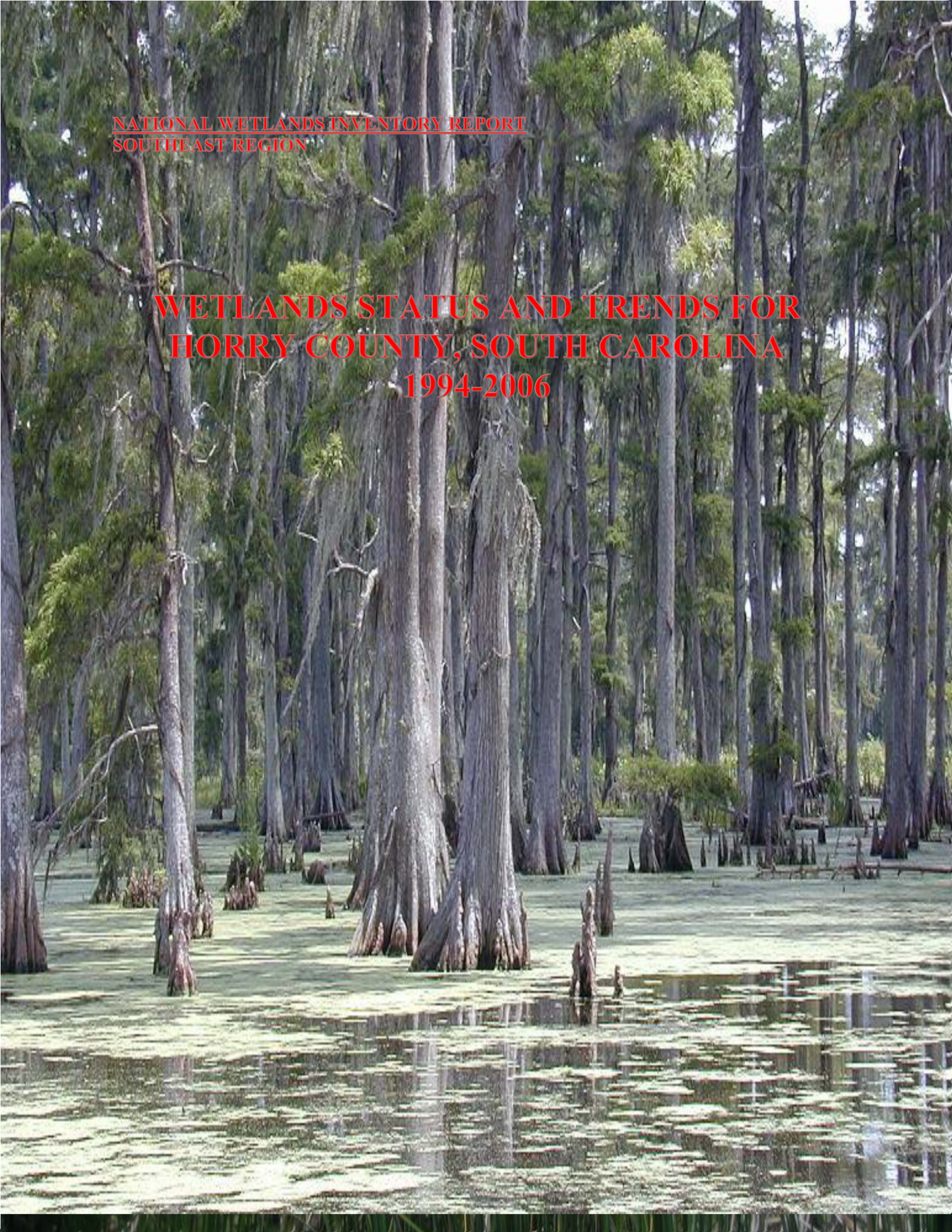

NATIONAL WETLANDS INVENTORY REPORT
SOUTHEAST REGION

WETLANDS STATUS AND TRENDS FOR HORRY COUNTY, SOUTH CAROLINA 1994-2006

WETLANDS STATUS AND TRENDS FOR HORRY COUNTY, SOUTH CAROLINA 1994-2006

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Table of Contents

List of Figures

List of Tables

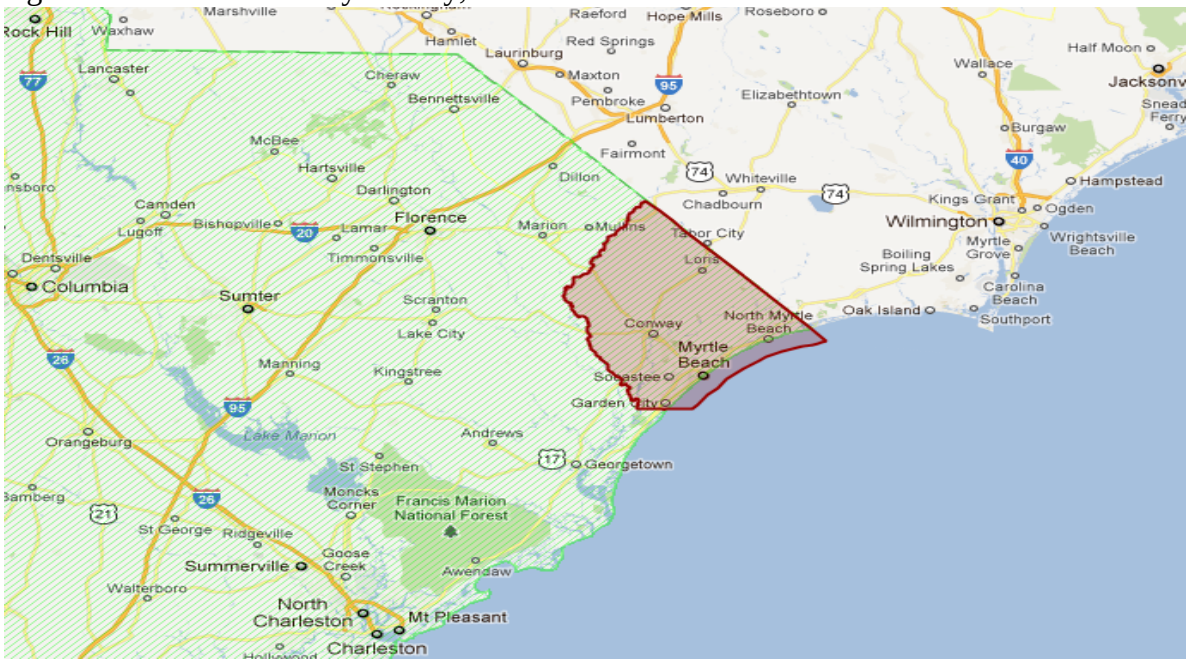
INTRODUCTION

The U.S. Fish and Wildlife Service's National Wetlands Inventory Program (NWI) is responsible for mapping the nation's wetlands and for conducting assessments of wetland trends. Horry County, South Carolina is an area where wetlands have been significantly impacted by urban development where information on the current status and recent trends are needed. Consequently, the NWI initiated a local wetland trends study to evaluate the extent of these impacts and to address the status of wetlands in terms of wetland acreage. This report summarizes the study findings and makes government agencies and the public aware of the general status of and recent changes in wetlands in Horry County. Some changes are natural such as vegetation succession, and plant colonization of shallow water, while other changes are human-induced including creation of wetlands and loss of wetlands to upland for a variety of purposes. In addition to increasing public awareness of the status of wetlands, the findings may be used by public agencies and private nonprofit organizations to develop wetland conservation strategies that aid regional and local natural resource planning efforts.

STUDY AREA

