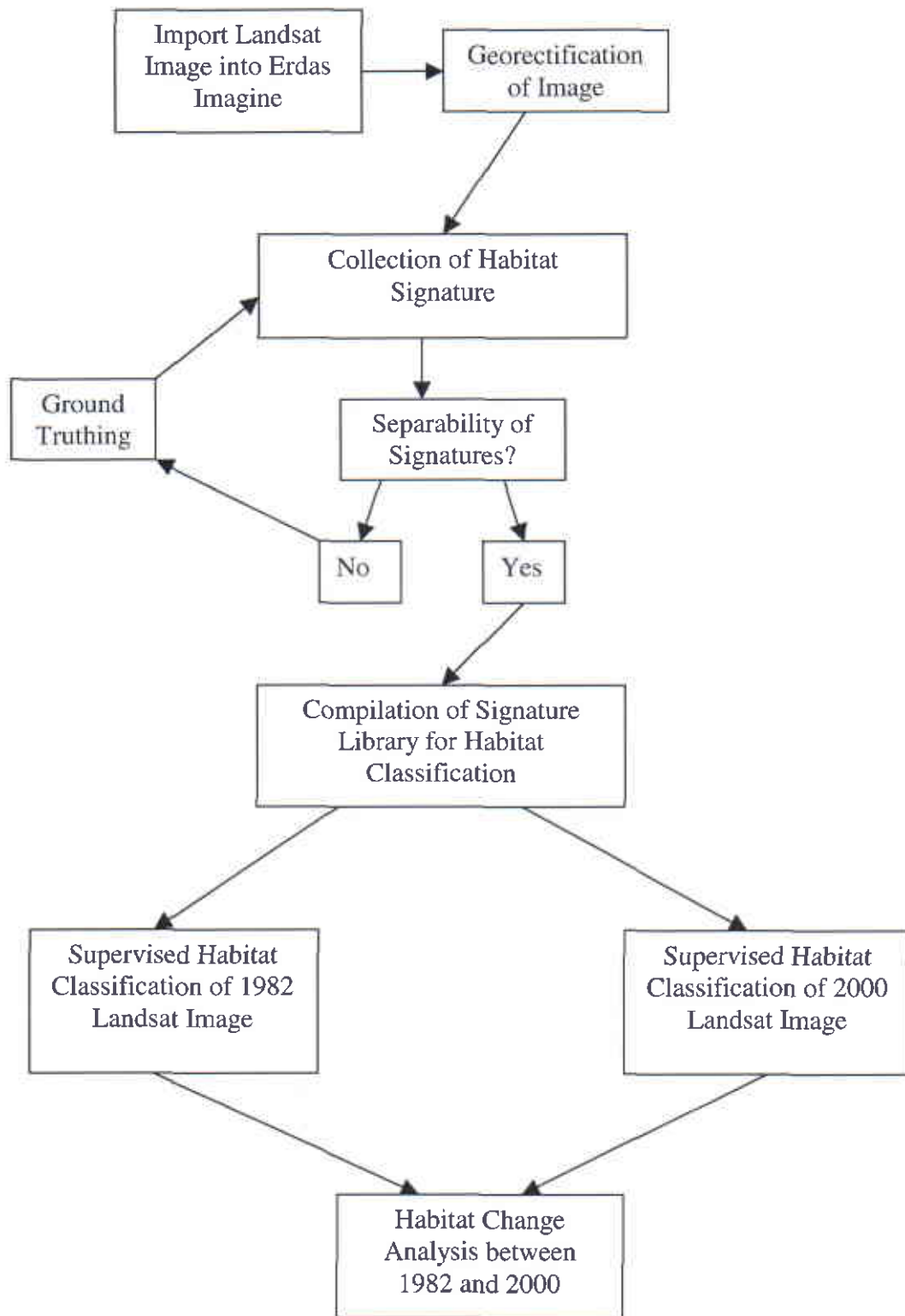


Figure 2 Flow Diagram of the Landsat Image Interpretation Process

RESULTS

1982 Habitat Classification

The Landsat 4 image (Figure 3) indicates that St. Tammany Parish was largely rural in 1982. Figure 4 presents the habitat classification for St. Tammany Parish. Upland forest, the largest land cover class with 237,232 acres (Table 2), appears to dominate the central area of the parish. The shoreline of Lake Pontchartrain contains the North Shore marshes (52,938 acres) and has a fringe of wetland forest leading into the Pleistocene Terrace. Most of the wetland forest in the parish is found in the Pearl River. Urban areas are restricted to Slidell (between I-10, I-12, and US Highway 11) and the Mandeville area along US Highway 190 south of I-12. In 1982, the urban areas occupy only 22,238 acres, or just 3.1% of St. Tammany Parish.

