Environmental Land Use Planning and Integrated Management at the River Basin Scale in Coastal North Carolina

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Abstract:

At its core environmental management is achieved through the design and control of human behavior. Land use planning provides an excellent tool for the management of a variety of influential human activities by controlling and designing the ways in which we use land and natural resources. In its present state, land use planning falls short of its potential as an environmental and natural resource management tool. This is primarily due to a lack of coordination and the failure of land use planners to consider the environment in their charge holistically. While this situation exists in North Carolina, the state is well positioned to leverage existing environmental management and land use planning programs to create greater effectiveness and efficiency. This is particularly true in the coastal zone where land use planning tools, specifically land use suitability analysis, can be applied through the river basin planning system to improve coastal management for both human and environmental sustainability and success.
Executive Summary

At its core environmental management is achieved through the design and control of human behavior. Land use planning provides an excellent tool for the management of a variety of influential human activities by controlling and designing the ways in which we use land and natural resources. In its present state, land use planning falls short of its potential as an environmental and natural resource management tool. This is primarily due to a lack of coordination and the failure of land use planners to consider the environment in their charge holistically. While this situation exists in North Carolina, the state is well positioned to leverage existing environmental management and land use planning programs to create greater effectiveness and efficiency. This is particularly true in the coastal zone where land use planning tools, specifically land use suitability analysis, can be applied through the river basin planning system to improve coastal management for both human and environmental sustainability and success.

The vast majority of environmental management systems are concerned with specific individual issues and local areas and many human impacts on the environment can be most easily conceived and communicated at these more targeted scales. Doing so, however, ignores the fact that the natural world is an interconnected and dependent system of which humans are a part, albeit a highly influential one. Considering environmental issues on an individual and separate basis will never be as effective as considering the issues, at least initially, at a systems level where all of the inputs can be taken into account. Since most environmental issues today involve at least some level of human influence, it would be wise to manage human interactions with the environment at wider scales with holistic policies that are as integrated and wide-reaching as feasible. Ecosystem based management systems generally and river basin management in particular offer this opportunity environmental planners, managers and policy makers.

Many aspects of environmental management are currently conducted in isolation. Managers focus on their own responsibilities and all too often fail to consider other related issues and ignore the interrelated nature of the environment as a whole. No where is this more true than in coastal zones. These dynamic and highly inter-connected regions are frequently affected by human land use decisions. While ecosystem based management has made significant strides in theory and design in recent years, straightforward and effective tools are needed to bring it into wider use. Land use planning and land use suitability analysis specifically offer just such a platform. Suitability analysis processes currently in use manage to do this to some extent already. By considering many environmental factors in the analysis process a significant amount of integration can be easily achieved. The trick lies in using a biophysical boundary that allows for a holistic but still feasible approach, getting various parties to contribute to the process, and in making sure that the resulting land use suitability maps are actually used in future land use planning decisions. When these goals are met land use planning will have gone a long way towards fulfilling its potential as a powerful integrative environmental management tool set.

North Carolina’s current coastal zone management system is structured around local land use planning conducted at the county level and below. A related, but unconnected, system of water resource management at the river basin level offers an existing ecosystem based management framework in the coastal zone. While both of these programs have a history of growth and adaptation
they are currently failing to truly live up to their potential as tools for holistic and effective environmental management. As such environmental management and land use planning in coastal North Carolina lack integration and consistency and fail to fully consider the interconnected nature of the coastal zone as an ecosystem. A series of reports and reviews over the past decade have arrived at the same basic conclusion and encouraged North Carolina to seek a more integrated approach.

The patchwork nature of land use planning in North Carolina has drawn critiques in the past. Researchers, NOAA reviewers, the Coastal Resources Commission, and others have all called for improvements at one time or another. Reviewers are in agreement that coastal land use planning in North Carolina can be done better. Plans with greater integration and consistency throughout the bio-physical ecology of the coastal region would provide more robust protection of resources, as well as encourage coordinated and more efficient development planning that will benefit the constituents of the region economically.

