

County Level Wetland Protection  
in the Southwest Florida Water Management District

By

Dana L. Parkinson

A thesis submitted in partial fulfillment  
of the requirements of the  
University Honors Program  
University of South Florida, St. Petersburg

May 3, 2013

Thesis Director: Christopher F. Meindl, Ph.D.  
Associate Professor, College of Arts and Sciences

University Honors Program  
University of South Florida  
St. Petersburg, Florida

CERTIFICATE OF APPROVAL

---

Honors Thesis

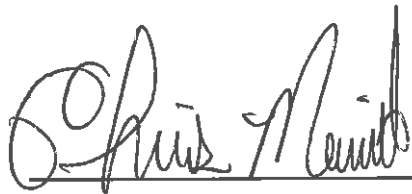
---

This is to certify that the Honors Thesis of

Dana L. Parkinson

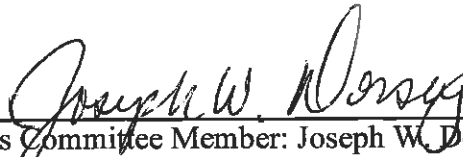
has been approved by the Examining Committee  
on May 3, 2013  
as satisfying the thesis requirement  
of the University Honors Program

Examining Committee:



---

Thesis Director: Christopher F. Meindl, Ph.D.  
Associate Professor, College of Arts and Sciences



---

Thesis Committee Member: Joseph W. Dorsey  
Assistant Professor, College of Arts and Sciences

**County Level Wetland Protection in the Southwest Florida Water Management District**

## **Abstract**

Wetlands provide groundwater recharge, buffer against storm surges, provide nurseries for fish, and many other ecosystem services humans depend on. Wetlands are threatened by encroaching development and other human influences. Protecting wetlands will become an increasingly important priority in the future as people deal with issues such as sea level rise. Wetlands are regulated at the federal, state, and county levels (see Appendix A). This thesis focuses on the wetland regulations of the sixteen counties that comprise the Southwest Florida Water Management District. In this thesis, public policies are compiled and inventoried to allow a general understanding of the methods of protection in each county.

## Introduction

Wetlands are found on every continent except Antarctica (EPA, 2012). They are the most controversial landscape in the US, especially in Florida. They offer many benefits to people, provide habitat for threatened and endangered species, and are an indicator of planetary environmental health (NRCS, 2012). Wetlands often have high levels of biodiversity and perform many ecological functions that are valued by people. The National Resources Defense Council (NRDC) categorizes wetland functions as such: curbing damage from floods, replenishing water supplies, improving water quality, providing wildlife habitat and ensuring biodiversity, and providing recreation, food, and aesthetic enjoyment (NRDC, 2012). Furthermore, wetlands destruction exceeds that of any other ecosystem (WRI, 2005). Although there are federal and state regulations to manage wetlands, rampant destruction of such valuable habitat continues. Some counties in Florida feel compelled to establish their own wetland protection methods. County level wetland protection in Florida has never been compiled, inventoried, and analyzed. This study found each county in the Southwest Florida Water Management District (SWFWMD) varies greatly in the way they protect their wetlands. The inventory and analysis of county level protection offer a starting point for further analysis. This research provides planners and environmentalists with ideas from neighboring counties they could implement. County level land use restrictions could lead to much more thorough wetland protection than is offered at the state or federal level.

According to the United States Fish and Wildlife Service (FWS), wetlands are defined by three main attributes: the presence of hydrophytes (plants adapted to live in inundated soil), hydric soils, and water at or near the surface (FWS, 2011). The definitions used for scientific purposes generally include those same three features, making them broad enough to encompass

many different types of wetlands. Scientific definitions of wetlands may seem vague, but in fact they leave room for the individual attributes of each wetland, which make them unique.

Scientists estimate that there were approximately 221 million acres of wetlands extant in 1780 in the conterminous United States. Half of these wetlands have been lost to agricultural and other land uses (Vileisis, 1997). Population growth in the United States prompted significant wetland loss due to land drainage for agriculture and livestock operations. From the 1970s to the 1980s, agriculture accounted for a 54% of wetland losses. As recently as the 1980s and 1990s wetland losses fell to 26%. Meanwhile, urban and rural development rose to become the main contributors to wetland losses in the 1980s and 1990s (Dahl, 1991).

Wetlands comprise a variety of plants, animals, saturation, and soils. To grasp the general gains and losses of wetlands in the conterminous US, the U.S. Fish and Wildlife Service (FWS) creates an inventory of basic wetland types by surveying several thousand sites using remote sensing and field verification (Dahl, 2011). This is a critical and valuable tool in understanding the status of this ecosystem in the United States. With the complexity of classifying a variety of plants, animals, water saturation, and soil conditions, this research is a difficult task with constantly changing variables. The first FWS wetlands report in 1956 coined the term “wetland”, which soon after became a commonly used term. Reports were published for ten year periods of data from 1956 until 1998, and have since been produced for 5 year periods of data (Shaw and Fredine, 1956; Frayer, Monahan, Bodwen, and Graybill, 1983; Dahl and Johnson, 1991; Dahl, 2000; Dahl, 2011). This increase in the frequency of wetland inventories is a reflection of the mounting concern for wetland losses. Although US Fish and Wildlife reports indicate the first recorded net gain in US wetlands from 1998 to 2004 (Dahl, 2005), these reports include areas that many people would not call a wetland. The criteria used by FWS to identify wetlands do not

differentiate between flourishing, natural wetlands and those which have lost ecological functions due to degradation from human actions (Vileisis, 1997). Indeed, golf course water hazards and shallow ponds in residential areas are usually counted as “wetlands”. FWS inventories account only for the number of wetland acres and do not address indicators of wetland health, such as ecological function and value (Dahl, 2005). “Deterioration in habitat, rather than actual loss of wetland, is perhaps the greatest challenge faced by wetland conservationists” (Reed, 1993). According to the report (Dahl, 2005), while natural freshwater wetlands decreased, there was a 700,000 acre increase in freshwater ponds. The report explains that most of these ponds were created by humans. Although these reports make it clear that wetland health is not accounted for in the data (Dahl, 2005), the secretaries of the Department of Agriculture and Department of Interior “hailed the apparent reversal in the long trend of wetland losses” (Barringer, 2006). During a press conference in March of 2006, Secretary of the Interior Gale Norton took criticism from the press for making claims about successful wetland conservation using a report that classifies ornamental ponds and golf course water hazards as wetlands (Pittman and Waite, 2009). Most of the ponds counted as freshwater wetlands were the byproduct of development. These ponds do not provide usable habitat and ecological function equal to a natural wetland.

The inventories use sound scientific research methods, and include a thorough explanation of the data collection and analysis, exclusion of certain wetlands, and the limitations of the findings. The 2005 report states “Types of procedural errors may have included missed wetlands, inclusion of upland as wetland, misclassification of wetlands or misinterpretation of data collection protocol” (Dahl, 2005, page 36). This information does not debunk the significance of the report’s findings, it simply clarifies its scope and possible errors. Given that the procedural

error was only 3-5% and the sampled area was around 1.93 billion acres, the research was significant for understanding the status and trends of wetlands in the conterminous US. However, when the net gain of wetlands is 32,000 acres, almost all of which are freshwater, and pond area is reported to have increased 12.6% over the study period, there is no reason for politicians to announce a triumphant turning point in wetland conservation (Dahl, 2005). Such announcements underscore the highly politicized nature of environmental policy.

Wetlands provide humans with an array of valuable resources and services that are economically, aesthetically, and environmentally significant. The World Resources Institute (WRI) defines ecosystem services as natural activities that provide goods and services that humans fundamentally depend on (WRI, 2013). WRI organizes wetland ecosystem services into four categories: provisioning, regulating, cultural and supporting services. Provisioning services include: the production of fish, wild game, fruits, and grains for food; storage and retention of fresh water for domestic, industrial, and agricultural use; production of fiber and fuel such as logs, fuel wood, peat, and fodder; and extraction of biochemical materials and medicines; genetic materials such as genes for resistance to plant pathogens and ornamental species (WRI, 2005). Regulating services include: climate regulation by acting as a source of and sink for greenhouse gases; influencing local and regional temperature, precipitation, and other climatic processes; groundwater recharge and discharge water purification and waste treatment through the retention, recovery, and removal of excess nutrients and other pollutants; erosion regulation through the retention of soils and sediments; natural hazard regulation through flood control and storm protection; and providing habitat for pollinators (WRI, 2005). Cultural services include: inspiration for many religions which attach spiritual and religious values to aspects of wetland ecosystems; opportunities for recreation activities; providing aesthetic value; and providing



opportunities for education and training (WRI, 2005). Supporting services include: soil formation through sediment retention and accumulation of organic matter, and nutrient cycling through the storage, recycling, processing, and acquisition of nutrients (WRI, 2005). Human dependence on wetlands is undeniable. Wetland preservation is absolutely necessary in order to maintain the quality of life people have come to expect and appreciate.

Wetlands vary in the functions they perform; different wetlands provide different ecosystem services. In addition, there is no ideal, climax state for any type of wetland to reach. They are constantly fluctuating and changing. Some wetlands remain inundated all year, while others provide standing water only seasonally. Because large amounts of water can be moving beneath the soil, the nature of water in wetlands is not always seen at the surface.

Because the term “wetland” encompasses areas that can vary so greatly, regulating them is challenging. Policymakers have personal preconceptions of what constitutes a wetland. These preconceptions can be comprised of facts, opinions, or a combination of both. Simply agreeing on the definition of a wetland is often a seemingly insurmountable task. Hydrologists use different definitions for wetlands than biologists. Soil chemists use different definitions than politicians. This divide between the scientific and legislative conceptions of wetlands has been the source of much confusion and many misunderstandings. Scientists strive for a flexible definition that includes ecosystems that are at least occasionally flooded, and have hydric soils and hydrophytic vegetation. Scientists recognize the great diversity of soils, hydrology, and biota that comprise wetlands. Meanwhile wetland managers and policymakers crave clear-cut, easily defensible definitions that will hold up in a judicial setting. They care less about the complex relationships between soil, water, and living things that make up a wetland. Their priority is finding a definition that will allow them to implement wetland policy. Understanding the journey

and evolution of wetland protection in the United States is key to grasping the complexity of the players, language, and effectiveness of wetland protection today.

Initially, the federal government supported the drainage of wetlands for their use in agriculture and development. They were seen as a nuisance that could only be usable if altered. In the 1850s, the Swampland Acts allowed the federal government to use buried tiles to help drain wetlands on federally owned land. Congress continued to subsidize wetland drainage for use in agriculture as late as the 1970s (Tzoumis, 1998). After converting tens of millions of acres of wetlands to other land uses by the mid-1900s, the public perception of wetlands began to change. Scientists began to clarify the relationship between wetland degradation and a decrease in wetland ecosystem services (Shaw and Fredine, 1956). Increased understanding of wetlands provided fuel for environmental activists and non-government organizations defending wetlands against destruction for agriculture and development (Tzoumis, 1998). Still, from the mid-1950s to the mid-1970s, the US lost 458,000 acres of wetlands per year. The Clean Water Act of 1972 brought further attention and protection to the status of the nation's waters. From the mid-1970s to the mid-1980s, the rate dropped to 290,000 acres lost per year (Dahl, 1991). From 1986-1997, the rate continued to decrease to 58,500 acres lost per year (Dahl, 2000). In 1987, the United States Environmental Protection Agency (EPA) convened the National Wetlands Policy Forum to discuss national goals regarding wetlands. One of the recommendations of this forum is a national policy of "no net loss" of wetlands (Lewis, 2001). No net loss of wetlands is a national goal first embraced in 1990 by President George H. W. Bush, and it has been adopted by every president since. Although this policy may appear straightforward, it is not without caveats. By using "net", the policy seems to suggest that it is acceptable to destroy wetlands as long as new wetlands are created. Furthermore, it suggests that wetlands will be of equal value to those lost.