Table 2 Habitat Classification of St. Tammany Parish, 1982

<u>Habitat</u>	<u>Area (acres)</u>	<u>Percent of Parish Area</u>
Marsh	52,938	7.4%
Upland Forest	126,425	17.6%
Wetland Forest	237,232	32.9%
Shrub/Scrub	54,909	7.6%
Ag-Grass-Barren	47,156	6.5%
Urban	22,238	3.1%
Water	179,641	24.9%
Total	720,540	100.0%

Figure 3 1982 Landsat 4 Image of St. Tammany Parish

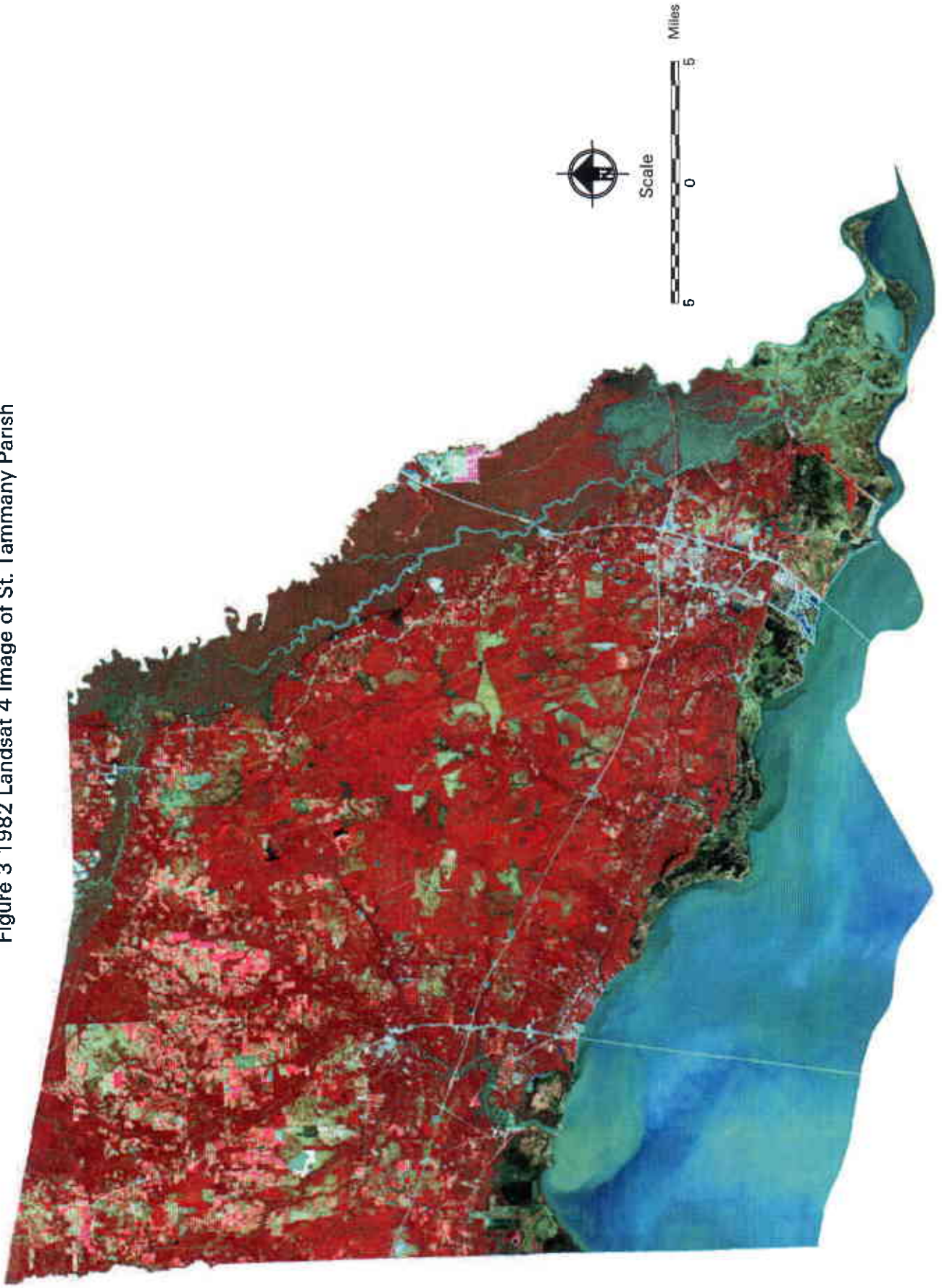
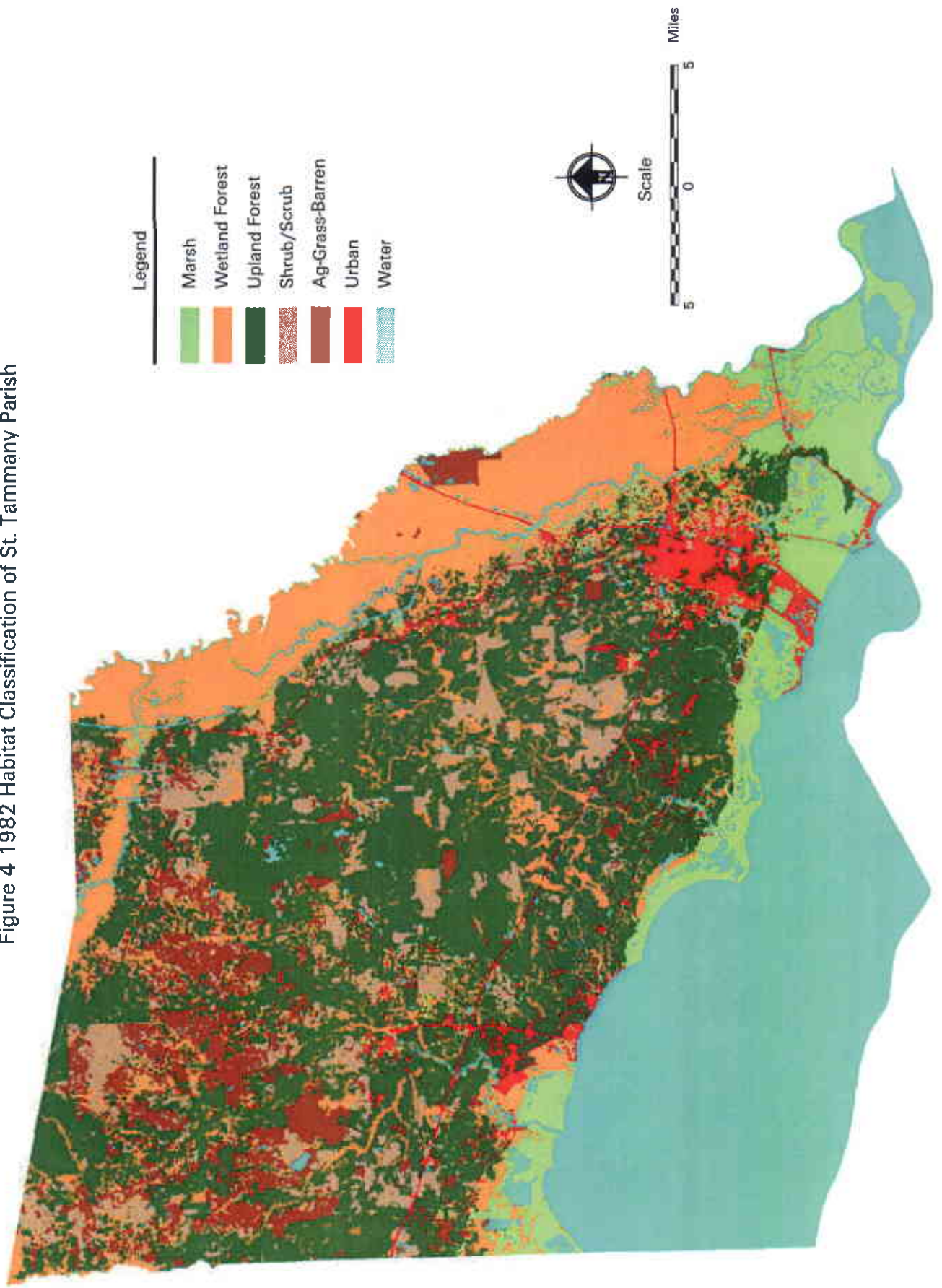