Horry County is bounded to the north by Brunswick and Columbus counties, North Carolina, to the east by the Atlantic Ocean, to the south by Georgetown County, and to the west by Dillon and Marion counties. It lies within the Lower Coastal Plain (locally referred to as the "low country"), which is made up of fluvial deposits that contain varying amounts of sand, silt, and clay. This is also the area known as the Atlantic Coast Flatwoods which extends from the sea shore inland about 30 to 70 miles. The area is characterized by broad flats and depressions. While there are areas of well drained soils, much of the flatwoods consist primarily of poorly drained soils with clay subsoils, especially near the coast and in the project area (Ellerbe 1974:18).

Figure 1: Location of Horry County, South Carolina.



Horry County has experienced rapid growth over the past several decades particularly along the "Grand Strand". This growth appears to be expanding within the incorporated regions and impacting the rural areas as well. Horry County's coastal waters and associated habitat are a very dynamic ecosystem and an extremely valuable natural resource. Coastal resources are also significant aesthetic, recreational, and educational assets to Horry County. Much of the expenditure for recreational and tourism in the South Carolina coastal zone is for purposes of enjoying outdoor activities and the aesthetic pleasures of undisturbed tideland areas (Horry County CP, 1999). A major land use for Horry County is timber harvesting. These areas of poorly drained soils that make up a lot of the original wetlands are some of the most intensively managed forested sites in the world (Allen and Campbell 1988).Even though the industry has scaled back, freshwater forested wetlands are being impacted by silviculture and other logging practices. The forest industry in the southeastern United States owns and leases forest lands largely for pulp and paper production (McKnight et al. 1981).