The Coastal Area Management Act land use planning process overseen by the Division of Coastal Management and the basinwide planning process overseen by the Division of Water Quality in North Carolina are well positioned for greater collaboration and synthesis due in part to their overlapping ecologies. Being able to leverage North Carolina’s existing environmental management infrastructure is a great advantage and is only possible because of the different departments’ shared ecologies. Particularly when examining the coastal zone, the bio-physical, human, and institutional ecologies involved in both land use and river basin planning in North Carolina enjoy many commonalities. These shared and overlapping ecologies create and offer the opportunities to adapt and improve coastal environmental management in North Carolina.

Creating an environmental management system based around land use planning tools from scratch is a tall order anywhere, let alone in the coastal zone. Luckily in North Carolina a coastal management system that utilizes land use planning as well as a river basin management plan that provides a useful holistic approach to the coastal environment are already in place. Small adjustments can be made in both of these programs to easily create an integrated system that effectively uses land use suitability analysis as a powerful tool for integrated planning and environmental management.

Given the existing management structures in North Carolina a land use suitability analysis component could easily be configured to bring together the River basin planning and CAMA programs and create a more fully integrated and effective coastal management scheme for the state. The necessary changes to existing programs, legislation, and regulation would be fairly minimal and can reasonably be expected to be enacted without much difficulty. Nearly all of these changes can be made by the Environmental Management Commission and CRC under their existing mandates as rules changes which greater streamline the potential process. These changes should be simple enough as to not create overly burdensome new responsibilities for the involved state agencies and local governments. In the simplest and most straightforward terms the application of an integrated land suitability analysis process at a river basin planning level that can then be used to guide local land use plans in the coastal zone will allow North Carolina to take a step forward in the integration and effectiveness of the state’s coastal management system.
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Introduction

Environmental management is at its core the management of humans. People may not always follow every rule to the letter and not every regulation will be properly enforced or carried out, but in theory at least, managers can regulate and dictate human actions. The same cannot be said of natural resources or wild animals, neither of which will ever respond to the dictates of policy directives. Even when it seems that environmental legislation targets a specific resource or species, a closer look will reveal that in actuality the regulations involved deal with human behavior and interaction with the species or resource in question. Humans interact with the natural world constantly, with nearly every human action affecting the environment for better or worse across a range of scales. At a broad level human actions have important impacts on the amount and quality of available habitat for both fauna and flora as well as water and air quality. Both of which have, in turn, wide ranging impacts for humans in terms of public health and quality of life.

The vast majority of environmental management systems are concerned with specific individual issues and local areas and many human impacts on the environment can be most easily conceived and communicated at these more targeted scales. Doing so, however, ignores the fact that the natural world is an interconnected and dependent system of which humans are a part, albeit a highly influential one. Considering environmental issues on an individual and separate basis will never be as effective as considering the issues, at least initially, at a systems level where all of the inputs can be taken into account. Since most environmental issues today involve at least some level of human influence, it would be wise to manage human interactions with the environment at wider scales with holistic policies that are as integrated and wide-reaching as feasible.

The interactions between humans and the natural world, and the impacts thereof, are heightened in dynamic and highly interconnected environments. This is perhaps nowhere more true than in coastal zones where water ties together ecosystems and humans and nature come face to face
on shorelines and beaches. Finding ways to manage human interactions with the environment in the coastal zone that consider the interconnectivity of the natural systems and human activities will allow for more effective and efficient management and planning and for the best uses and preservation of natural resources to occur.

Environmental management systems that seek to make more holistic and integrated decisions and create policies based on considering interconnected natural systems do exist. Two ideas in particular are in fairly widespread, but imperfect, use today. Ecosystem based management and land use planning both predate the flurry of national environmental legislation and environmental advocacy that gripped the United States in the late 1960’s and early 1970’s, but it was during this time that the seeds for greater implementation of these ideas were sown.