Figure 4 1982 Habitat Classification of St. Tammany Parish



2000 Habitat Classification

The Landsat 7 ETM image (Figure 5) and the 2000 habitat classification (Figure 6) illustrate the increase in urbanization that occurred in St. Tammany Parish after 1982. The City of Slidell broke through its city limits and the urbanization along US Highway 190 has increased north of I-12 into the Abita Springs area. While the majority of urban growth took place south of I-12, pockets of urban growth can be seen in the more rural areas in northern St. Tammany, which indicates that even these areas are not immune from urbanization.

Table 3 shows the summary of the habitats found in St. Tammany in 2000. The marsh class, found primarily along the shoreline of Lake Pontchartrain had 41,849 acres. Wetland forests, found primarily in the Pearl River Basin, composed 122,479 acres. There were 203,244 acres of upland forest, 51,770 acres of shrub/scrub, and 48,912 acres of agriculture-grassland-barren habitat. Urban areas constituted 70,821 acres or 9.8% of St. Tammany Parish.

Table 3 Habitat Classification of St. Tammany Parish, 2000

<u>Habitat</u>	<u>Area (acres)</u>	<u>Percent of Parish Area</u>
Marsh	41,849	5.8%
Upland Forest	122,479	17.0%
Wetland Forest	203,244	28.2%
Shrub/Scrub	51,770	7.2%
Ag-Grass-Barren	48,912	6.8%
Urban	70,821	9.8%
Water	181,466	25.2%
Total	720,540	100.0%