One of the most unusual ecosystems found in Horry County is the Carolina bay (Figure 2). Carolina bays are oval or elliptical depressions of unknown origin (Sharitz and Gibbons 1982). There is no precise accounting of the number of Carolina bays in Horry County that have been converted to upland. Fortunately, Carolina bays can be found at several of South Carolina Department of Natural Resources' Heritage Trust Program Preserves. At the Lewis Ocean Bay Heritage Preserve in Horry County, twenty three undisturbed bays can be observed.

Figure 2: Example of Carolina Bays in Horry County.

METHODS

Wetland trends involve conducting an area-wide inventory of wetlands covering two time periods. This approach is generally used for small geographic areas where more detailed investigations can be carried out. For this study, we chose the inventory of change approach to evaluate wetland trends. Change detection was done through image interpretation procedure examining aerial imagery to determine wetland trends for the time period 1994-2006. Delineations revealed wetland habitat changes on the landscape that indicated land use impacts over the twelve year study period.

Data Sources

The 2006 NWI data were available for this study and served as the foundation for the project. These data were derived by a combination of aerial image analysis and interpreting collateral data sources. Aerial image interpretation was done via onscreen techniques. The 1994 color-infrared DOQQs were acquired from the South Carolina Department of Natural Resources. In support of the contemporary period (2006), one-foot resolution true color digital imagery was obtained from USDA NAIP program. These sources allowed an assessment of wetland changes from 1994 to 2006. Digital soils data available from the USDA Natural Resources Conservation Service 1986 survey (USDA-SCS. 1986) were consulted to help delineate drier-end wetlands (e.g., seasonally saturated flatwoods) that typically are hard to detect through conventional image interpretation.

Interpretation of Trends

Changes in wetlands due to both natural and human-induced actions were detected on the imagery by directly comparing the status of wetlands on each set of imagery. An on-screen, "heads up" process was used for detection and delineation. This method required working back in time comparing the 2006 NWI wetlands to the 1994 imagery. The most current NWI data and the 2006 imagery (from which it was derived) were used as the foundation for the trends assessment. Wetlands were added, deleted, or their boundaries were reconfigured to more accurately represent their status at the applicable time period. Wetlands and deepwater habitats were classified according to the Service's official wetland classification system (Cowardin et al. 1979) which is the national standard for wetland classification http://www.fgdc.gov/standards/projects/FGDC-standards-projects/wetlands-mapping/index_html

Wetland changes between 2006 and 1994 were identified by overlaying the 2006 NWI data on the 1994 imagery. The causes of the changes were determined by consulting the 2006 images. Each change was digitized, with the cause recorded, creating a trends data layer. Conversions of wetlands to non-wetlands were labeled by their respective land use or land cover classification following (Anderson et al. 1976). The minimum area of change detected was approximately 0.5 acre.

Data Analysis and Tabulation

Geospatial data were analyzed through geographic information system technology, using ArcGIS 9.3 (Environmental Systems Research Institute, Inc., ESRI). Statistics addressing wetland status and trends for the study were generated using this program. For the 2006 NWI data, the target mapping unit (tmu) was approximately 0.5 acre, recognizing the inherent limitations of image interpretation for mapping wetlands (Tiner 1990). Such targets are for general guidance only, and many conspicuous, smaller wetlands are often mapped, with ponds being the most common wetland type mapped below the tmu.

Figure 3: Freshwater forested wetland

RESULTS

Wetland and Deepwater Habitat Status: 2006

Wetland and deepwater habitats occupied 660 square miles of the study area and amounts to 58 percent of Horry County. Forested wetlands were the dominant type, representing 217,224 acres of wetlands in Horry County. Scrub-shrub wetlands were next in abundance, accounting for 36,896 acres, followed by emergent wetlands with over 11,000 acres inventoried. Ponds (e.g., palustrine unconsolidated bottoms and shores) totaled nearly 7,400 acres. Estuarine wetlands represented 2,479 acres, the majority of this wetland type were emergent (2,182 acres).

The deepwater habitat portion of the study area had over 149,000 acres inventoried. Marine open water represented 136,177 acres, followed by estuarine open water at 3,142 acres. Freshwater deepwater habitats included lacustrine (1,383 acres) and riverine (8234 acres) (Table 1).

Figure 4: Estuarine marsh.

Wetland Trends

The general trends for the region were losses of vegetated wetlands (forested, scrub-shrub, and emergent types) and gains in non-vegetated wetlands (ponds and shallow lakes/impoundments).