The term “loss” could mean a loss in acreage or a loss in function (Lewis, 2001). Nevertheless, this policy reflects the nation’s aspiration to stop, or perhaps just slow down, its overall trend of wetland degradation. In 2004, President George W. Bush announced a new “wetlands initiative” that extends beyond “no net loss,” calling for an increase in wetlands. The goals of this policy include not only increasing the quantity of wetlands but the quality as well (Dahl, 2005). While the federal government recognizes the importance of this ecosystem, it still often supports actions that cause wetland destruction, such as highways the cut through wetlands, interrupting local hydrology and ecology. This is the paradox of national wetland policy. Today, Congress continues to make decisions affecting the future of wetlands in the United States. Deregulation often plays a role in spurring economic growth, but can also remove environmental regulations that protect wetlands. Because wetlands are so difficult to identify and define, and they occupy property that could be developed, there is a continuing trend of natural wetland loss in the United States. The goal of no net loss of wetlands stands as recognition that protecting this natural resource is a nationwide priority.

Wetland regulations exist on public and private property at the federal, state, and county level. The first law affecting wetlands, the Swamp Land Act, was enacted in 1849. Since that time, many other laws have passed that regulate the use of wetlands and slow the rate of their destruction- but none have stopped it. University of Florida professor Alyson Flournoy (2004) calls the current situation “slow net loss”. In less than 150 years half the nation’s wetlands have been destroyed. Laws and government permitting programs intended to preserve the nation’s water quality are inadequate. On the state level, Florida’s wetlands are regulated by the Department of Environmental Protection (DEP) through the state’s five water management districts, and through some local governments, as outlined in Chapter 373 of the Florida Statutes

(The Florida Legislature, 2013). Florida has lost nearly 9 million acres of wetlands and is currently undergoing changes that may incite more rapid wetland destruction. Florida counties have the opportunity to further regulate wetlands through Florida Statute 373.441.3:

“373.411.3. Consistent with s. 373.441, this section does not prohibit a county, municipality, or local pollution control program from adopting or implementing regulations that are stricter than those adopted pursuant to this section [Water Resources]” (The Florida Legislature, 2013).

County level wetland regulations provide an opportunity to manage them in a more responsible manner, tailored to the specific types found in each individual county. Moreover, each county can prioritize its wetlands, directing development to less sensitive areas while preserving ecosystem services in other wetlands. Effective statewide wetland management should begin with each individual county.

The Sunshine State contains roughly 11.4 million acres of wetlands (Dahl, 2005): more wetlands than any other state besides Alaska (Pittman and Waite, 2009). Although 11.4 million acres appears to be a vast amount, 200 years ago Florida had 20.3 million acres of wetlands (Pittman and Waite, 2009). Wetlands play crucial roles in Florida, from helping buffer against storm surges to supporting the economy. Although wetland regulations exist at the federal and state levels, wetland degradation continues. Yet county level wetland regulations reflect a local population’s priorities, clearly showing each county’s relative desire to ensure the future of its wetland resources.

The relationship between the government and private landowners in terms of natural resources is complicated. Private landowners think they have unlimited freedom to use their property as they wish, while the government has a responsibility to protect natural resources that the public has a right to, such as clean air or clean water. Individual land owners don’t often directly reap the benefits of their wetlands, such as groundwater recharge, directly because of the

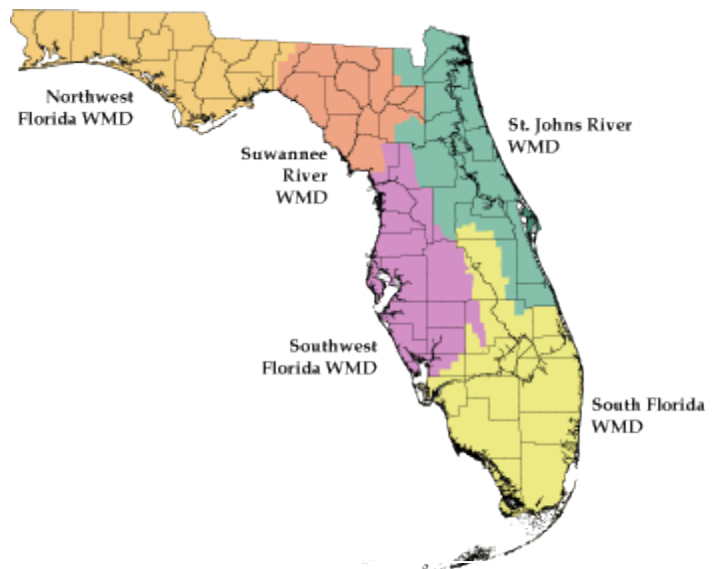
nature of wetlands. Many wetlands are part of far reaching interconnected systems that provide benefits to everybody. Public resources such as clean air and clean water are hard to regulate because they are used by everyone but owned by no one. Wetlands are often private property, but they are public resources because they help provide many services all people rely upon. Individuals that own wetlands cannot reap the benefits of their wetlands directly, but they can profit from building on filled wetlands (DEP, 2002). The history of wetland litigation in the United States includes many lawsuits that revolve around the issue of regulating private property. Courts consider the scope of a regulation and the impact on an owner's rights and expectations. The government can exercise police power to prevent harm without any responsibility to award compensation. But when the government "takes" private property for the benefit of the public, they must award property owners "just compensation" (Merriam-Webster, 1996). The government conducts these "takings" to maintain public safety (such as protecting clean drinking water sources) and provide a healthy environment. Many wetlands were destroyed before their benefits were fully understood. Indeed, they are still not completely understood. Based on what is understood about these ecosystems so far, we cannot afford to lose any more of them.

## Problem Statement

The Southwest Florida Water Management District (SWFWMD) is comprised of 16 counties in west central Florida. All of these counties have their own wetland protection regulations, but no two of them have exactly the same wetland policies, programs, and regulations. County level wetland regulations can tailor protection to suit the specific types of wetlands that exist within the county. Regulations at the county level prove that local leaders and citizens alike find that state and federal regulations inadequate to protect their county's wetlands. There is currently no single resource that compiles these regulations. In this thesis, county level wetland regulations within the SWFWMD are collected, classified, and analyzed. Initial county level wetland protection analysis reveals various methods used by Florida counties to protect their wetlands.

This information can be used in future research to determine whether these counties experience benefits due to their enhanced wetland management. Perhaps there is a direct correlation between counties that manage their wetlands more carefully than state and federal law mandates and the ecosystem services they receive. The research conducted for this thesis assembles information on local government policies that could provide the basis for substantive suggestions for environmental regulation in the State of Florida.

**Figure 1. Florida's Five Water Management Districts.**



[http://www.dep.state.fl.us/secretary/watman/images/wmd\\_map.gif](http://www.dep.state.fl.us/secretary/watman/images/wmd_map.gif)

## Literature Review

Environmental conservation was not a priority to the founders of the United States. There was no need to manage the abundant natural resources that, like the country itself, seemed to have no limit. Conversely, by the end of the nineteenth century it was clear to some legislators that wetland losses could be detrimental to the lives of the people, and some regulation was necessary. Initial wetland restoration efforts began due to concern over diminishing waterfowl populations used for recreational hunting, food, and their aesthetic value (Vileisis, 1997). Soon, scientific research explained wetlands' role in nutrient cycling and water. As public perceptions changed about these ecosystems, so did the policies that affected them. Although today's federal wetland permitting program is arguably useless in preserving wetlands, there are national goals, state programs, and county level regulations that strive to conserve them for the future. Over the past century, the US transformed from a country whose federal government aided wetland drainage to a country whose goal is to increase wetland acreage for the benefit of its people.

The fragmented nature of environmental protection in the United States government has caused both overlaps and gaps between policies affecting wetlands. Sometimes, wetland policies even contradict each other. This fragmentation is caused by laws and regulations created to reflect both the changing public perceptions about the natural environment, and scientific findings and new technology that further understanding of wetlands. Our laws pertaining to wetlands have increased in stringency and effectiveness in proportion to their perceived increase in importance. Environmental policy has not been a high priority of the federal government and adding rules to protect the environment has been far from a streamlined process. Usually, environmental policies are enacted in response to the ramifications of environmental degradation that has demonstrably altered natural processes we value. Environmental protection laws and

regulations reflect the environment's increased priority, yet such policies have often been controversial.

Wetlands have existed in the United States for much longer than the science that explains them, and many were degraded before the impacts of such degradation were fully understood. Public opinion of wetlands has transformed over time, from fear and disgust to appreciation and interest. Interest in wetlands increased dramatically after their degradation caused the loss of wetland functions valuable to people. Environmental problems, such as soil erosion and increased flooding, prompted scientists to research and explain the relationships between environmental degradation and reduced wetland functions. The laws and regulations pertaining to wetlands created since European settlement in the United States reflect the combination of increasing scientific research and public interest. Today there are several layers of policies regarding wetlands. There are national policies, state policies, and, in some places, county policies.

During colonial times, settlers considered wetlands to be dangerous places. At the same time, colonists found wetlands could provide fish, water, lumber, and grasses for grazing livestock. Their aversion to wetlands stemmed from a deeper aversion to the unknown wilderness of their new home. The appearance of dense plant growth, shade, and water created an image of mystery, evil, and danger. The colonists only entered wetlands when they wanted resources found there. Settlers frequently used the grasses found in tidal salt marshes for grazing domesticated animals. Although early colonists did not want to live within a wetland, they understood they understood the benefits of living near one in order to survive. The Puritans who settled Boston, Massachusetts, initially avoided swamps and marshes. As populations increased, cities grew larger. People filled wetlands with dirt in order to make them suitable for



development. This marked a change in the relationship between people and wetlands: they were tolerated as a source of important natural resources but often filled when people wanted more dry land (Vileisis, 1997).

Although people depended upon wetlands, they still retained their negative feelings towards them. They were associated with Native Americans, who they considered evil. People considered them as dark, wicked, dismal places. Some even associated wetlands with Satan. However, this misunderstanding of wetland ecosystems did not stop their use as a source of food and supplies. As urban sprawl created an incentive for wetland destruction surrounding cities, urban and near urban wetlands became exploited. Cities grew up on lands that used to support livestock, creating a need for imported grasses (Vileisis, 1997).

Many early Americans believed that wetlands were more valuable when drained and filled. Since wetlands provided some resources while they inundated, it seemed only logical to many people that these areas could be much more productive if converted to dry land. Most notably, farmers took advantage of the nutrient-filled soil beneath the water. They did not understand that the qualities seen as annoyances, such as soil saturation and foul smell, were actually part of an ecosystem that provided many benefits to people. Many people who worked in or near wetlands contracted diseases such as malaria or yellow fever. These ailments were first attributed to the unpleasant smell that is common in wetlands, and only later credited to mosquitoes and other disease carrying organisms. Because settlers were averse to working in these conditions, slave labor drained and filled many wetlands. Additionally, there appeared to be no need to conserve these seemingly infinite resources. Compared to Europe, America had an endless supply of food, water, and land (Vileisis, 1997).