Ecosystem based management seeks to apply a holistic approach to environmental management by considering entire ecosystems instead of individual issues and land use planning provides the opportunity for an integrated and broad approach to managing a variety of human activities that effect the natural world. The United States Coastal Zone Management Act (CZMA) of 1972 recognized the potential benefits of land use planning when it was included among the requirements for state programs to qualify for federal funding incentives. The United States Environmental Protection Agency (EPA) created in 1970 and the United States Clean Water Act (CWA) passed initially in 1972 have both served to push ecosystem based management as a desirable and effective technique.

While land use planning and ecosystem based management techniques are now fairly widespread in the coastal zones of the United States and around the world, neither technique tends to be rigorously applied. Further, despite the integrative goals of both techniques they have only rarely, if ever, been employed in concert as part of a singular system. Brought together they could be the next step forward in the evolution of coastal environmental management towards greater efficiency and
effectiveness. Land use planning executed in an ecosystem based framework has the potential to provide the basis for addressing a range of diverse coastal environmental issues in an integrative manner that enhances coordination and addresses current management shortfalls (European Commission, 2007).

The Problem – Fragmented planning

North Carolina’s current coastal zone management system is structured around local land use planning conducted at the county level and below. A related, but unconnected, system of water resource management at the river basin level offers an existing ecosystem based management framework in the coastal zone. While both of these programs have a history of growth and adaptation they are currently failing to truly live up to their potential as tools for holistic and effective environmental management. As such environmental management and land use planning in coastal North Carolina lack integration and consistency and fail to fully consider the interconnected nature of the coastal zone as an ecosystem. A series of reports and reviews over the past decade have arrived at the same basic conclusion and encouraged North Carolina to seek a more integrated approach.

In 2000, in response to a growing lack of consideration for environmental impacts in land use plans, the Land Use Plan Review Team (LUPRT) was convened to address concerns with the state of land use planning in North Carolina and make recommendations for the future. Among other recommendations the LUPRT report called for greater coordination among plans and planners and clearer and stronger guidelines for the inclusion of environmental concerns in the creation of local land use plans (LUPRT, 2000). These findings were supported by research conducted by Norton and colleagues culminating in a series of papers in 2005. This research also found that plans were narrowly concerned with local issues and failed to consider the coastal zone as a larger system (Norton, 2005a; 2005b; 2005c). In 2006 the most recent periodic assessment of the North Carolina Coastal Management Program by the National Oceanic and Atmospheric Administration’s (NOAA) Office of Ocean and Coastal
resource Management (OCRM) also echoed these concerns. The assessment generally praised the program for its performance but made suggestions that North Carolina seek to improve the integration and cooperation levels existing in the state’s coastal management systems (OCRM, 2006). In reviewing the future of water management and resource use in North Carolina in 2007 the Nicholas Institute stressed the importance of land use planning to water management and suggested that the sustainable future use and management of water resources in the state would hinge upon the integration of water and land use planning (Holman, 2007). All of these reports also make it clear that North Carolina enjoys a sound framework for coastal environmental management and that they believe that their suggestions can be readily attained through simple changes. This paper investigates a potential solution that will improve coastal environmental management in North Carolina through the utilization of land use suitability analysis at a river basin scale in order to advance efficiency and coordination by making use of the potential for holistic ecosystem based style management inherent in land use planning.

**General Recommendation – Using land use suitability analysis for integrated planning**

As previously discussed land use planning is one of the broadest and most easily integrated tool sets available to environmental planners and managers as they attempt to govern human interactions with the natural world. Within the range of individual tools that fall under the land use planning umbrella, one stands out for its potential to enhance cooperation and integration by bringing together environmental managers with a range of responsibilities and concerns. Land use suitability analysis provides the back bone for much land use planning and is developed on a network of environmental factors (Randolph, 2004). Different agencies, officials, representatives and other constituents can come together to collaborate on the suitability analysis process with the end product incorporating these varied concerns into a streamlined and efficient regulatory tool.
Many aspects of environmental management are currently conducted in isolation. Managers focus on their own responsibilities and all too often fail to consider other related issues and ignore the interrelated nature of the environment as a whole. No where is this more true than in coastal zones. These dynamic and highly inter-connected regions are frequently affected by human land use decisions. While ecosystem based management has made significant strides in theory and design in recent years, straightforward and effective tools are needed to bring it into wider use. Land use planning and land use suitability analysis specifically offer just such a platform. Suitability analysis processes currently in use manage to do this to some extent already. By considering many environmental factors in the analysis process a significant amount of integration can be easily achieved. The trick lies in using a bio-physical boundary that allows for a holistic but still feasible approach, getting various parties to contribute to the process, and in making sure that the resulting land use suitability maps are actually used in future land use planning decisions. When these goals are met land use planning will have gone a long way towards fulfilling its potential as a powerful integrative environmental management tool set.