Vegetated Wetlands

Losses and Changes in Wetland Type

From 1994-2006, a total of 14,605 acres of vegetative wetlands were lost due to land use changes (Table 2). In addition, 976 acres of vegetated wetlands were converted to non-wetland or non-vegetated wetlands (ponds) (Table 3). The largest wetlands lost were attributed to timber harvesting which accounted for 30 percent. At 20 percent, wetlands losses related to transitional lands (lands that are in transition to a variety of development types) were detected. Also at 20 percent, losses were attributed to residential development. The fourth largest impact came from commercial development at 7 percent. At 5 percent each, losses related to agricultural activities, recreational development, and ponds were recorded. Transportation activities accounted for 4 percent of the losses; 3 percent reflect losses from conversion to rangelands and one percent from industrial development. The average annual loss of wetlands during this period was 1,250 acres. Forested wetlands received the brunt of the impacts, declining by more than 12,000 acres. Other impacts on vegetative wetlands were identified by way of timber harvesting and pond conversion which impacted over 13,000 acres of change in wetland types (Table 4).

Gains

There were no gains in vegetative wetlands for the time period 1994-2006.

Forested Wetland Cuts (Conversion of Wetland Type due to Timber Harvesting)

Due to the amount of timber harvesting within Horry County, forested wetlands were impacted by cutting practices over 12,000 acres of forested wetlands (Table 4) were converted. Twenty four percent of forested wetlands loss went to upland managed pine development. The remaining seventy six percent were converted into other vegetated wetland types (mostly wetland emergent and/or shrubs).

Figure 5: Impacted wetland from a timber cut.

Nonvegetated Wetlands

Losses

Nonvegetated wetlands in Horry County are ponds. Nearly158 acres of these habitats were altered during the time period 1994-2006 (Table 5). Most of them were filled in for upland development or conditions related to timber harvesting.

Change

There was a small change from nonvegetated wetland type to vegetated wetland. Approximately 29 acres transitioned in this manner (Table 6)

Gains

Increases in nonvegetated wetlands mainly through pond construction occurred throughout the study period. Palustrine unconsolidated bottom acreage rose by 22 percent. Overall, pond acreage (palustrine unconsolidated bottom) increased by nearly 1,600 acres during the 12-year period (Table 7).

Figure 6: Area of Wetland Losses in Horry County 1994-2006.