Early legislation reflected people's desires to use wetlands for agriculture and for expanding cities. During the 1830s and 1840s, farmers began to use buried, ceramic tiles to help drain wetlands. These tiles diverted excess moisture away from farm fields. By arranging them in special patterns to lead to ditches and other bodies of water, farmers were able to reduce soil moisture and increase crop yields. The first farmer who used the tiles in New York increased his crop production by over 400%, demonstrating the value of tiles (Vileisis, 1997). The Swamp Land Acts of 1849, 1850 and 1860, transferred millions of acres of U.S. government-owned "swamp and overflowed lands" (wetlands) to the states. States then sold the properties to farmers and developers for a very low price. The United States government hoped to increase wetland drainage. Unfortunately, this act merely passed the responsibility of draining wetlands to farmers, who then asked state government authorities for assistance (Vileisis, 1997). This legislation marked the first attempt by Congress to define wetlands for regulatory purposes.

Increased transportation and urban sprawl across the county provided opportunities for adventurous artists to encounter many new landscapes. Art inspired by wetlands piqued the curiosity of many who then read the writings of naturalists such as John Bartram and John Audubon, adventurers who saw more in wetlands than resources. John Bartram explored biodiversity in the southeast U.S. during the mid-1700s, and his son William engaged in similar activity throughout the region during the 1770s. His parents instilled in him the importance of nature, and because of this he kept extensive journals from his travels in America that led to his book *Travels through North and South Carolina, Georgia, East and West Florida, the Cherokee Country, the Extensive Territories of the Muscogulges or Creek Confederacy, and the Country of the Chactaws. Containing an Account of the Soil and Natural Productions of Those Regions; Together with Observations on the Manners of the Indians*. John Bartram greatly influenced the

early nineteenth century naturalist/painter John James Audubon, the inspiration for the Audubon Society. In the foreground of his paintings were realistic waterfowl. Just as important, the backgrounds of his paintings were ecologically accurate. His art work conveyed the vastness of wetlands, especially how they stretched into the horizon. He conveyed both their ecology and the sense of optimism they instilled in Americans who used them for their resources (Vileisis, 1997).

Waterfowl were once so common, some people viewed them as a nuisance. In the mid-1800s, a passenger aboard a steamboat in California confessed that they were “greatly annoyed, by the almost deafening, tumultuous and confused noises, of the innumerable flocks, of geese and ducks, which were continually flying to and fro, and at times blackening the very heavens with their increasing numbers, and making the aerial region ring, with their tumultuous croaking and vehement squeaking” (as quoted in Vileisis, 1997, page 27). By the early 1900s, it was impossible to deny the decline of wildlife associated with wetlands. Waterfowl were hunted for recreation, as a food source, and for their feathers, which were used in ladies’ hats. Waterfowl populations dwindled from masses that sometimes blackened the sky to populations small enough to inspire conservation efforts by recreational hunters. By 1901, 35 states had groups comprised of scientists, citizens, and hunters dedicated to saving birds.

The issues stemming from wetland degradation were not initially tackled head-on because they were so varied, complex, and poorly understood. Environmental policies require proactive action; legislation limiting environmental degradation prevents negative impacts, some of which have not been fully realized (Vileisis, 1997). For example, by 2005 Louisiana’s Gulf coast lost many of its coastal wetlands that would have helped buffer storm surges from hurricane Katrina and perhaps saved lives. For decades scientists have been warning against

coastal development that destroyed the wetlands protecting New Orleans  
(<http://www.ncbi.nlm.nih.gov/pmc/articles/pmc1332684/>).

The implications of wetland degradation became increasingly apparent by the late 1800s. For example, beaver hunting caused an increase in riverine erosion. When beavers create dams, they expand wetlands adjacent to rivers. Without beavers, wetlands slowly disappear. Additionally, farmers took note of hydrologic changes after draining and filling wetlands, but these effects were localized and not drastic enough to cause alarm. Still, these indicators prompted the beginnings of a shift in public opinion towards wetlands. People recognized the once wicked, dangerous landscape as a valuable, finite resource (Vileisis, 1997).

The U.S. population grew rapidly throughout the twentieth century. Innovations from the industrial revolution increased quality of life through the mass production of many goods. Cities continued to expand, draining wetlands and building homes and businesses in their place. Additionally, many cities filled wetlands with garbage. Yet agricultural expansion caused even more wetland losses. State and federal governments stimulated wetland destruction by creating programs to increase agricultural production to support the growing population. Meanwhile, wetland dependent systems traditionally tied together through numerous, sometimes invisible, connections fragmented. For example, some waters no longer flowed underground from one wetland into the next. Also, nutrients exchange halted without the slow, steady flow of water. Migrating birds returned to former wetlands only to find their seasonal habitat disrupted and unusable. These symptoms of increasing human populations caused wetlands to function less effectively. By the turn of the twentieth century, resources such as fish and clean water were scarcer than ever. Because recreational duck hunting was such a popular American pastime,

unhappy hunters finding decreasing numbers of birds to hunt drove many early efforts to restore wetlands (Vileisis, 1997).

### Federal Wetland Regulation

In the late 1800s, water pollution was so out of hand that garbage and sewage clogged many waterways and obstructed boats. Cities and businesses all over the country often simply dumped solid waste into rivers and lakes. In response to this pollution, Congress drafted the Rivers and Harbors Act of 1899 (Pittman and Waite, 2009). At the time, rivers and other waterways served as the main avenues of commerce and military activity; because of this, it was indeed the government's responsibility to maintain them (Gardner, 2011). Section 10 of the Rivers and Harbors Act states that anything placed in waterways having the potential to obstruct navigation requires approval by the U.S. Army Corps of Engineers (USACE). Section 13 (also known as the Refuse Act) restricts dumping "any refuse matter of any kind or description" in a navigable waterway. The Rivers and Harbors Act directed the USACE to operate a permitting program and enforce the law (Pittman and Waite, 2009). The Corp's success in running the permitting program was a contributing factor to their later involvement in the Clean Water Act (Gardner, 2011).

The role of the USACE in wetland protection became more complex after the Clean Water Act in 1972. The complexities are easiest to grasp with a clear understanding of administrative law. Administrative law structures the relationships between the president, Congress, and government agencies. Statutes are the result of laws passed by Congress and signed by the president. Moreover, both the legislative and executive branches create government agencies (such as the USACE) to enforce laws. Congress assigns responsibilities to

the agencies which give them authority; it passes legislation that agencies implement; and it appropriates funds to execute their duties. Despite the control of Congress, the president has even more influence on agencies through political appointments (Gardner, 2011). Congress outlines the goals of laws, delegating details to an agency. Complications can arise here. Because Congress delegates the authority to flesh out specifics to the agencies, they sacrifice their direct involvement in implementation. Agencies create rules and fulfill the statutes outlining their duties. Many agency rules are regulations: rules that, because they are crafted in accordance with laws, end up having the same effect as laws. An agency's work sometimes includes oversight of another agency (Gardner, 2011).

The National Environmental Policy Act (NEPA) is a law promoting environmental health by requiring all federal agencies to evaluate the impact of their actions on the environment. These actions can impact the environment directly, such as road construction, or indirectly, such as permitting construction projects by private companies. Congress passed it in late 1969 and President Richard Nixon signed it into law on January 1, 1970. This was the first explicitly "environmental" law passed in the United States and affects countless actions by numerous government agencies (CEQ, 2007). There are over 1,300 federal government agencies and their subsidiaries listed in the Code of Federal Regulations (GPO, 2009). The agencies must complete an Environmental Assessment that analyzes possible environmental impacts of any action. Sometimes a more detailed assessment is required, called an Environmental Impact Statement. There are special circumstances such as emergencies which call for special procedures, but generally all government agencies follow the same rules outlined in the law. The Council on Environmental Quality, the Environmental Protection Agency, and the U.S. Institute for Environmental Conflict Resolution are the three federal agencies that oversee the NEPA process

(CEQ, 2007). There are no civil or criminal penalties for noncompliance with NEPA, but compliance is mandatory (CEQ, 2007). NEPA has no specific connection to wetlands, but its overarching authority often includes wetland impacts and is worth mentioning. For example, the National Oceanic and Atmospheric Administration Fisheries Service protects wetlands due to their role as fish habitat. In addition, the Corps grants permits to fill wetlands, and this activity falls under the purview of NEPA.

The Clean Water Act (CWA) of 1972 is an expanded, significantly amended version of the Federal Water Pollution Control Act of 1948 (EPA, 2013). Initially, President Nixon vetoed the bill because he believed it was too expensive, but Congress overrode his veto. The CWA is perhaps the most substantive law that directs actions affecting wetlands. Yet nowhere in the CWA is the word “wetlands” actually used. Section 402 of the CWA outlines the National Pollutant Discharge Elimination System, which requires dischargers of point source pollution to obtain a permit from the EPA (Gardner, 2011). Section 404 of the CWA demands that a permit is required before any dredged or fill material can be disposed of in navigable waters of the US. This permitting program deals with pollution that is less obvious, but it is considered pollution based on environmental impacts. Both permitting programs include a notice-and-comment process which allows time for the public to comment on permit applications and agencies to respond to the comments. This allows the public to be involved in the process more directly (remember, the public does not elect members of government agencies who craft regulations). Because developing a wetland often requires dredging and filling, Section 404 plays a major role in wetland protection (Gardner, 2011). Congress was split as to which government agency would implement the Section 404 permitting program. The House of Representatives preferred the USACE. The USACE has long been successfully operating a permitting program related to

Sections 10 and 13 of the 1899 Rivers and Harbors Act. The USACE found this situation amenable because it would allow the agency to more easily process permits for its own actions (such as dredging rivers for navigation); the Senate, on the other hand, argued that this is why the USACE would be a poor candidate for the job (Gardner, 2011). The Senate favored the EPA. In the end, the USACE “was given the authority to issue permits for the discharge of dredged or fill material, but in making such decisions, it was required to follow the EPA’s regulations” (Gardner, 2011, page 74). The CWA did not specify exactly what waters would be covered or how they would be regulated. The CWA “established the basic structure for regulating pollutants discharges into *the waters of the United States* [emphasis added]” (EPA, 2013). It was up to the Corps and the EPA to flesh out the details. The USACE is able to minimize the number of permits it processes by issuing nationwide permits. This is a program that grants general permits for types of discharge that will have only minimal adverse effects on the environment (EPA, 2012).

From 1972 to 1975 the USACE regulated the “navigable waterways” in the CWA in the same manner they regulated “navigable waterways” in the Rivers and Harbors Act. However, Congress specifically defined “navigable waterways” as “waters of the US” and further stated its expectations for its application in “the broadest constitutional interpretation” (Gardner, 2011). Environmental groups called attention to the broader intended scope of “waters of the US” in the CWA. After coaxing from the EPA, the USACE created a regulation that defined “waters of the US” in greater detail. According to the Clean Water Act § 33 C.F.R. § 1251, Stat. 328.3(a) (1972):



“(a) The term *waters of the United States* means

- (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- (2) All interstate waters including interstate wetlands;
- (3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
  - (i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
  - (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
  - (iii) Which are used or could be used for industrial purpose by industries in interstate commerce;
- (4) All impoundments of waters otherwise defined as waters of the United States under the definition;
- (5) Tributaries of waters identified in paragraphs (a) (1) through (4) of this section;
- (6) The territorial seas;
- (7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1) through (6) of this section.”