Figure 5 2000 Landsat 7 ETM Image of St. Tammany Parish

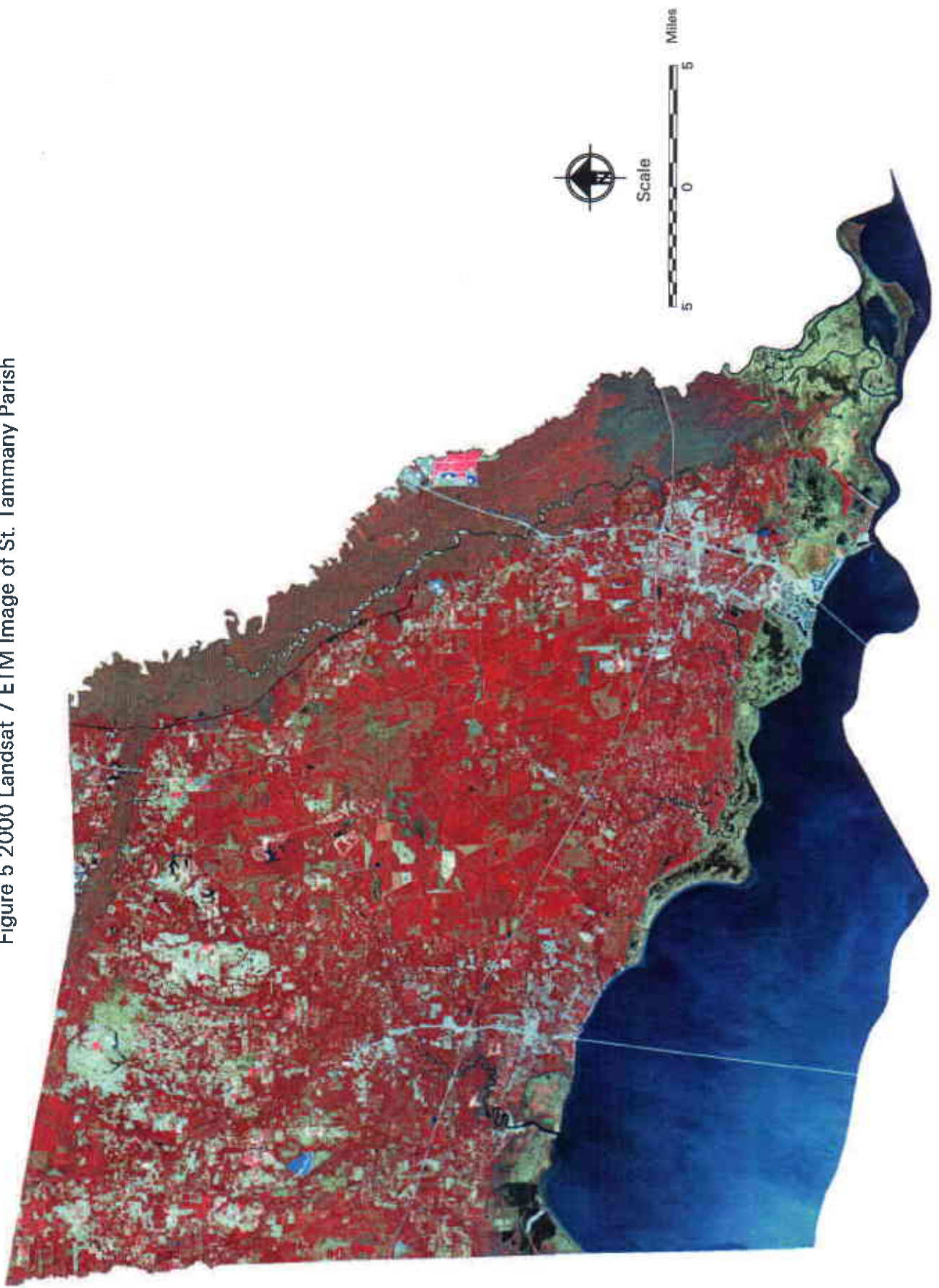


Figure 6 2000 Habitat Classification of St. Tammany Parish

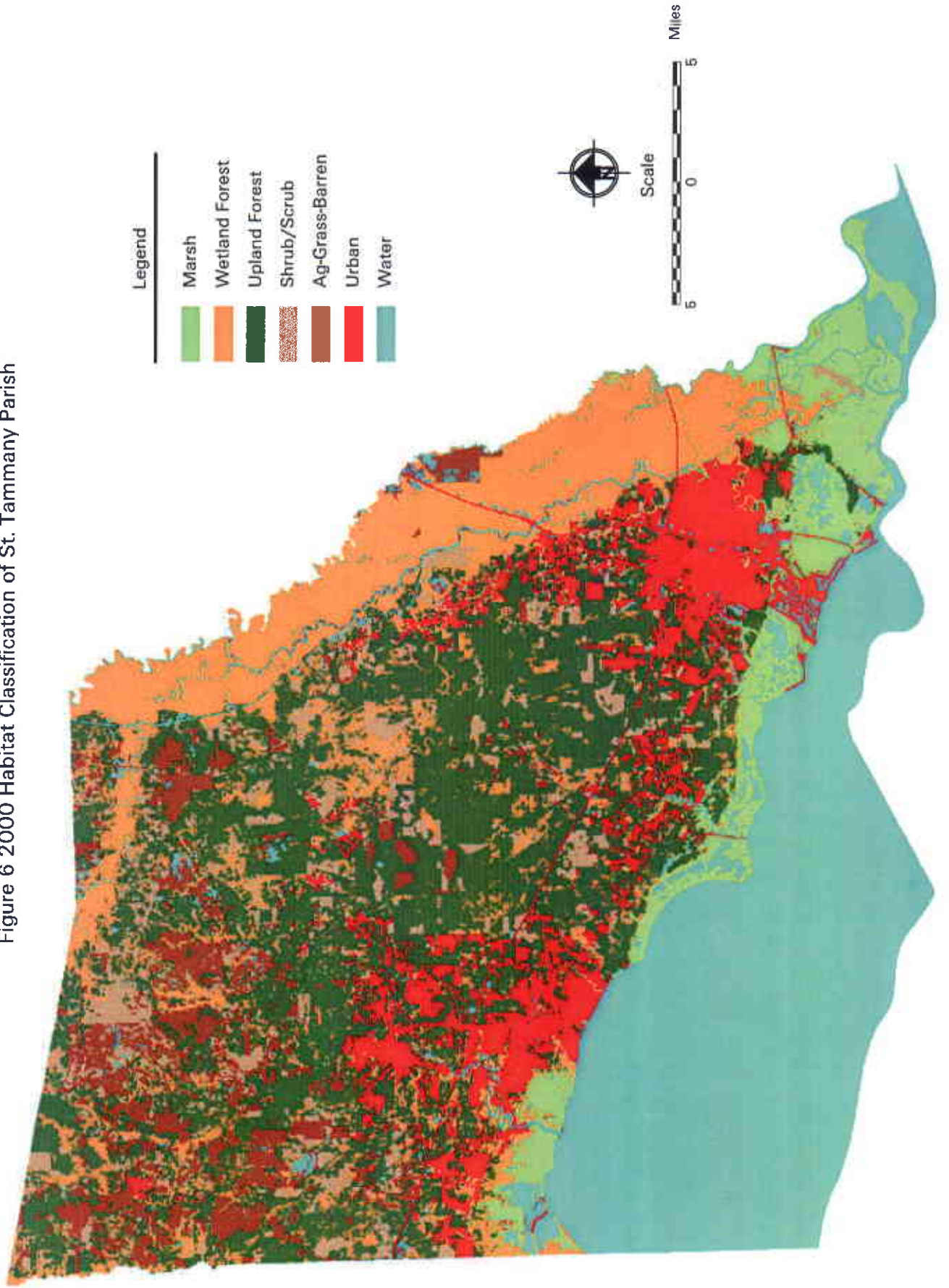


Table 4 Change Detection Analysis for St. Tammany Parish, 1982-2000

TO: 2000 Habitat Classification

	Marsh	Wetland Forest	Upland Forest	Shrub/Scrub	Ag/Grass/Barren	Urban	Water
Marsh	35,510	4,352	1,304	1,212	302	5,402	4,857
Wetland Forest	1,563	83,019	24,345	6,374	2,805	6,760	1,559
Upland Forest	1,135	27,187	141,617	28,501	7,475	30,628	687
Shrub/Scrub	797	3,110	27,373	7,794	9,873	4,886	1,077
Ag/Grass/Barren	13	2,039	6,430	7,099	27,474	3,337	763
Urban	506	292	1,235	348	357	19,019	481
Water	2,324	2,480	940	441	624	790	172,042