Creating an environmental management system based around land use planning tools from scratch is a tall order anywhere, let alone in the coastal zone. Luckily coastal states all have some existing coastal zone management plans which may provide a useful basis upon which to expand in the search for more effective coastal management based on integrated planning. This is particularly true in North Carolina where a coastal management system that utilizes land use planning as well as a river basin management plan that provides a useful holistic approach to the coastal environment are already in place. Small adjustments can be made in both of these programs to easily create an integrated system that effectively uses land use suitability analysis as a powerful tool for integrated planning and environmental management.
Ecosystem Based Management and Land Use Planning Background

Before the specifics of North Carolina’s situation can be discussed it is instructive to briefly examine both land use planning and ecosystem-based management and their roles in the environmental management tool set more closely. A proper introduction is needed before any specific proposals can be effectively discussed. Both Eco-system based management and land use planning have long and interesting histories and continue to evolve and grow into their potential to serve as highly effective tools for successful environmental management.

Origins of Ecosystem Based Management

The idea of using naturally occurring bio-physical boundaries for environmental and natural resource management purposes is not new. Indeed, nearly 20 years ago authors and proponents were already insisting as much (Slocombe, 1993). Looking further into the past reveals traditional environmental management practices based around local ecosystems. Berkes and his collaborators (1998) discussed the importance of ecosystems in the culture and lives of many traditional ancient cultures in North America, Southeast Asia, Africa, and the Pacific Islands. One of the most commonly cited examples of historic ecosystem-based management is the traditional Hawaiian system of ahupua’a, in which decisions were made affecting the allocation and use of resources within local watersheds (Derrickson et al, 2002; Berkes et al, 1998). Watersheds can make excellent natural delineations for management areas, a notion which this report will address and build upon. Beginning with a brief background on and introduction to ecosystem-based management will make the substance of this report more meaningful.

Defining Ecosystem-based Management

The term ecosystem-based management can be used in reference to both the manner in which the boundaries of a management area are delineated as well as the attempt to address environmental management issues within the area holistically. This notion of holistic management hinges on the
recognition that all aspects of the ecosystem are interwoven and that successful environmental management must consider the challenges faced and goals pursued in light of the naturally occurring integration. A narrow, single issue focus will fail as the targeted issue is affected by parts of the ecosystem outside of the focus.

Ecosystem-based management, like many terms common to conservation and environmental work, is prone to differing definitions and interpretations. Moving beyond theoretical discussions of ecosystem-based management and into actual implementation and real world application only provides an even greater array of takes on the system. Regardless of preferred applications or interpretations, proponents of ecosystem-based management agree that a holistic approach to environmental and resource management is key to long term, sustainable success (Mitchell, 2005).

A good working definition of ecosystem-based management for the purposes of this paper was provided by Slocombe (1998) who observed that “ecosystem-based management is the process of managing and understanding the interaction of the bio-physical and socioeconomic environments within a self-similar, self-maintaining regional or larger system.” In Slocombe’s view, “Ecosystem-based management seeks to transcend arbitrary political and administrative boundaries, to achieve more effective, integrated management of resources and ecosystems at regional and landscape scales.” These goals are important in that they address the short comings of considering environmental issues individually while also searching for greater efficiency and effectiveness in management schemes generally.