Nonetheless, it is still possible to destroy a wetland without breaking this law. For example, a developer can drain and clear the wetland as long as there is no discharge into waters of the United States. “An activity’s effect on wetlands is not, standing alone, a sufficient bases for Section 404 jurisdiction...Persons contemplating drainage activities as a means of avoiding Section 404 scrutiny must be careful to employ techniques that do not cause the discharge of a pollutant” (Connolly, Johnson, and Williams, 2005, page 129). In fact, only “point source discharges” trigger the need for a Clean Water Act permit (Gardner, 2011). The USACE’s involvement in wetland protection is perplexing and frustrating for environmentalists. The agency has the responsibility of issuing CWA Section 404 permits, but not the responsibility of protecting wetlands. The EPA’s guidelines and the notice and comment process are the only elements of the law binding the Corps to wetland protection for the sake of the environment.

The EPA’s guidelines for permit issuance follow a three step process: find practicable alternatives, avoid adverse environmental impacts, or compensation (mitigation). The application is denied if there are practicable alternatives available. These alternatives must be economically and technologically reasonable for the land owner. This may include moving the development to another location (CNRA, 2003). Most developers in Florida currently bypass this step: they use specific language describing the type of property they are seeking to develop so that there are no

nearby alternatives (Pittman and Waite, 2009). The second step, if there are no practical alternatives, is to minimize environmental damage. The third step, if there is no way to minimize environmental damage, is to compensate for destroyed and degraded wetlands through mitigation. In this context, mitigation means creating, restoring, or enhancing (such as removing invasive species and planting native species) wetlands that are preferably located nearby.

The USACE issues more CWA Section 404 permits in Florida than in any other state, permitting more wetland losses in Florida than anywhere else (Pittman and Waite, 2009). From 1999 to 2003 the Corps received around 12,000 permit applications. Only one was denied (Pittman and Waite, 2009). In 2003, permit applications totaled 3,282 acres of wetlands developers hoped to destroy. The USACE only denied 185 acres of the destruction (Pittman and Waite, 2009). Corps officials in Washington D.C. argued that there was nothing wrong in Florida. They claimed that it was legal to approve permits to wipe out wetlands at this rapid rate. Lieutenant General Carl Strock, the former U.S. Army chief of engineers contended “Our role is not to be an impediment to the development process... we’re not the ones making decisions about where growth occurs” (as quoted in Pittman and Waite, page 76).

The USACE declared their approval of mitigation banking in 1993 (Pittman and Waite, 2009). Instead of a developer paying for wetland mitigation (compensation by enhancing, restoring, or creating wetlands) on-site or nearby, developers may compensate for their wetland destruction by purchasing a certain number of credits from a mitigation bank. A mitigation bank is an institution (private or public) that either restores or creates wetlands that can be used to compensate for destroyed wetlands. Florida’s DEP and the U.S. EPA jointly created standards for a mitigation credit system in 1995 (Pittman and Waite, 2009). Determination of how many credits a bank is worth is a contentious ordeal because each credit can be worth tens of thousands

of dollars. By 2006, credits in Florida sold for as much as \$150,000 each (Pittman and Waite, 2009). Credits are awarded to mitigation banks in stages (Pittman and Waite, 2009). For example, when the bank puts a property under a conservation easement, it initially receives some credits. One recent controversial wetlands issue was attributed to Florida governor Rick Scott (elected in 2010). The Florida Department of Environmental Protection's top wetlands expert Connie Bersok was suspended in 2012 after refusing to bend the rules to require less mitigation credits for a large development project support by Florida Governor Rick Scott and his pro-business administration (Pittman, 2012).

Mitigation banking quickly became popular nationwide. It appeared that mitigation offered benefits to all parties involved: developers paid for compensation, the government regulated the allotment of credits and monitored fewer large properties instead of numerous small ones, and environmentalists could be appeased because mitigation must take place before wetland destruction can occur. The state government was too disillusioned to project any potential disadvantages to the wetland mitigation banking system. In fact, state and federal government became large customers for the banking business as the Department of Transportation began compensating for wetland losses through mitigation banks (Pittman and Waite, 2009). Millions of taxpayer dollars were poured into this system that had yet to prove any scientifically reliable results. In 2007, the SFWMD signed off on a golf course development that would decimate 655 acres of swamps in the western Everglades. The only mitigation required was "enhancing" other wetlands elsewhere (Pittman and Waite, 2009). Obviously wetland mitigation banking is fraught with issues that do not align with the county's policy of "no net loss" of wetlands. A 2001 National Academy of Sciences Report explored the ineffectiveness of the "no net loss" policy and compiled many resources to create policy

recommendations to improve the CWA Section 404 permitting program (NAS, 2001).

Recommendations include: the Corps keep data on both permitted and mitigation areas; a national database be created to track wetland area and functions lost and gained; expansion of quality assurance measures for data entry in the Regulatory Analysis and Management System database (NAS, 2001). Not only is the failure of the “no net loss” policy recognized, but well-researched recommendations exist for policymakers to consider.

### Florida Wetland Regulation

The organization with the authority to regulate the natural environment in Florida is the Florida Department of Environmental Protection (DEP). According to their website, the mission of the DEP is to protect, conserve, and manage Florida’s natural resources and enforce the state’s environmental laws (DEP, 2012). The DEP is involved in water management through its oversight of the state’s five water management districts of Florida: the Northwest Florida Water Management District, the Suwannee River Water Management District, the St. Johns River Water Management District, the South Florida Water Management District, and the Southwest Florida Water Management District (Fig. 1). A Governing Board consisting of at least 9 members appointed by Florida’s Governor and confirmed by the Florida Senate oversees each district. Members of each board are unpaid citizens who serve four-year terms; members may serve multiple terms (DEP, 2012). According to the DEP, “regulatory programs delegated to the districts include programs to manage the consumptive use of water, aquifer recharge, well construction and surface water management” (DEP, 2012). The DEP administers the Environmental Resource Permit (ERP) program which regulates anything that alters surface water flows. This program is run, in part, through the water management districts, but the following counties which have their own Environmental Protection Commissions: Broward,

Miami-Dade, and Hillsborough (the only of these three included in this study), which administer the ERP. Water management districts manage permits pertaining to: agriculture; large scale residential and commercial subdivisions; and quantity, quality, and use of water (DEP, 2012).

The DEP, on the other hand, generally reviews applications pertaining to large-scale development such as: waste facilities, mining, power plants, natural gas and petroleum exploration, navigational dredging, and seaports. It also reviews applications for single-family docks and boat ramps that are not a part of a larger residential or commercial development. The DEP also approves State Programmatic General Permits, which function similarly to the USACE's Nationwide Permits, but at the state level (DEP, 2012).

The federal government protects wetlands through Section 404 of the Clean Water Act. The Corps issues Section 404 permits, but denies that the agency has responsibility to protect wetlands from development. The Florida DEP and water management districts issue ERPs, but are subject to political influences from the governor (who appoints the secretary of the DEP), which can hinder wetland protection. Although state and federal governments offer some level of wetland protection, it is often not enough to protect wetland ecosystem services for future generations.

## **Research Methods and Materials**

### Research Questions

The Southwest Florida Water Management District (SWFWMD, sometimes also called Swiftmud) covers ten entire west central Florida counties and parts of six others. Some of these counties have significant wetland protection programs while other offer only minimal (if any) wetland regulations. To date, no one has ever examined county level wetland protection in Florida. Which counties (if any) appear to take wetland protection more seriously, and which counties leave wetland protection to the state and federal governments? What policies or programs in the 16 counties of Swiftmud protect wetlands?

### Methods

The relative focus of this thesis includes current legislation (comprehensive plans, land development regulations, etc.) for the year 2013. This thesis serves as a case study of wetland protection within the counties of the SWFWMD. No previous county level wetland regulation research currently exists, so I developed a methodology that is appropriate for this research. This allowed me the flexibility to craft methods that best outlined the regulations I encountered, and to analyze each county relative to all other counties in the SWFWMD.

Hillsborough County is unique in having an Environmental Protection Commission, so I decided to begin my research in this county because I suspected they would have a plethora of wetland regulations, and its proximity allowed me to meet with an employee in their Wetlands Management Division. I called the Hillsborough County Environmental Protection Commission (HCEPC) by using the phone number listed on their website (<http://www.epchc.org/>). I spoke to Chris Cooley, an environmental supervisor who offered me background information on the role

of the DEP, the role of SWFWMD, and the structure of the HCEPC. In addition, he explained that the information I was looking for could be found in each county's comprehensive plans and land development regulations. He also offered advice on how to contact county planners and environmental managers on the phone. This invaluable information helped lay the groundwork for my research. Mr. Cooley also invited me to observe a wetland delineation in Hillsborough County. This offered me a lot of insight into the delineation process and gave me valuable field experience.

After meeting with Mr. Cooley, I decided to start my research by finding and saving on my laptop the Comprehensive Plan and Land Development Regulations from each county, and calling planners (or environmental specialist if possible) from each county to discuss the extent of their county level wetland regulations. This proved to be extremely time consuming. After spending many hours on the phone taking notes, I decided to start double checking the information I received on the phone from county employees against published comprehensive plans and land development regulations. I found that many of the county employees I spoke to gave me information that did not align with the policies in these documents. I came to the realization that the analysis of each county would require me to read significant portions of each of these documents. It took me from two to three hours to analyze each county. I had originally planned to review each of Florida's 67 counties, but felt compelled (due to time constraints) to narrow the scope of my research to the counties in the SWFWMD (16 counties). I chose this water management district because it includes the counties I have spent the most time in.

For each county, I visited the county's official website. Each county lists its departments. I first looked for the department related to planning and/or zoning. I searched pages within that department to find the Comprehensive Plan and Land Development Regulations. Because both

of these documents are available electronically, I used the search tool (control + f) to scan the documents for the words “wetland” and (for coastal counties) “mangrove”. I chose the word “wetland” because when policymakers want to reference these ecosystems, they generally use this term. I chose the word “mangrove” because I wanted to capture information on coastal wetland as well as information regarding coastal management. I did a sample scan on the comprehensive plan of a randomly chosen coastal county for the phrases “swamp,” “salt marsh,” and “marsh” to verify the precision of my words choices (“wetland,” “mangrove”) in wetland protection. I found that “swamp,” “salt marsh,” and “marsh” were included almost exclusively in examples or in definitions that also included the word “wetland”. Every document from every county included the word “wetland”. Some offered only a few results while others offered hundreds. I found each instance of each of these words, then read information near the word to better understand the context in which it was used. If I felt I could not understand the policy in which the word was used, I would go back to the beginning of the section and read the entire section. I always found the heading of the section containing the word and read any introductory information provided. If the word was in a paragraph, I would read the entire paragraph. If the title of any section contained the word “wetland” (such as “Wetland Protection”, I would read the entire section (the word “mangrove” was never used in any section titles).

I captured information by creating a spreadsheet and recorded notable policies. I created these categories as I read, often backtracking to ensure that I used the same categories for all counties I evaluated. This occurred frequently, especially during my first three county evaluations.