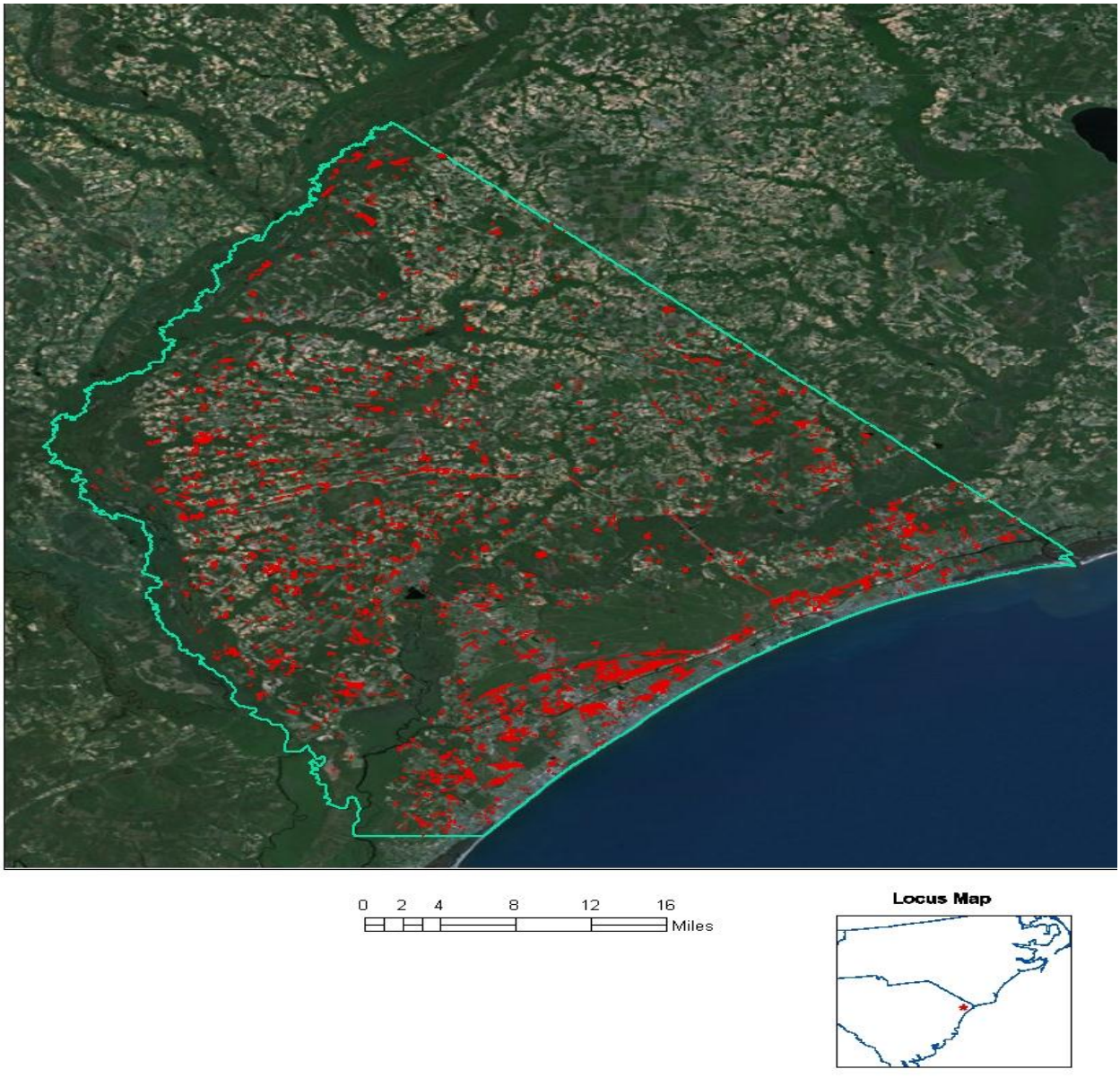


Figure 7: Area of Wetland Gains in Horry County 1994-2006.