Applications of Ecosystem-based Management

One of the more common applications of ecosystem-based management in practice has been the management of species populations as part of a larger system as opposed to in isolation (Grumbine, 1994). The management of species as such recognizes their interconnectedness and reliance on other species within their ecosystems and can be seen increasingly in fisheries management. Where
consideration is made for the role that species play as an important source of food for other species in the ecosystem and the needs of those predators are taken into account when setting catch limits for the population being managed. Another fairly widespread adoption of ecosystem-based management has arisen in protected areas and parks due largely to the pre-established boundaries and clearly stated management goals for these areas. By the 1990's the United States Forest Service (USFS), Park Service, Bureau of Land Management (BLM) and Fish and Wildlife Service (USFWS) had all adopted some form of ecosystem based management for the lands and resources under their control (Randolph, 2004). Since these areas are often parts of larger ecosystems this practice can be seen as a half measure. Given all of the difficulties surrounding the actual implementation of ecosystem-based management plans however, these partial ecosystems are often the most complete management areas that are feasible.

Within delineated management areas two fundamentally different approaches to the implementation of ecosystem-based management schemes have emerged. The two approaches vary in the tradeoffs that they make in an effort to achieve successful management goals. The comprehensive approach considers the inclusion of all potentially influential factors in the management decision making process. The comprehensive approach insures that all factors are considered and that the interconnectedness of the ecosystem in question remains front and center in the management scheme. Such attention to detail often erodes effectiveness in implementation by bogging down the process and bringing so many questions and opinions and angles to the table for consideration that decisions are made slowly and implementation occurs even more slowly, if at all.

The integrated approach emerged as a counterpoint to the comprehensive approach and attempts to find greater effectiveness and efficiency through tradeoffs. The integrated approach still considers the entire ecosystem in question but it does so through a few selectively chosen factors and relationships. Often a key subset of critical factors can be identified that are responsible for most of the variation within the ecosystem. Dealing with fewer variables streamlines the decision making process
and makes implementation much simpler, and the integrated approach to ecosystem-based management seeks to put these advantages to use. The integrated approach also recognizes that not all factors and relationships within an ecosystem can be controlled or managed. While the integrated approach runs some risk of overlooking important issues within the ecosystem, much of this risk can be alleviated by the careful application of expertise and knowledge early in the process of developing ecosystem-based management plans. Using fewer factors that are known to be manageable allows the integrated approach to enjoy a smoother process and greater success with implementation than the comprehensive approach (Mitchell, 2005). This paper, and the proposed management solutions which it discusses, is concerned with the integrated approach to ecosystem-based management.

For ecosystem-based management schemes to succeed in achieving their desired goals, as described by Slocombe, they must be adopted by an agency or organization with the authority to make management decisions. All too often ecosystem-based management is discussed and favored by advisory groups or teams assigned to concoct management plans which lack the power to implement them (Grumbine, 1994). Finding ways to successfully implement ecosystem-based management plans or even plans that have been influenced or represent some of the central tenets of ecosystem-based management continues to be a stumbling block. This failure of full scale ecosystem-based management to emerge in actual practice is often born of the existing political and administrative boundaries and the desire of the management agencies concerned to maintain their responsibilities and protect their turf. Working to get agencies that already enjoy wide ranging environmental management responsibilities to apply their plans on an ecosystem scale may prove the most practical manner for advancing ecosystem-based management in the real world.

Finding existing bio-physical boundaries that can be easily translated to and leveraged for ecosystem based management also serve to advance its application in the real world. Watersheds tend to make good natural delineations for ecosystems, with water flowing downstream and connecting
everything in the ecosystem together. As previously mentioned watershed management and planning enjoy a long history. They also tend to range across many local political boundaries and depending on the scale at which they are considered, state and international ones as well. When considered at appropriate scales watersheds may provide useful management areas for state level agencies tasked with a range of environmental management and planning responsibilities. It is worth discussing the history and current conditions of watershed and river basin management projects to better understand the foundations upon which this proposal relies.