I excluded various elements of the county policies as I saw fit. My goal was to include policies and regulations that had specific requirements that clearly affect wetlands. I chose not to



capture information from the many policies and objectives that make positive statements about wetlands that are not supported by regulations which require specific actions. The following include elements of public policies that I chose to exclude:

- General wetland avoidance, including suggesting other sites for development or broad objectives that state the importance of wetlands
- Regulations affecting small areas overall (such as mobile home parks) or site specific regulations (relating to one particular property or project)
- Identifying, delineating, or surveying wetlands before land development (identification alone does not qualify as protection)
- Conservation easements vary by county, by property; not enough information was provided about the scope of each easement to accurately capture this information
- Anything cited as a federal, state, or Water Management District level policy (policies required above the county level)

After evaluating three or four counties, my research became more streamlined. Part of this research process included learning the language used in comprehensive plans and land development regulations. I learned to filter out statements that did not require any specific action, and focus on policies that clearly impact wetlands. I was able to draw on my experience in reading for environmental courses (such as Environmental Law and Wetland Environments) and my internship with the Habitat Conservation Division of NOAA Fisheries Service in making these distinctions. In both my internship and my environmental courses I was required to understand the relationship between Congress, government agencies, and regulations at the federal and state levels. I gained background knowledge on the NEPA, the CWA and Section 404 permitting, wetland science, wetland mitigation, and the role of government agencies such as

the EPA and the Corps. Additionally, I understood the distinction between environmental goals set forth by the government not supported with regulations, and goals supported by regulations requiring specific actions. This information allowed me a level of familiarity with the material I researched that aided in my comprehension of the complex nature of wetland protection.

Additionally, this research process provided me the opportunity to learn a lot about the language used in public policy. In future research endeavors I will be able to conduct qualitative research at a more rapid rate based upon my experience in this project.

## Results

I was able to evaluate 15 of the 16 counties in the SWFWMD. I was not able to capture any information on DeSoto County because their county website was hacked and has been under construction for over a month. I spoke to a planner from DeSoto County who assured me that he could e-mail me a copy of the documents I needed. Later contact to their office was not returned.

Tables 2 and 3 list the relevant information captured from comprehensive plans and land development regulations. Hillsborough County is excluded from this portion of my research process because their wetland protection methods are not all included in the county's comprehensive plan and land development regulations. Instead, the comprehensive plan refers to the Hillsborough County EPC for wetland protection. Because this county's wetland protection clearly covers the specific methods I used to classify wetland protection through their overarching strong protection, I felt it unnecessary to list the methods used by this county. A thorough list of Hillsborough County's wetland protection methods is enough material for a thesis of its own. Due to time constraints and my goals of learning methods of wetland protection from counties with smaller budgets, I felt that my research on Hillsborough County best fit into this thesis with a written description.

## **Analysis**

Because not all counties contain coastal and urban areas, I found it unfair to “score” each county based on a scale that revolves around methods of wetland protection outside of their county’s parameters. Therefore, I created a “score” from the 17 protection methods that any county in the SWFWMD could potentially adopt. Only policies, programs, and regulations encountered in research of the SWFWMD counties is used in this analysis. This allowed me to create a relative score, which holds each county to the standards of the cumulative area of study: the highest level of wetland protection a county could offer in this region if they combined all the methods of protection found in the region. The levels of protection in Figure 2 offer a “snapshot” of the number of current wetland protection methods by county based on each county’s relative score.

**Table 2. Categories of general methods of wetland protection.**

Wetland Protection Method	Description
County Level Wetland Permitting Program	Permitting program for wetlands within the county; program run by the county.
Environmental Department separate from Planning & Zoning	County finds environmental issues important enough to have its own department (may be present only where funding is available).
Specifically prioritizes or manages wetlands by category	By categorizing wetlands, counties can provide protection to many wetlands from development. However, they may also be targeting wetlands for destruction.
Specific goals to increase wetlands	Counties that find wetlands to be important enough to merit goals to increase their acreage annually.
Isolated wetlands considered	Wetlands under ½ acre in size do not require state permits. These counties provide some level of protection to these wetlands.
Wetland (from easement) dedication or "adopt" a wetland	Incentivizes wetland protection.
Special mitigation ratio (example: 1:2 or 1:3)	Mitigation requirements related to the type of wetland. For example: forested wetland mitigation requires a 1:2 ratio, while coastal wetlands require a 1:4 ratio. These ratios could require more mitigation than the credit system run by the state.
Strict (more than Uniform Mitigation Assessment Method) county mitigation policies	Some counties state they use mitigation methods that offer more protection than the state program.
Restrictions on fertilizer use near wetland	This policy recognizes the threat of eutrophication and an overabundance of nutrients in wetlands.
Septic waste management buffer	This buffer also recognizes eutrophication and nutrient supply issues by separating nutrient-rich septic material from wetlands.
Wetlands set aside for ecological functions with only minimal use (natural resources area)	This regulation allows wetlands to exist with as little interaction with humans as possible in order to provide the ecosystem services people depend on.
Elevated walkways/ boardwalks	Some counties mention and/or suggest these structures which act as somewhat of a compromise between the integrity of a wetland and accessibility by humans for passive recreation.
Increased fines for littering	Threats of pollution to wetlands are considered particularly dangerous to the ecosystem.
Wetland Density (units/acre) specifications	Development is regulated to a specific density of dwellings per acre.

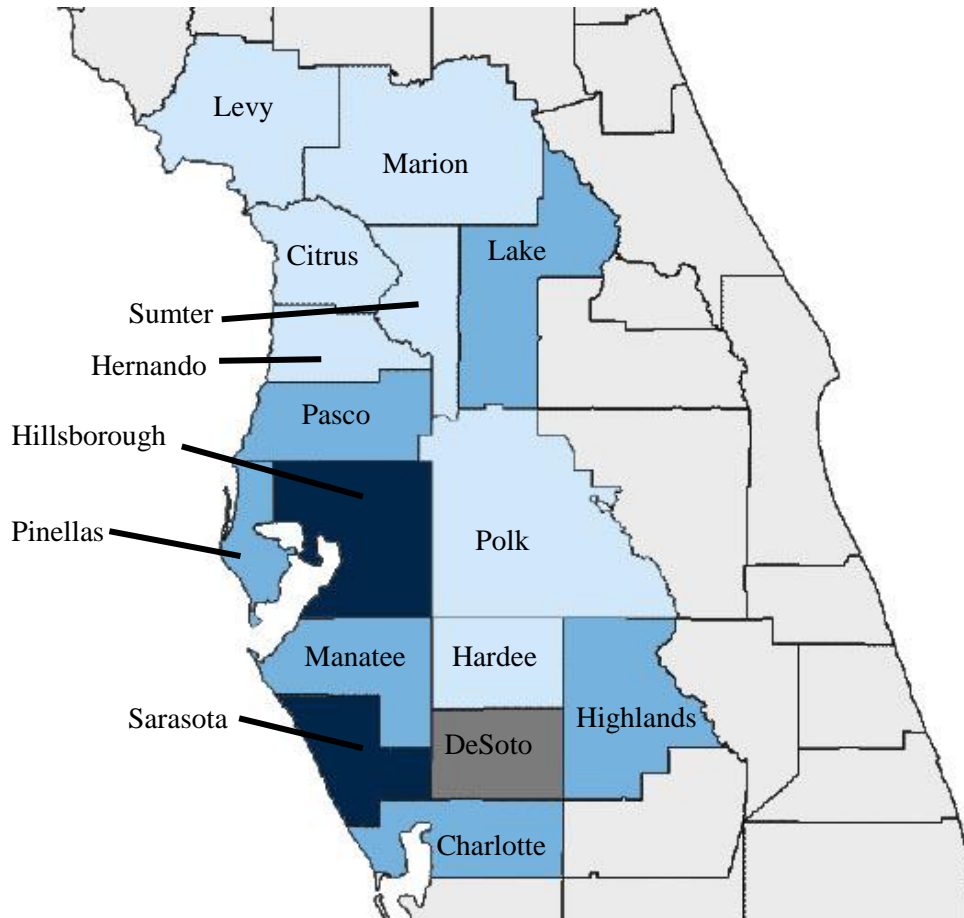
Upland protection	Wetland mitigation can lead to the destruction of upland
-------------------	--

	habitats to create new wetlands – however some counties find uplands to be valuable enough to offer them protection as well. This suggests these counties consider environmental protection of certain ecosystems, and thus more likely to be concerned about wetland ecosystems.
Aesthetics	Many counties recognize the aesthetic appeal to wetlands by using terms such as “beautiful visages” or “attractive landscapes.” Aesthetics may play a role in tourism and other economic benefits associated with recreation (fishing, swimming, kayaking and canoeing, camping).
Discusses role in erosion/ sedimentation	Wetlands provide a location for sediments suspended in water to sink to the bottom; wetland removal has many implications for issues surrounding erosion and sedimentation.

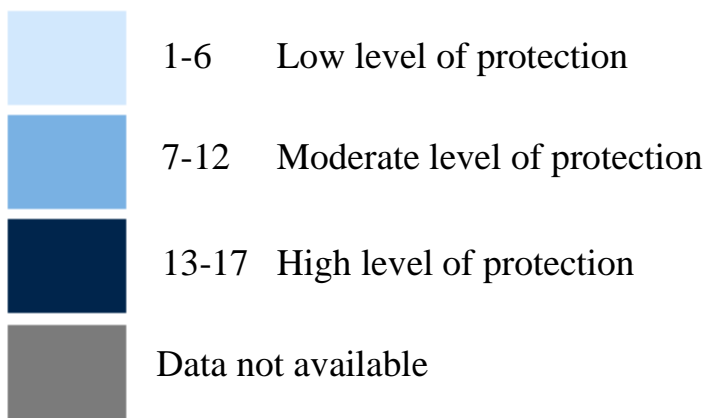
**Table 3. Categories of wetland protection methods which depend on special circumstances.**

Wetland Protection Method	Description
Coastal land use (wetlands listed) regulations	Regulations that restrict certain activities (including mangrove removal, development on a coastal wetland) that specifically use the word “wetland.”
Shoreline or vegetation standards (such as wetland tree width)	Shoreline vegetation standards that prevent the destruction of habitats containing specific types of vegetation.
Shoreline buffer zone/ setback standards	Development on the coast is restricted to a certain setback or buffer zone from the water.
Wetland destruction expressly prohibited in urban areas	No wetland destruction in urban areas under any circumstance.
Estuary Organization	Counties that participate in an estuary organization such as the Tampa Bay Estuary Organization.