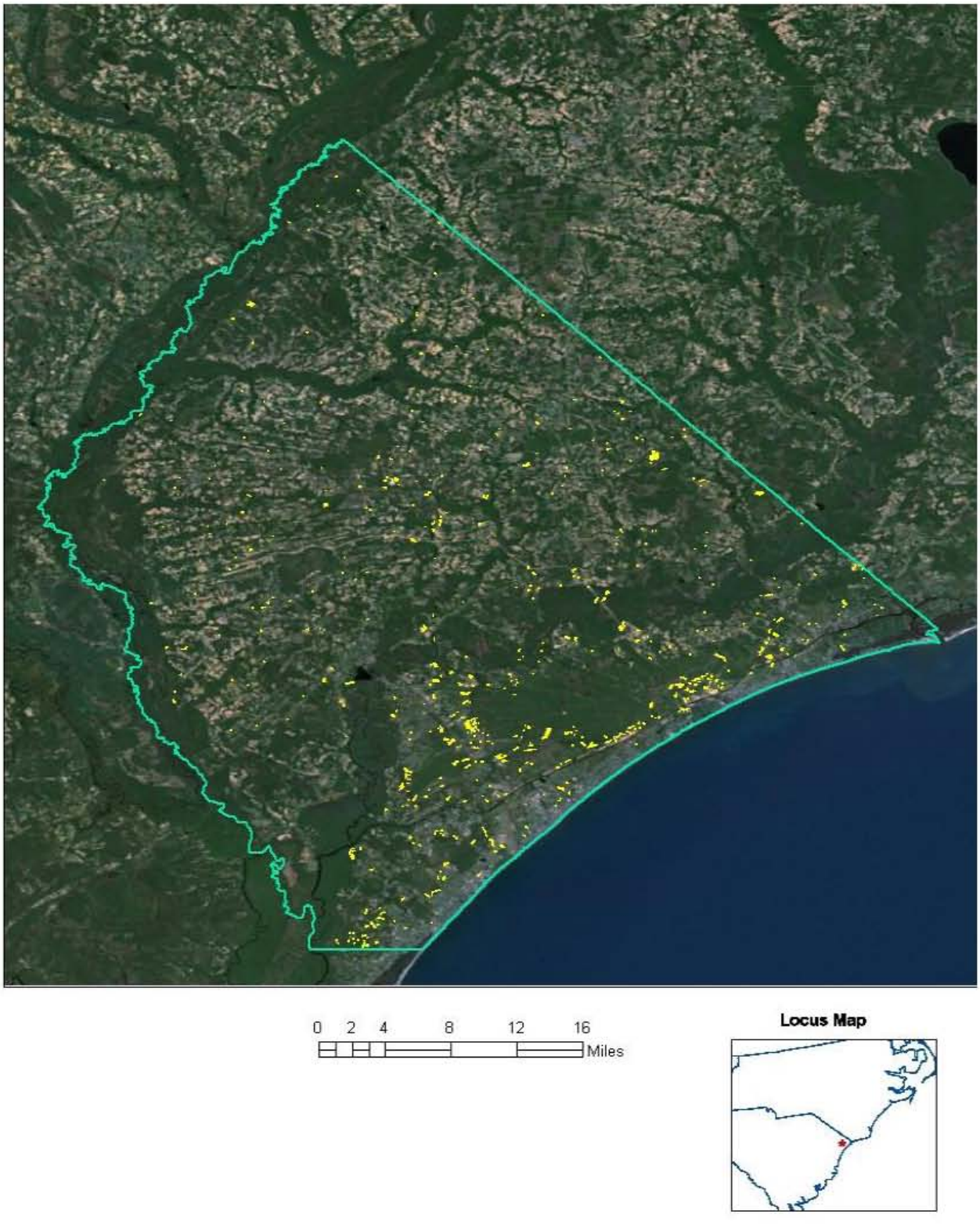


Table 1. Extent of wetlands and deepwater habitats in Horry County, 2006.

	NWI Classification		*Acreage*
Habitat	**System**	**Class**	
Wetland	**Estuarine**	**Emergent**	**2182.3**
		Scrub-Shrub	**64.2**

		Emergent	**9,093.6**
		Scrub-Shrub	**36,831.9**
		Unconsolidated Shore	**7.4**
		Total Palustrine Wetlands	**270,615**
Riverine		**Unconsolidated Shore**	**1.5**

		Total Riverine Wetlands	**1.5**
	GRAND TOTAL –WETLAND		**274,017.9**
Deepwater Habitat			
	Lacustrine	**Unconsolidated Bottom**	**1382.4**
	Estuarine	**Unconsolidated Bottom**	**3,142.1**
	Marine	**Unconsolidated Bottom**	**136,176.7**
	Riverine	**Unconsolidated Bottom**	**8,234.2**
	GRAND TOTAL-DEEPWATER HABITAT		**148,935.4**

Table 2. Causes of vegetated wetland trends: Losses

Nature of Change	*Cause of Change*	*Wetland Type Affected*	*Acres Changed*
LOSS to	**Agriculture**	**Emergent**	**37.8**
		Forested	**675.9**
		Scrub-Shrub	**85.8**
		(Subtotal)	***(799.5)***
	Commercial Development	**Emergent**	**21.3**
		Forested	**974.5**
		Scrub-Shrub	**121.9**
		(Subtotal)	***(1117.7)***
	Industrial Development	**Forested**	**79.9**
		Scrub-Shrub	**29.0**
		(Subtotal)	***(108.9)***
	Rangeland	**Emergent**	**1.1**
		Forested	**434.2**
		(Subtotal)	***(435.3)***
	Recreational Development	**Emergent**	**2.8**
		Forested	**617.6**
		Scrub-Shrub	**167.7**
		(Subtotal)	***(788.1)***
	Residential Development	**Emergent**	**31.2**
		Forested	**2,546.2**
		Scrub-Shrub	**295.2**
		(Subtotal)	***(2872.6)***
	Timber Harvesting	**Emergent**	**132.4**
		Forested	**3317.6**
		Scrub-Shrub	**1165.7**
		(Subtotal)	***(4615.7)***

Table 2. Causes of vegetated wetland trends: Losses Continued.

Nature of Change	*Cause of Change*	*Wetland Type Affected*	*Acres Changed*
LOSS to	**Transitional Development**	**Emergent**	**53.1**
		Forested	**2484.5**
		Scrub-Shrub	**343.9**
		(Subtotal)	***(2881.5)***
	Transportation Development	**Emergent**	**85.1**
		Forested	**810.6**
		Scrub-Shrub	**89.6**
		(Subtotal)	***(985.3)***
	TOTAL VEGETATED LOSSES		**14,604.6**

Table 3. Causes of vegetated wetlands trends: Change in Type

Nature of Change	*Cause of Change*	*Wetland Type Affected*	*Acres Change*
CHANGE IN TYPE	**Scrub-Shrub**	**Aquatic Bed**	**11.3**
	Pond Creation	**Emergent**	**34.6**
	Pond Creation	**Forested**	**745.9**
	Pond Creation	**Scrub-Shrub**	**195.4**
		(Subtotal)	***(987.2)***
TOTAL CHANGE IN VEGETATED			**987.2**

Table 4. Causes of vegetated wetlands trends: Change in Wetland Type due to Timber Harvesting