Watershed / River Basin Management Background

Watersheds are simply and elegantly defined by the Center for Watershed Protection as “the land area that drains to a common body of water, such as a stream, lake, estuary, wetland, or even the ocean.” (CWP, 2011) The shared nature of water resources provided by rivers, primarily for drinking and irrigation purposes, has long been recognized. Legal disputes and competing claims to these resources have given rise to arrangements and usage plans on local, regional, and international scales. The desire and need to protect water resources has also given rise to agreements on similar scales that address the connectivity inherent in watersheds and river basins. The water protection schemes are often focused on the upstream effects of human actions on the quality and availability of downstream water resources. While investigating the history of watershed planning and management Molle (2009) discussed the recognition of the interconnected nature of the water resources within watersheds and the accompanying issues with upstream-downstream relationships that have been reported occurring as long ago as the third century BC in China. The navigable portions of rivers within watersheds have also served throughout history to tie together the watershed from a socio-economic standpoint. The importance of both the navigational and resource use aspects of watersheds can be seen in the rise of many early civilizations in fertile and navigable river basins (Nile, Tigris and Euphrates, Yangtze) and
again in the importance of rivers and river basins in the growth and establishment of settlements in the American colonies and early United States (Teclaff, 1996).

John Wesley Powell made the first strong arguments for direct use of watersheds as planning and management units in the United States during the end of the 19th century. As head of the United States Geological Survey (USGS) Powell proposed creating a system of governance in the arid regions of the western United States based on watersheds as opposed to the prevailing system of counties and municipalities. Powell’s plans were based on the need to control and manage the use, availability, and quality of the scarce water resources available in the region (Worster, 2001). While Powell’s designs were not enacted, such a radical change in governance structures proved unpopular particularly with the hugely influential railroad companies who stood to lose significant sums if they could not develop the land they had been granted while expanding rail service through the west.

Powell’s plans would later reemerge as the necessity for integrated water resource management became clearer following the droughts of the dust bowl years and the growing desire to harness and develop natural resources to greater benefit humans. The Tennessee Valley Authority (TVA), created in 1933 as one of President Roosevelt’s New Deal projects, set out to manage a large scale watershed across state and local boundaries with a number of different management goals. In the end, the TVA was successful in directing flood control and hydropower projects within the watershed but the rest of its more ambitious social programs fell by the wayside. While generally considered a success, at least concerning power and flood control, the TVA was the only such large scale project undertaken in the United States (Teclaff, 1967).

The environmental movement of the late 1960’s and early 1970’s in the United States which gave rise to greater recognition of pollution and water quality concerns and the potential for ecosystem based management structures created the starting point for thinking about watershed management in terms of environmental protection in the United States. As the CWA has been amended and updated
the EPA has come to embrace what it calls the Watershed Protection Approach (WPA)\(^1\) and to encourage states to adopt the approach as part of their water quality management programs. The WPA developed out of the recognition in the late 1980’s that disparate environmental control laws and regulations that addressed a single issue were not having the desired effect, particularly in regards to water quality (Randolph, 2004). The WPA was originally introduced in 1991 and has been aggressively promoted since 1996 by the EPA; it entails several major concepts identified by Randolph (2004) as the following four principles:

1. Targeting priority problems and applying good science to understand them
2. Promoting a high level of collaboration through stakeholder involvement
3. Integrating multiple solutions from multiple agencies and private parties
4. Measuring success through monitoring and other data gathering.

Today most watershed management and planning schemes in the United States are focused on protecting water quality and ensuring water supplies into the future. By 2002 when the EPA issued the most recent review of the subject more than 20 states had adopted statewide watershed management approaches for their water quality management systems (EPA, 2002). Given the increase in complexity that comes with attempting to manage watersheds at an interstate level, the emergence of statewide approaches is both a logical and useful development for watershed management.

Since most state watershed management programs are designed to address water quality and supply issues they often fall short of a traditional definition of ecosystem based management, in that the programs do not address the ecosystem as a whole. Statewide watershed management programs have however taken significant steps towards ecosystem based management by embracing naturally occurring bio-physical boundaries as management units. The principles that underlie the EPA’s WPA are

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\(^1\) More information on the WPA can be found in Watershed Protection: A Statewide Approach from the EPA available online at http://www.epa.gov/owow/watershed/state/
also primed for an ecosystem based approach as the interconnected nature of watersheds makes them excellent candidates to excel with an ecosystem based management system.