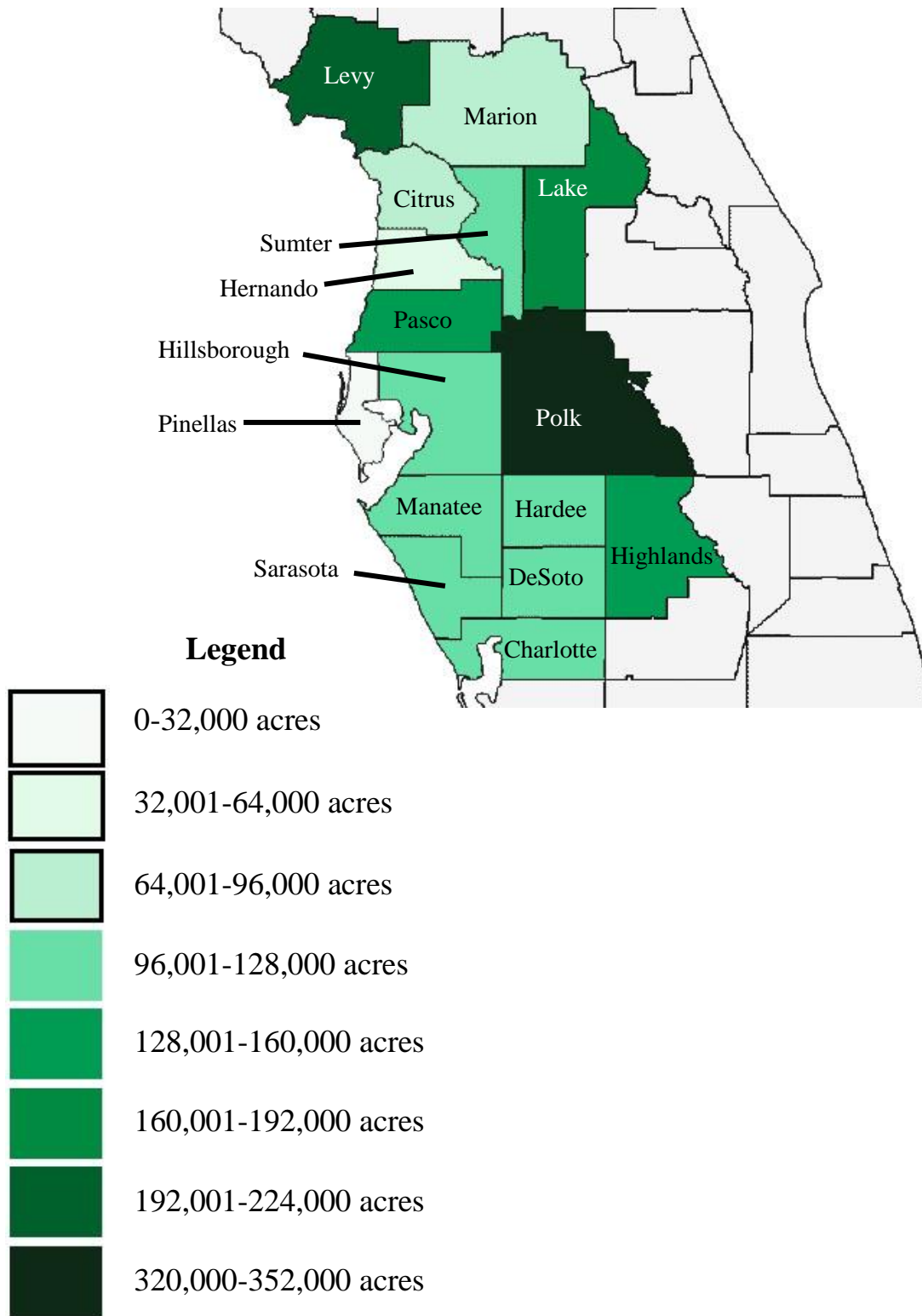
**Figure 2. Relative wetland protection offered by counties in the Southwest Florida Water Management District. Numbers refer to the raw number of specific wetland protection rules and policies offered in these counties.**



**Legend**



**Figure 3. Acres of wetland per county in the Southwest Florida Water Management District according to a 1984 U.S. Fish and Wildlife Service report.**





## Discussion

In order to capture valuable information about each county that did not fit into one of the twenty two categories found in Tables 2 and 3, I wrote short descriptions of wetland protection policies for each notable county. If all of a county's wetland protection methods could be included in the twenty three categories, a description is not provided. I felt the characteristics in Tables 2 and 3 would severely understate the overwhelming wetland protection offered through the Hillsborough County EPC. Instead of only using their comprehensive plan and land development regulations, I read three documents published by the Hillsborough County EPC (Rules of the Environmental Protection Commission of Hillsborough County Chapter 1-11; Chapter 1-14 Mangrove Trimming and Preservation; Wetlands; Basis of Review for Authorization of Activities Pursuant to Chapter 1-11 – Wetlands). The data found for Hillsborough County is contained completely within the county's description. After learning how much Hillsborough County spends on environmental protection annually (in 2007, the EPC's budget was \$2 million dollars) (Pittman and Waite, 2009), two things became clear: Hillsborough County's EPC is easily the leader in wetland protection in the SWFWMD; and other counties will not be able immediately create such a large, established, well-funded organization. Hillsborough County warrants high praise for balancing wetland preservation and urban development in a highly populated county. However, my goals include helping counties with little wetland protection increase their abilities to do so on a tighter budget. I sincerely hope that every county will one day have an environmental protection commission, but it will take many steps to get there. The first steps are increasing wetland protection methods on a smaller budget.

Even if counties could not create a fully funded environmental protection commission, there are many wetland protection methods counties could adopt. The first consideration in wetland protection for a county is: what type and how many acres of wetlands are there in the county? The second is: how much funding is available for the county to create and implement further protection methods? Wetland protection can be an expensive effort. Nonetheless, the long-term benefits of wetland protection are significant.

The following are discussions of counties which use language in their Comprehensive Plans and Land Development Regulations which offer wetland protection that could not be captured using the criteria found on the spreadsheet. All referenced information is available in each county's comprehensive plans and land development regulations, which are public record. In addition to regulations and requirements, these documents include suggestions, broad objectives, and long-term goals, some of which are relevant to wetland protection. Four counties in the SWFWMD do not have descriptions because of lack of information (DeSoto County) or because their protection methods are all easily classified (Citrus County, Hardee County, Marion County).

### Charlotte County

Inland or coastal: Coastal

Total vegetated wetlands: 127,045 acres (FWS, 1984)

Percent wetland coverage: 27% (FWS, 1984)

2010 Population: 159,978 (NACO, 2013)

Score (number of wetland protection methods): 7/17 (Moderate)

Wetland protection methods:

- Wetland Density (units/acre) specifications

- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Septic waste management buffer
- Specifically prioritizes or manages wetlands by category
- Discusses role in erosion/ sedimentation
- Restrictions on fertilizer use near wetland
- Coastal land use (wetlands listed) regulations

Charlotte County’s policies provide a unique method of protection that offers positive regional impacts. Charlotte County not only requires preservation of wildlife corridors (greenways), it also requires a type of blueway corridor for water resources. Blueways assist in storm water control, connecting various surface waters for both increased ecosystem services to humans and habitat for wading birds. Greenways provide a 75-foot wide wildlife corridor. Passive recreation is allowed, but its main purpose is to provide habitat for wildlife. The wildlife corridor also provides habitat for native plants. The county states that “The [wildlife] corridor should provide sufficient cover to encourage use by wildlife through compliance with the following provisions:

- density bonus program or other incentive program for landowners that provide habitat management of wetlands
- eutrophication triggering buffer
- The use, storage, transmission, or generation of hazardous substances, or substances which may artificially accelerate the eutrophication of wetlands and water bodies, is prohibited within 200 feet of wetlands
- Boat ramps /slips not allowed to be constructed where there are mangroves” (Charlotte County Comprehensive Plan).

Charlotte County also has fertilizer regulations to reduce the use of nutrients that lead to eutrophication of water bodies. The also prohibit any construction of towers on properties containing forested wetlands.

#### Citrus County

Inland or coastal: Coastal

Total vegetated wetlands: 94,678 acres (FWS, 1984)

Percent wetland coverage: 24% (FWS, 1984)

2010 Population: 141,236 (NACO, 2013)

Score (number of wetland protection methods): 1/17 (Low)

Wetland protection methods:

- Wetlands set aside for ecological functions with only minimal use (natural resources area)

#### Desoto County

Inland or coastal: Inland

Total vegetated wetlands: 124,148 acres (FWS, 1984)

Percent wetland coverage: 30% (FWS, 1984)

2010 Population: 34,862 (NACO, 2013)

Score (number of wetland protection methods): Not available

#### Hardee

Inland or coastal: Inland

Total vegetated wetlands: 122,594 acres (FWS, 1984)

Percent wetland coverage: 30% (FWS, 1984)

2010 Population: 27,731 (NACO, 2013)

Score (number of wetland protection methods): 0/17 (Low)

#### Hernando County

Inland or coastal: Coastal

Total vegetated wetlands: 58,245 acres (FWS, 1984)

Percent wetland coverage: 18% (FWS, 1984)

2010 Population: 172,778 (NACO, 2013)

Score (number of wetland protection methods): 6/17 (Low)

Wetland protection methods:

- Wetland Density (units/acre) specifications
- Upland protection (separate from buffer)
- Specifically prioritizes or manages wetlands by category
- Isolated wetland protection
- Aesthetics
- Coastal land use (wetlands listed) regulations

Hernando County's greatest strength in protecting wetlands is its policies on wetland restoration to areas affected by mining activities. Hernando County boldly prohibits resource extraction (such as phosphate mining) in rivers, streams, lakes, or springs which cannot be restored. This policy eliminates off-site mitigation (creating new wetlands) as an option for the mining industry. They also back up this policy with a definition of "restoration," which demands that the type, nature, and function of the ecosystem must be returned to its natural state before mining occurred. Hernando County uses their categorization of wetlands to apply specific housing density (dwellings per acre) standards. This county includes a section outlining the allowed uses of current wetlands. It includes encouraging the development of passive and active uses such as: fishing, hiking, nature study, hunting, camping, and picnicking. In other counties, this suggestion is often mentioned in passing and contained within a related section instead of being highlighted by isolating it as a section of its own.

### Highlands County

Inland or coastal: Inland

Total vegetated wetlands: 179,170 acres (FWS, 1984)

Percent wetland coverage: 26% (FWS, 1984)

2010 Population: 98,786 (NACO, 2013)

Score (number of wetland protection methods): 9/17 (Moderate)

Wetland protection methods:

- County Level Wetland Permitting Program
- Wetland Density (units/acre) specifications
- Upland protection (separate from buffer)
- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Septic waste management buffer
- Specifically prioritizes or manages wetlands by category
- Isolated wetland protection
- Aesthetics
- Wetland destruction expressly prohibited in urban areas

Highlands County has a moderate quantity of wetland protection methods and a relatively small population. Highlands County thoroughly explains the extent to which they overlay maps of wetlands with future land use maps. This county clearly explains its desire for development to occur as far away from wetlands as possible. This county considers specific characteristics of wetlands such as: wetland type, value, function, size, condition and location. This expressly shows the detail in which they will consider wetlands during future development. Highlands County has a density credits program where a developer can enhance existing wetlands in exchange for allowing higher density development on the same property.

### Hillsborough County

Inland or coastal: Coastal

Total vegetated wetlands: 144,556 acres (FWS, 1984)

Percent wetland coverage: 21% (FWS, 1984)

2010 Population: 1,229,226 (NACO, 2013)

Score (number of wetland protection methods): High

Hillsborough County is the leader in county level wetland protection within Swiftmud. The Hillsborough County Environmental Protection Commission (HCEPC) was created in 1967. According to their website, the mission of the HCEPC is “to protect our natural resources and

quality of life for the citizens of Hillsborough County.” The HCEPC basically bans any wetland destruction unless it is absolutely necessary, such as building an access road. HCEPC employees review all permits and monitor projects. They can even require proof of financial responsibility in order to ensure that wetland mitigation will be completed. They publish a strategic plan each fiscal year outlining their goals and how they will achieve them. The HCEPC has a community partner program to increase public outreach, increase awareness, and educate citizens on environmental issues. The HCEPC is divided into five divisions: air management, legal and admin services, waste management, water management, and wetlands management. The wetlands management division webpage is further divided into several areas: aerial reviews, alternatives to seawalls, assessment and permit reviews, compliance and enforcement, docks and boardwalks, functions of wetlands, hydrology of wetlands, mangrove trimming, as well as sections on specific projects. The HCEPC currently has a staff of 130, including 23 employees in the Wetland Management Division (HCEPC, 2012). Their website is the most easily navigable website of the 16 counties within Swiftmud, and the commission is the most impressive example of county level environmental protection in the region.