FROM: 1982 Habitat

Figure 7 1982-2000 Urban Habitat Change in St. Tammany Parish

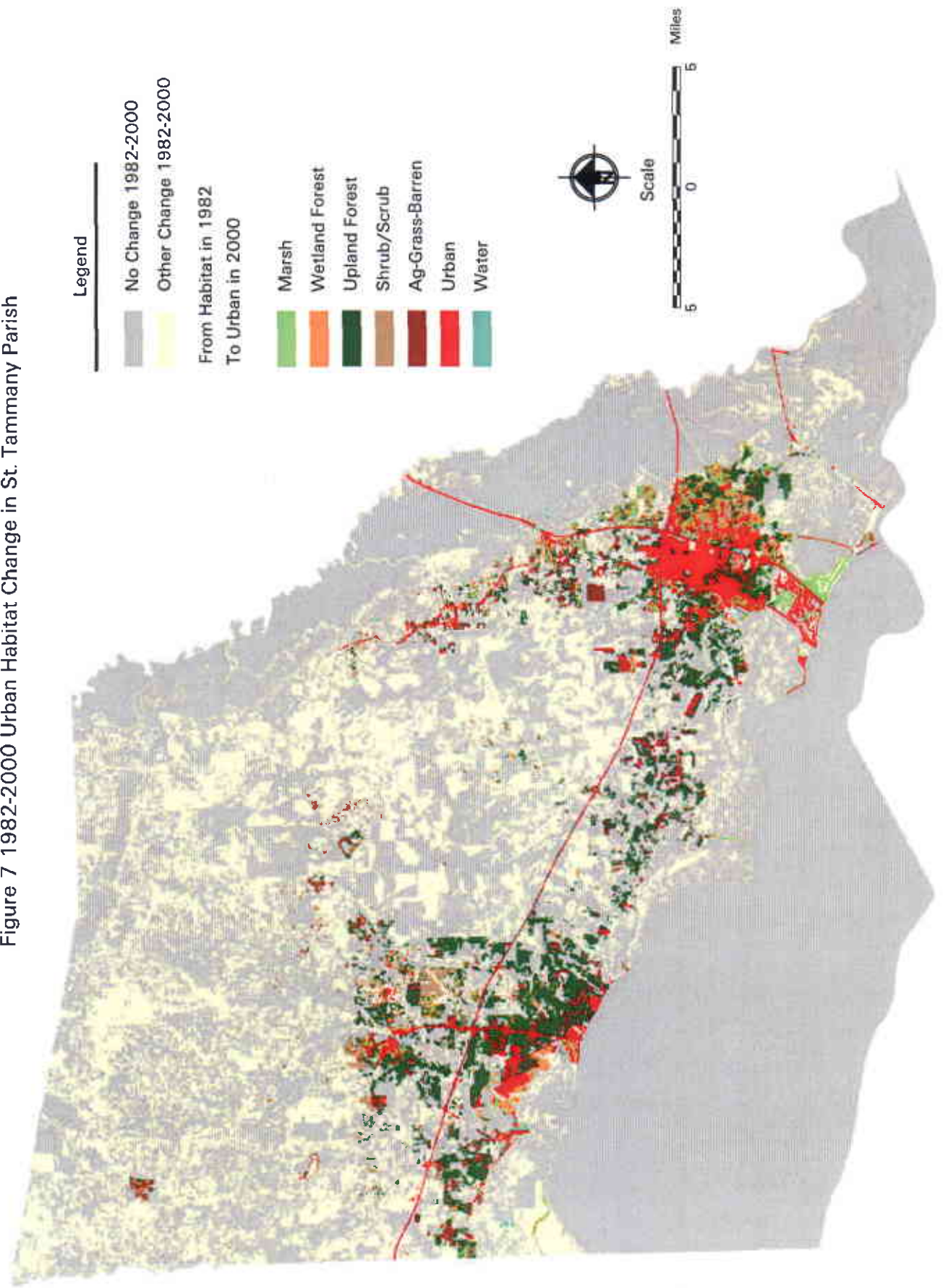
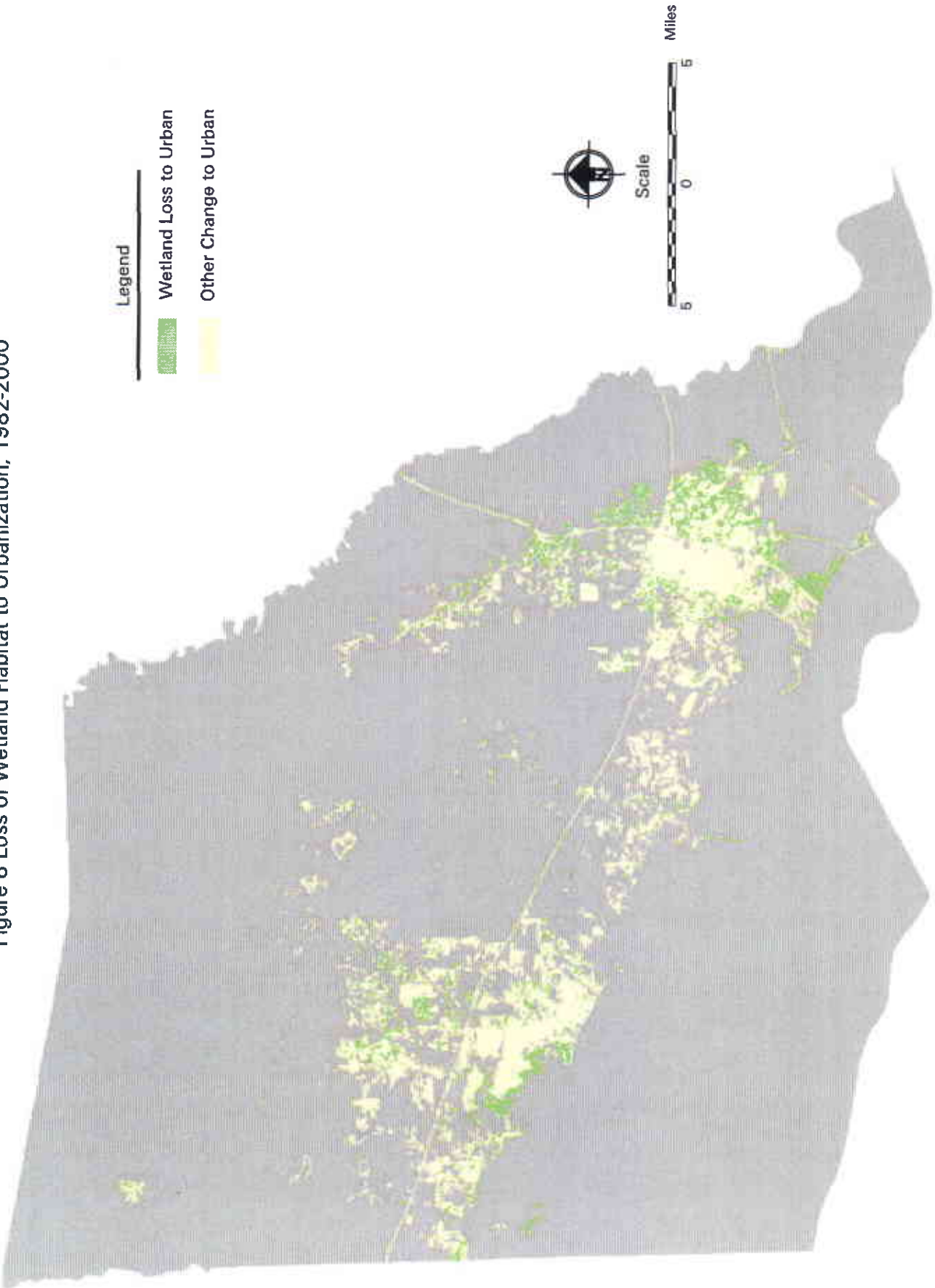