An ecosystem based management system at a watershed scale need not supersede the authority of the local governments whose jurisdictions the system inhabits. Instead it must find ways to bring the different governments and agencies with regulatory authority in the watershed together and encourage them to work in consort with other local constituents. Only with cooperation and coordination among the stakeholders can the issues at hand be addressed at an ecosystem scale and the advantages of using the watershed boundaries for planning and management be realized.

Coastal Land Use Planning Background

Land use planning as a tool for environmental management first rose to national prominence in the United States in the environmental era of the late 1960’s and early 1970’s. Prior to that time land use planning had long existed in the design and planning of cities and transportation networks dating back at least hundreds of years if not more (Randolph, 2004).

In many other countries national land use plans exist; in the United States however land use planning has always fallen to state and local governments, albeit with some guidance for the federal level. While a nascent movement for a national land use planning framework and mandate ultimately proved unsuccessful (Kayden, 2000), there was enough enthusiasm about the need to protect the nation’s coastal zones and resources for action to be taken in that smaller arena. In 1972 The United States Coastal Zone Management Act (CZMA) was enacted to this end.

Coastal Zone Management Act

The CZMA was created in order to encourage the cooperative management of the nation’s coasts among federal, state, and local agencies and governments. Congress declared in Section 303 of the CZMA that it is the national policy of the United States to “preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding
generations." In effect the CZMA calls for the balancing of environmental concerns and economic development in coastal zone management and planning. The CZMA is often referred to as a carrot act as it provides an incentive to states to act rather than forcing them to do so. In this case through the provision of financial assistance to states that create approved plans for land and water use within their designated coastal zones. Section 307 of the CZMA provided additional incentives for creating an approved plan by requiring all federal actions “affecting the coastal zone” to be consistent with approved state management plans. It is worth noting that the CZMA does not require states to meet substantive goals with their coastal management programs, only that states create programs to manage certain coastal zone issues. Chief among these programmatic requirements is the creation of a land use planning system for each states coastal zone (Cicin-Sain and Knecht, 2000).

**Land Use Suitability Analysis**

Land use planning encompasses a variety of tools and strategies, many of which are best applied at a more local level where the constituents who are most directly impacted can best be included in the discussion about how the land around them is put to use. The key to land use planning’s successful application as a management system that can increase efficiency and integration lies in the land use planning tools that take a broader approach. Land use suitability analysis is one of the simplest and potentially most effective tools of this nature. The idea itself is extremely simple – by examining the existing natural features and resources along with the built environment in a given area planners can determine which land is suitable for future development and which is not. Land use suitability analysis can be performed in a binary, suitable or not suitable, plane or along a spectrum of suitability. Planners and managers can decide which inputs to examine in preparing the analysis along with what relative weight should be assigned to each input.

The earliest recorded uses of the technique in the United States emerged as hand drawn overlays in the late 1800’s and early 1900’s (Malczewski, 2004). Collins et al (2001) follow land use
suitability analysis’s evolution from the early hand drawn days, through the advancement of the planning literature in the mid 20th century, and into the computer age and use of GIS that powers today’s analyses. GIS technology can be used to seamlessly stack layers for each individual category under consideration by planners and then tally each layer, with weights if desired, to arrive at a final suitability score for a designated piece of land or for the entire region divided into segments. The resulting suitability map, or score for a specific location, can then be utilized as the first step in the decision process that guides the future land use of the region.