### Lake County

Inland or coastal: Inland

Total vegetated wetlands: 203,642 acres (FWS, 1984)

Percent wetland coverage: 29% (FWS, 1984)

2010 Population: 297,052 (NACO, 2013)

Score (number of wetland protection methods): 12/17 (Moderate)

Wetland protection methods:

- County Level Wetland Permitting Program
- Wetland Density (units/acre) specifications

- Elevated walkways/ boardwalks
- Upland protection (separate from buffer)
- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Septic waste management buffer
- Isolated wetland protection
- Aesthetics
- Discusses role in erosion/ sedimentation
- Wetland (from easement) dedication or "adopt" a wetland
- Increased fines for littering
- Shoreline buffer zone/ setback standards

Lake County, as the name implies, contains many freshwater wetlands. This county provides one of the highest numbers of protection methods within counties with “moderate” numbers of protection methods (it ties with Pinellas County, which contains considerably fewer acres of wetlands). Lake County makes use of strict conservation easements. A conservation easement is a “legal agreement between a landowner and a land trust or government agency that permanently limits uses of land in order protect its conservation values. It allows landowners to continue to own and use their land” (Land Trust Alliance, 2013). Conservation easements are flexible and vary by property. In addition, this county encourages development on wetlands, if necessary, to be in areas where the wetlands are of a low quality and have 80% or more invasive species. This policy goal harnesses development as a way to remove invasive species. Lake County allows wetlands in conservation easements to be dedicated to non-profit organizations, Lake County, or a conservation agency (such as the DEP). This county has special development standards for lake shorelines. Finally, Lake County requires that developers minimize wetland destruction when constructing golf courses.

### Levy County

Inland or coastal: Coastal

Total vegetated wetlands: 240,730 acres (FWS, 1984)



Percent wetland coverage: 33% (FWS, 1984)

2010 Population: 40,801 (NACO, 2013)

Score (number of wetland protection methods): 6/17 (Low)

Wetland protection methods:

- Septic waste management buffer
- Aesthetics
- Special mitigation ratio (example: 1:2 or 1:3) herbaceous vs. forested
- Shoreline buffer zone/ setback standards
- Shoreline or vegetation standards (such as wetland tree width)
- Coastal land use (wetlands listed) regulations

Although Levy County only has a “low” number of wetland protection methods, half of these methods protect coastal wetlands. Levy County recognizes the environmental value of mangroves, sea grass beds and adjacent aquatic water as nesting and feeding grounds for American Bald Eagles in the region. This county requires that any coastal marshes or wetlands disturbed by development must, at a minimum, be restored to their previous state.

### Manatee County

Inland or coastal: Coastal

Total vegetated wetlands: 120,801 acres (FWS, 1984)

Percent wetland coverage: 25% (FWS, 1984)

2010 Population: 322,833 (NACO, 2013)

Score (number of wetland protection methods): 9/17 (High)

Wetland protection methods:

- County Level Wetland Permitting Program
- Elevated walkways/ boardwalks
- Upland protection (separate from buffer)
- Septic waste management buffer
- Discusses role in erosion/ sedimentation
- Special mitigation ratio (example: 1:2 or 1:3) herbaceous vs. forested
- Estuary Organization
- Shoreline buffer zone/ setback standards
- Coastal land use (wetlands listed) regulations

This county appears to have a good sense of why wetlands are vital in coastal planning. Any development within the “coastal buffer” requires the approval of the Manatee Board of County Commissioners. They include many soft regulations, such as urging the use of wetlands in storm water treatment, preventing erosion, and other uses that benefit from wetland ecosystem services. Manatee County mentions wetlands in a section its comprehensive plan called “Neighborhood Identity”, and suggests that wetlands be included in neighborhood parks and preserved spaces. This county mentions the word “mangrove” much more frequently than other counties, which implies that they are concerned about coastal wetlands. Although coastal wetland protection appears relatively strong, this county exempts phosphate mining companies from having to complete wetland impact reviews.

### Marion County

Inland or coastal: Inland

Total vegetated wetlands: 96,133 acres (FWS, 1984)

Percent wetland coverage: 8% (FWS, 1984)

2010 Population: 331,298 (NACO, 2013)

Score (number of wetland protection methods): 2/17 (Low)

Wetland protection methods:

- Wetland Density (units/acre) specifications
- Septic waste management buffer

### Pasco County

Inland or coastal: Coastal

Total vegetated wetlands: 146,386 acres (FWS, 1984)

Percent wetland coverage: 30% (FWS, 1984)

2010 Population: 464,697 (NACO, 2013)

Score (number of wetland protection methods): 11/17 (Moderate)

Wetland protection methods:

- Environmental Department separate from Planning & Zoning
- Wetland Density (units/acre) specifications
- Elevated walkways/ boardwalks
- Upland protection (separate from buffer)
- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Specifically prioritizes or manages wetlands by category
- Isolated wetland protection
- Discusses role in erosion/ sedimentation
- Restrictions on fertilizer use near wetland
- Coastal land use (wetlands listed) regulations
- Wetland destruction expressly prohibited in urban areas

Pasco County's wetland protection methods will become increasingly important as urban sprawl from the Tampa Bay area spreads north. Pasco County has a regulation that prohibits any development that encroaches on a wetland that is 200 acres or larger. Indeed, the county has categories of wetlands that prioritize the protection of what it considers high-value wetlands. Pasco County requires different mitigation standards for each category, and monitors the mitigation process.

### Pinellas County

Inland or coastal: Coastal

Total vegetated wetlands: 19,248 acres (FWS, 1984)

Percent wetland coverage: 10% (FWS, 1984)

2010 Population: 916,542 (NACO, 2013)

Score (number of wetland protection methods): 12/17 (Moderate)

Wetland protection methods:

- Environmental Department separate from Planning & Zoning
- Wetland Density (units/acre) specifications
- Elevated walkways/ boardwalks
- Upland protection (separate from buffer)

- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Specifically prioritizes or manages wetlands by category
- Isolated wetland protection
- Aesthetics
- Discusses role in erosion/ sedimentation
- Special mitigation ratio (example: 1:2 or 1:3) herbaceous vs. forested
- Estuary Organization
- Coastal land use (wetlands listed) regulations

Although Pinellas County appears to offer a considerable level of wetland protection, it is important to remember that this is the county with the fewest acres of wetlands in the SWFWMD by a margin of around 40,000 acres. Pinellas County uses a map series to identify wetlands by priority. Some are reserved for preservation. There is a very thorough section on the history of wetland protection at the federal and state levels that puts the county wetland protection in context. It is the most concise, easy to read section on wetland policies I have encountered. The county created its own mangrove trimming program in 1996 and manages mangroves on a county-wide bases. Qualifications for becoming professional mangrove trimmers are described in great detail. This precaution extends to invasive species removal as well. The county discourages against shoreline hardening and favors soft shoreline stabilization by planting vegetation. Seawalls are prohibited in areas supported by wetlands. There is a section that describes a study on the effects of sea level rise in Tampa Bay. The goal is to ensure the long-term survival of coastal wetlands. The county states in its comprehensive plan that “all mangroves and other wetlands, regardless of size, are recognized to be of special ecological value.”

### Polk County

Inland or coastal: Inland

Total vegetated wetlands: 329,699 acres (FWS, 1984)

Percent wetland coverage: 25% (FWS, 1984)

2010 Population: 602,095 (NACO, 2013)

Score (number of wetland protection methods): 5/17 (Low)

Wetland protection methods:

- Wetland Density (units/acre) specifications
- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Septic waste management buffer
- Aesthetics
- Discusses role in erosion/ sedimentation

Polk County contains the largest area covered by wetlands in the SWFWMD, but a “low” number of wetland protection methods. Polk County has setback standards for communication towers. They require that all water bodies within a distance of two times the height of the tower should be indicated, and the structure must have a 50 foot buffer from any wetland. This county also uses a density bonus points system. In this system developers can leave more than the required upland buffer around a wetland for additional bonus points which can be used to increase density ratios in other parts of the development. Polk County proclaims that no land intended for development shall consist entirely of wetlands.

### Sarasota County

Inland or coastal: Coastal

Total vegetated wetlands: 122,396 acres (FWS, 1984)

Percent wetland coverage: 32% (FWS, 1984)

2010 Population: 379,448 (NACO, 2013)

Score (number of wetland protection methods): 13/17 (High)

Wetland protection methods:

- Environmental Department separate from Planning & Zoning
- Elevated walkways/ boardwalks
- Upland protection (separate from buffer)

- Aesthetics
- Discusses role in erosion/ sedimentation
- Wetland (from easement) dedication or "adopt" a wetland
- Mitigation Policies stricter than UMAM
- Specific goals to increase wetlands
- Special mitigation ratio (example: 1:2 or 1:3) herbaceous vs. forested
- Estuary Organization
- Shoreline buffer zone/ setback standards
- Coastal land use (wetlands listed) regulations

Sarasota County appears to offer a high level of wetland protection, yet does not have an Environmental Protection Commission like Hillsborough County (the only other county to have a “high” number of protection methods). Sarasota County has an in depth description of the county’s water resources, including descriptions of different types of wetlands and a section on sea level rise and its implications for wetlands. Their comprehensive plan includes descriptions of ecological services provided by wetlands and their impacts on Sarasota County (including the role of wetlands in fisheries). According to their comprehensive plan, “Approximately 39 percent of tidal wetlands and 30 percent of the seagrass coverage has been lost throughout the [Sarasota] Bay region” (Sarasota County Comprehensive Plan page 2-40). In addition, “The County has a strong program to protect wetlands and requires at least a 1:1 replacement for unavoidable destruction of wetland habitat” (Comprehensive Plan page 2-65). They add that “In instances where the UMAM [Uniform Mitigation Assessment Method] requirements do not apply, the mitigation shall consist of the creation at a one-to-one ratio for herbaceous wetlands and two-to-one ratio for forested wetlands, in accordance with Level I performance standards” (Comprehensive Plan page 2-92). Sarasota County has an environmental quality objective that requires the county to restore or create 18 acres of intertidal and 11 acres of non-forested freshwater wetlands each year.

### Sumter County

Inland or coastal: Inland

Total vegetated wetlands: 125,681 acres (FWS, 1984)

Percent wetland coverage: 35% (FWS, 1984)

2010 Population: 379,448 (NACO, 2013)

Score (number of wetland protection methods): 5/17 (Low)

Wetland protection methods:

- Wetland Density (units/acre) specifications
- Wetlands set aside for ecological functions with only minimal use (natural resources area)
- Septic waste management buffer
- Specifically prioritizes or manages wetlands by category
- Aesthetics

Although Sumter County has a “low” number of wetland protection methods, it categorizes its wetlands, which I believe is one of the strongest methods for directing development and emphasizing future land use regulations. Sumter County requires special analysis before any development can occur on any wetland that: has a direct hydrological connection to a natural surface water body greater than 500 acres or to the Florida Aquifer; an isolated wetland 100 acres or larger; or any wetland of any size that contains nesting federal and/or state listed wildlife species.

### Errors

Because of its qualitative nature, it is difficult to calculate a percentage error. However, this research has never been conducted before and can provide a solid foundation for future research in wetland protection regulations in Florida.

Some counties include several types of habitat under one name, such as “environmentally sensitive lands”. Due to time constraints and my specific research methods, I did not search for terms like these when I encountered them. Due to the repetitive nature of my search for the

words “wetland” and “mangrove”, it is possible that I simply skipped an instance where these words were used. Another possibility is that the government documents I used were outdated as new versions had not been posted to the county websites. I created my research methods as I began my research, backtracking to ensure that I evaluated each county by the same set of criteria. It is possible that I learned aspects of certain regulations after evaluating several counties, and misinterpreted previous information. Although my research methods are unique to this study, they captured several important policies that counties use to protect their wetlands.