Figure 8 Loss of Wetland Habitat to Urbanization, 1982-2000



DISCUSSIONS AND CONCLUSION

Table 5 summarizes the habitat changes that have occurred in St. Tammany Parish over the past 18 years. Between 1982 and 2000, 616 acres of marsh a year have been lost, and 219 acres of wetland forest a year have been lost to urbanization. Even while accounting for the nature of the timber industry, 33,988 acres of upland forest were lost to urban growth, or 1,888 acres per year. Urbanization in St. Tammany has occurred at rate of 2,699 acres per year. At this growth rate, urban areas will occupy 138,296 acres, or 19.2% of the parish by 2025, and 205,771 acres, or 28.6% of St. Tammany by 2050.

By performing this research, the University of New Orleans – Coastal Research Laboratory tested and developed a methodology for detecting and analyzing land cover change in St. Tammany Parish. This methodology can now be applied to parishes Basin-wide to assess land cover change between any time periods

Table 5 Summary of Habitat Change Rates, 1982-2000

	1982 (Acres)	2000 (Acres)	Amount of Change (Acres)	Change Rate 1982-2000 (Acres/Year)	Percent Change
Marsh	52,938	41,849	-11,090	-616	-20.9%
Wetland Forest	126,425	122,479	-3,946	-219	-3.1%
Upland Forest	237,232	203,244	-33,988	-1,888	-14.3%
Shrub/Scrub	54,909	51,770	-3,140	-174	-5.7%
Ag/Grass/Barren	47,156	48,912	+1,755	+98	+3.7%
Urban	22,238	70,821	+48,582	+2,699	+218.5%

REFERENCES

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