Nature of Change	*Wetland 1994*	*Wetland 2006*	*Acres Changed*
CUTS	**Forested**	**Aquatic Bed**	**12.5**
	Forested	**Emergent**	**3130.9**
	Forested	**Emergent/ Scrub-Shrub**	**1019.9**
	Forested	**Scrub-Shrub**	**8762.6**
	TOTAL CHANGE IN VEGETATED		**12,925.9**

Table 5. Causes of nonvegetated wetland trends: Losses

Nature of Change	*Cause of Change*	*Wetland Type Affected*	*Acres Changed*
LOSS to	Agriculture	Unconsolidated Bottom	10
	Commercial	Unconsolidated Bottom	2.7
	Industrial	Unconsolidated Bottom	0.6
	Rangeland	Unconsolidated Bottom	46.2
	Recreational	Unconsolidated Bottom	0.8
	Residential	Unconsolidated Bottom	16.1
	Transitional	Unconsolidated Bottom	70.4
	Development	Unconsolidated Shore	5.6
	Transportation	Unconsolidated Bottom	2.5
	TOTAL NONVEGETATED LOSSES		157.7

Table 6. Causes of nonvegetated wetlands trends: Change in Type

Nature of Change	*Cause of Change*	*Wetland Type Affected*	*Acres Changed*
CHANGE IN TYPE	Emergent	Unconsolidated Bottom	9.5
	Forested	Unconsolidated Bottom	8.2
	Scrub-Shrub	Unconsolidated Bottom	11.1
	TOTAL CHANGE IN NONVEGETATED		28.8

Table 7. Causes of nonvegetated wetland trends: Gains

Nature of Change	*Cause of Change*	*Nonvegettated Type*	*Acres Changed*
		PUB	**223.9**
		PUS	**4.1**
		(Subtotal)	***(284.3)***
	Development	***(Subtotal)***	***(1.6)***
	Development	***(Subtotal)***	***(1.4)***
		PUB	**52.1**
		(Subtotal)	***(75.5)***
	Development	***(Subtotal)***	***(5.5)***
	Development	***(Subtotal)***	***(8.7)***
	Harvesting	**PUB**	**825.7**
		(Subtotal)	***(984.8)***
	Development	**PUB**	**176.3**
		(Subtotal)	***(219.1)***
	Development	***(Subtotal)***	***(4.5)***
	TOTAL GAINS		**1585.6**

STUDY LIMITATIONS

Wetlands identified with the wetter water regimes such as permanently flooded, semipermanently flooded, and seasonally flooded are usually the most easily recognized types through image interpretation and are therefore the most accurately mapped. In contrast, seasonally saturated and temporarily flooded wetlands are quite challenging to detect through remotely sensed techniques. These wetlands typically lack standing water except in few shallow depressions that may contain water for brief periods after heavy summer rains. They have high water tables during these seasons that have supported the establishment of wetland vegetation and formation of hydric soils. The lack of surface wetness makes them particularly difficult to photointerpret as well as to recognize in the field. In addition, seasonal differences of the 2006 imagery (acquired in the spring & fall) other confines on detecting forested wetlands may have occurred. Examination of soil properties is usually required to verify the existence of these wetlands. Soil surveys conducted by the U.S. Department of Agriculture, Natural Resources Conservation Service provide a useful source of information to aid photointerpreters in mapping these difficult types. This information is now available in digital form to facilitate this process. Limited field checking in the general area by NWI personnel found that there was a good correlation between hydric soils and these drier-end wetlands. Nonetheless, the interpretation of these types should be considered conservative and field verification is recommended to evaluate the potential uses of these types.

Habitat fragmentation by roads, residential and commercial development has also played a significant role in adversely affecting wetlands. This type of development has often reduced the connectivity among wetlands, especially for those wetlands not intersected by streams. In addition, such development has most likely adversely impacted the hydrology of wetlands across the region as local drainage patterns have been disrupted.