## Conclusion

Wetland degradation is an issue that affects the entire world. According to the World Resources Institute, the main causes of this destruction across the globe are “infrastructure development, land conversion, water withdrawal, eutrophication and pollution, overharvesting, and overexploitation, and the introduction of invasive alien species” (WRI. 2005, page 6). Wetland protection is a global issue that should be considered seriously by national governments. In the United States, federal wetland protection policies may have slowed but not eliminated wetland losses. The State of Florida, too, has failed to protect these crucial ecosystems.

Although county level wetland protection might be the most effective way to sidestep less effective federal and state wetland protection policies, the negative influences of politics can exist at the regional and county levels as well. Creating and implementing new wetland protection programs at the county level will be challenging. Yet working at the county scale to create protection methods that are tailored to the local area and the citizens who live there is the most effective way to protect wetlands. Indeed, according to Pittman and Waite, “Some of the most stringent wetland regulations in Florida have been imposed by county governments” (Pittman and Waite, 2009, pg 282).

### Future research questions include:

What county level wetland protection methods are the most effective? How do we measure their effectiveness? Who pays for these efforts? Who implements them? Who monitors them?

My future research goals include further exploring the methods used in this research to find which wetland protection rules are the most useful for SWFWMD counties. Perhaps a method used in one county could be implemented in a neighboring county if they are dealing

with similar types of wetlands. Neighboring counties whose citizens have similar concerns over wetland degradation can make a regional impact on water resources. Communication and cooperation within and between counties is the key to effectively protecting wetland in Florida.

## Works Cited

Barringer, Felicity. 2006. "Fewer Marshes + More Man-made Ponds = Increased Wetlands."

*New York Times*. 31 March 2006. Web.

CEQ (Council on Environmental Quality). 2007. *A Citizen's Guide to the NEPA: Having Your*

*Voice Heard*. Executive Office of the President: December. Web. Accessed 5 April

2013. <[http://ceq.hss.doe.gov/nepa/Citizens\\_Guide\\_Dec07.pdf](http://ceq.hss.doe.gov/nepa/Citizens_Guide_Dec07.pdf)>.

Connolly, Kim M., Johnson, Stephen M., and Douglas. R. Williams. *Wetlands Law and Policy:*

*Understanding*

*Section 404*. American Bar Association: 2005.

CNRA (California Natural Resources Agency). *Guidelines for Specification of Disposal Sites for*

*Dredged or Fill Material*. The State of California, 2013. Web. 3 April 2013.

<[http://ceres.ca.gov/wetlands/permitting/404/epa\\_guidelines\\_230.html#B](http://ceres.ca.gov/wetlands/permitting/404/epa_guidelines_230.html#B)>.

Dahl, Thomas and Craig R. Johnson. 1991. *Status and Trends of Wetlands in the Coterminous*

*United States Mid-1970's to Mid-1980's*. Washington, D.C.: United States Department of the Interior, U. S. Fish and Wildlife Service.

Dahl, Thomas E. 2000. *Status and Trends of Wetlands in the Coterminous United States 1986 to*

*2007*. Washington, D.C.: United States Department of the Interior, U. S. Fish and Wildlife Service.

Dahl, Thomas E. 2005. *Status and Trends of Wetlands in the Coterminous United States 1998 to*

*2004*. Washington, D.C.: United States Department of the Interior, U. S. Fish and Wildlife Service.

- Dahl, Thomas E. 2005. *Florida's Wetlands: An Update on Status and Trends 1985 to 1996*. Washington, D.C.: United States Department of the Interior, U. S. Fish and Wildlife Service.
- Dahl, Thomas E. 2011. *Status and Trends of Wetlands in the Coterminous United States 2004 to 2009*. Washington, D.C.: United States Department of the Interior, U. S. Fish and Wildlife Service.
- DEP (Florida Department of Environmental Protection). 2002. *Homeowner's Guide to Wetlands*. Web. Accessed 20 March 2013.  
<[http://www.dep.state.fl.us/water/wetlands/docs/erp/wetland\\_guide.pdf](http://www.dep.state.fl.us/water/wetlands/docs/erp/wetland_guide.pdf)>.
- DEPb. 2013. *About DEP*. Web. Accessed 25 January 2013.  
<[http://www.dep.state.fl.us/mainpage/about/about\\_dep.htm](http://www.dep.state.fl.us/mainpage/about/about_dep.htm)>.
- DEPc. 2013. *Water Management Districts*. Web. Accessed 25 January 2013.
- EPA (Environmental Protection Agency). 2004. *Wetlands Overview*. United States Environmental Protection Agency. Web. Accessed 29 March 2013.  
<[http://water.epa.gov/type/wetlands/upload/2005\\_01\\_12\\_wetlands\\_overview.pdf](http://water.epa.gov/type/wetlands/upload/2005_01_12_wetlands_overview.pdf)>.
- EPAb. 2012. *Wetland Definitions*. United States Environmental Protection Agency. Web. Accessed 23 March 2013.  
<<http://water.epa.gov/lawsregs/guidance/wetlands/definitions.cfm>>.
- EPAc. 2012. *Laws, Regulations, Treaties: Regulations*. United States Environmental Protection Industry. Web. Accessed 4 April 2013.  
<[http://water.epa.gov/lawsregs/lawsguidance/cwa/wetlands/regs\\_index.cfm](http://water.epa.gov/lawsregs/lawsguidance/cwa/wetlands/regs_index.cfm)>.

- EPAd. 2013. *Our Mission and What We Do*. United States Environmental Protection Agency. Web. Accessed 23 March. 2013. <<http://www.epa.gov/aboutepa/whatwedo.html>>.
- EPAe. 2013. *Laws and Regulations*. United States Environmental Protection Agency. Web. 29 March 2013. <<http://www.epa.gov/regulations/laws/cwa.html>>.
- EPAf. 2013. *EPA History: Clean Water Act*. United States Environmental Protection Agency. Web. Accessed 29 March 2013. <<http://www2.epa.gov/aboutepa/epa-history-clean-water-act>>.
- Fruyer, Warren E., Monahan, T.J., Bodwen, David C., and Franklin A. Graybill. 1983. *Status and Trends of Wetland and Deepwater Habitats in the Conterminous United States*. United States Fish and Wildlife Service.
- FWS (United States Fish and Wildlife Service). 1984. *Florida Wetland Acreage*. United States Fish and Wildlife Service, National Wetlands Inventory.
- Gardner, Royal C. *Lawyers, Swamps, and Money: U.S. Wetland Law, Policy, and Politics*. Island Press: 2011.
- GPO (United States Government Printing Office). 2009. *Appendix C: Agencies Appearing in the Code of Federal Regulations*. Web. Accessed 29 March 2013. <<http://www.gpo.gov/fdsys/pkg/GOVMAN-2009-09-15/pdf/GOVMAN-2009-09-15-Pg641.pdf>>.
- Haag, Kim H. and Terrie M. Lee. 2010. *Hydrology and ecology of freshwater wetlands in central Florida—A primer*. U.S. Geological Survey Circular 1342: 138.

HCEPC (Hillsborough County Environmental Protection Commission). 2012. *Environmental Protection Commission of Hillsborough County*. Web. Accessed 1 May 2013.

<<http://www.epchc.org/documentcenter/view/129>>.

Land Trust Alliance. 2013. *Conservation Easements*. Web. Accessed 1 May 2013.

<<https://www.landtrustalliance.org/conservation/landowners/conservation-easements>>.

Lewis, William M. *Wetlands Explained: Wetland Science, Policy, and Politics in America*.

Oxford University Press: 2001.

Merriam-Webster. 1996. Merriam-Webster's Dictionary of Law. Merriam-Webster, Inc.

*Regulatory Taking*. Accessed via FindLaw, 2012. Web. Accessed 12 April 2013.

<<http://dictionary.findlaw.com/definition/regulatory-taking.html>>.

Mitsch, William J. and James G. Gosselink. *Wetlands*. Hoboken, New Jersey: John Wiley &

Sons, Inc., 2007.

NACO (National Association of Counties). 2013. *Find a County*. Web. Accessed 1 May 2013.

<<http://www.naco.org/Counties/Pages/FindACounty.aspx>>.

NAS (National Academy of Sciences). 2001. *Compensating for Wetland Losses Under the Clean*

*Water Act*. National Academy Press.

NRCS (National Resource Conservation Service). 2013. *Wetland Delineation*. United States

Department of Agriculture, National Resources Conservation Service. Web. Accessed 24 November 2012.

<[http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/wetlands/?cid=nrcs143\\_010939](http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/wetlands/?cid=nrcs143_010939)>.

NRCSb. 2013. *Wetlands*. United States Department of Agriculture, National Resources Conservation Service. Web. Accessed 25 November 2012.

<<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/>>.

NRDC (National Resources Defense Council). 2013. *Wetlands at Risk: Imperiled Treasures*.

National Resource Defense Council. Web. Accessed 24 November, 2012.

<<http://www.nrdc.org/water/conservation/atrisk/intro.asp>>.

Pittman, Craig . and Matthew Waite. 2009. *Paving Paradise: Florida's Vanishing Wetlands and the Failure of No Net Loss*. University Press of Florida.

Reed, Denise J. 1993. "Hydrology of temperate wetlands." *Progress in Physical Geography*. 17: 27.

The Florida Legislature. 2013. The State of Florida. *The 2012 Florida Statutes*. Web. Accessed March 19, 2013

<[http://www.leg.state.fl.us/Statutes/index.cfm?App\\_mode=Display\\_Statute&Search\\_String=&URL=0300-0399/0373/0373PARTIVContentsIndex.html](http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0373/0373PARTIVContentsIndex.html)>.

Vileisis, Ann. *Discovering the Unknown Landscape*. Washington D.C.: Island Press, 1997.

WRI (World Resources Institute). 2005. *Ecosystems and Human Well-Being: Wetlands and Water Synthesis*. Millennium Ecosystem Assessment. Washington, D.C., 2005.

WRIB. 2013. *What Are Ecosystem Service?*. World Resources Institute. Web. Accessed 12

February 2013. < <http://www.wri.org/project/mainstreaming-ecosystem-services/about>>.

## Appendix A

### United States Wetland Regulations

Federal Level Wetland Regulations  
**Created by:** Congress  
**Implemented/Overseen by:** Army Corps of Engineers. EPA. FWS. NOAA



- Rivers and Harbors Act
  - Illegal to dump “any refuse matter of any kind or description” in navigable waters of US (Section 13, also called Refuse Act)
  - Illegal to obstruct navigation in a waterway (Section 10)
- NEPA
  - Environmental impacts must be considered before any alteration to the environment
- CWA Sec 404 dredge and fill permits
  - Wetland degradation and destruction is only allowed if a permit is given by the Corps
  - Exceptions: Nationwide permits

### Florida State Level Wetland Regulations

**Created by:** State of Florida (allowed by Congress because regulations do not impede on national regulations)  
**Implemented by:** FDEP, water management districts, county Environmental Protection Commissions



- Environmental Resource Permit (ERP) Program regulates activities involving the alteration of surface water flows
  - Program run by water management districts
  - Exceptions: Broward, Miami-Dade, and Hillsborough Counties which issue ERP permits through their county Environmental Protection Commissions
- State Programmatic General Permits
  - approved by the Corps to reduce duplication of permit requests to the Corps & the DEP (same concept as nationwide permits- reduce the most common permits that are always granted)

### Florida County Level Wetland Regulations

**Created by:** Individual counties (allowed by the state because regulations do not impede on state regulations)  
**Implemented by:** Individual county governments and Environmental Protection Commissions



Varies by county