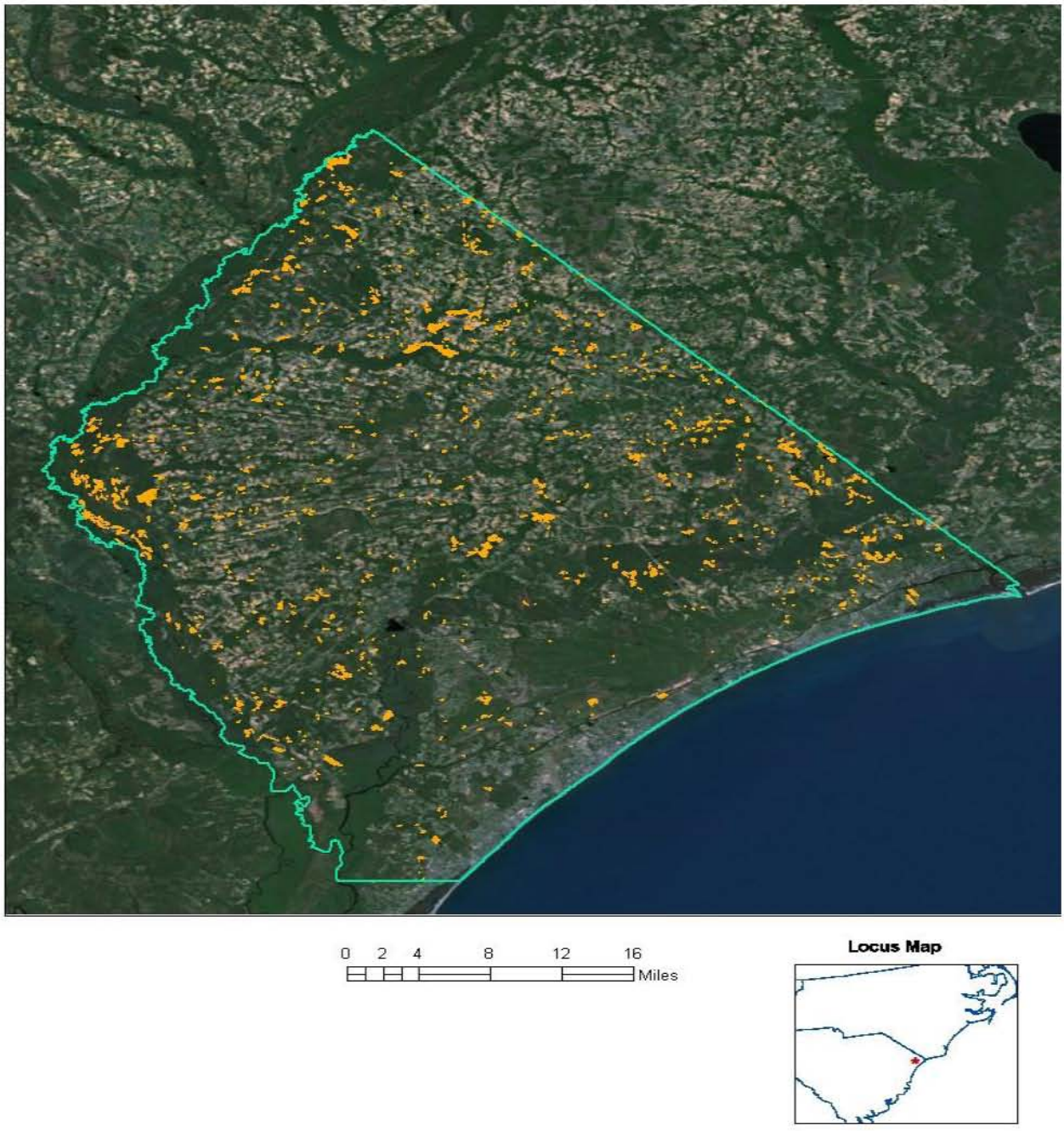
SUMMARY

In 2006, wetlands represented thirty eight percent of Horry County. Forested wetlands remained the dominant type, occupying nearly 217,000 acres and accounting for eighty percent of the county's wetlands. The county lost nearly six percent of its vegetated wetlands from 1994 to 2006 while nonvegetated wetland acreage (e.g., ponds) rose by twenty two percent (5,700 to 7,292 acres). Transitional land development was the main cause of the vegetated wetland loss, being responsible for 40 percent of the losses from 1994 to 2006.

Silviculture accounted for the second largest percentage of wetland loss (30 percent). Besides the actual wetland loss / conversion connected with timber practices, related impacts from road construction, ditching, fertilizers and cutting practices will have long term influences on this land. If best management practices are used and careful monitoring occurs, silviculture and timber removal may only minimally affect some wetland functions. Other practices that can acutely impact habitat is the conversion to a monoculture environment, typically loblolly pine (*Pinus taeda*).
Because timber removal generally occurs in 20-50 year rotations, careful harvest may not be a permanent threat to wetlands, but a variation in practices may occur. Adverse effects of timber

harvest can include a rise in water table due to a decrease in transpiration, soil disturbance and compaction by heavy equipment, sedimentation and erosion from logging decks, skid trails, roads, ditches, drainage, and altered hydrology from ditching, draining, and road construction (Shepard 1994).

Figure 8: Wetlands (Changed or Converted) to Different Types due to Timber Activities, 1994-2006.



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