Land use suitability analysis offers an easy and straightforward way to bring together many of the concerns and factors surrounding human interaction with nature. Since most environmental management involves the search for compromise between the preservation of the natural world and its resources and the economic development and prosperity or quality of life enjoyed by humans, tools that can consider these multiple issues simultaneously are of great value. Land use suitability analysis is just such a tool. Natural resource conservation and protection concerns can be addressed by designating areas as not suitable or less suitable for development that provide and buffer habitat for a variety of flora and fauna, ecosystem services, water resources, and recreational uses to name a few. Likewise natural hazard mitigation that protects lives, infrastructure, and real estate value can be obtained by designating dangerous areas including storm surge, erosion, fire, and flood zones as not suitable for development. On the flip side of the equation areas can be designated as suitable or highly suitable for development in order to maximize efficiency and the potential of existing infrastructure including roads, water, electrical, and sewer services and other modes of transportation; or simply to keep development clustered together where density can prove to be a driver of economic growth. Nearly any factor affecting the suitability of land for development can be considered during analysis.

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The compilation of factors considered for the analysis and the process itself provide an unparalleled opportunity to bring together the managers and planners from the various agencies and governments with responsibilities in the region as well as providing an additional opportunity for stakeholder engagement and the use of strong science in the direction and creation of policy.

**Focusing on North Carolina**

With an understanding of the general outlines and backgrounds of ecosystem based management and land use planning broadly we can now begin to focus more specifically on their application in North Carolina. While land use planning and ecosystem based management make appearances throughout the state, this project is most concerned with their utilization in the coastal zone. In North Carolina the coastal zone for legislative and management purposes has been defined as the 20 coastal counties named in the Coastal Area Management act which are discussed in more detail later. The 20 CAMA counties, as they are often referred to are: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington. However, the coastal zone often includes the entire coastal plain below the fall line for more general scientific purposes. In the figure below the Tidewater counties with the exception of Jones and the addition of Gates, Hertford, and Bertie comprise the CAMA counties. North Carolina’s coastal plain is seen here:
River Basin Management in North Carolina

River Basin management in North Carolina today is a project and responsibility of the North Carolina Department of Environment and Natural Resources (NC DENR) Division of Water Quality (DWQ) with origins in federal legislation known as the Clean Water Act (CWA). The first federal legislation to address water quality and pollution was passed in 1948. The Federal Water Pollution Control Act was fairly limited in scope and addressed the issue through the setting of water quality standards for contaminants in surface waters but did little to regulate pollution directly or to encourage planning. The legislation commonly referred to as the CWA was passed in 1972 and reauthorized and expanded in 1977. Other laws and amendments have changed the CWA in the intervening years as well. The CWA is broadly concerned with protecting water quality by addressing and regulating pollution sources and discharges directly and planning for the control of non-point source pollution (EPA, 2011). During the 2000’s the watershed approach to water quality management gained in popularity under the direction of the EPA. As an attempt to create more holistic management systems that consider the entire watershed instead of addressing the CWA mandates on an issue by issue and pollutant by pollutant approach was made (EPA, 2008). The watershed approach is defined by the EPA as: being hydrologically
defined, involving all stakeholders, and strategically addressing priority water resource goals (EPA, 2011a). North Carolina’s evolution towards a watershed approach began even earlier and has grown and developed as the EPA has provided increased resources and assistance for watershed approaches.

The river basin management approach to water quality was first adopted in North Carolina in 1991 as a strictly voluntary program in order to streamline the state’s National Permits Discharge Elimination System (NPDES) and coordinate permit issuance with water quality modeling (EPA, 2002). In 1997 river basin water quality planning and management was mandated by the North Carolina legislature (NCGS, 1997a; 1997b) and DWQ proceeded to create plans for each of the state’s 17 major river basins as individual Basinwide Planning Units (DWQ, nd). The 17 defined river basins in North Carolina are in the process of switching from a state specific delineation system to one based simply on the United States Geological Survey’s (USGS) Hydrologic Unit Code system (HUC) (DWQ, 2010). HUCs range from two to eight digits as they progress through four levels of specificity from regions to sub-regions to accounting units and finally to cataloging units (USGS, 2011), which are the eight digit HUCs that North Carolina’s river basins will be based on going forward. North Carolina’s river basins include the Broad, Cape Fear, Catawba, Chowan, French Broad, Hiwassee, Little Tennessee, Lumber, Neuse, New, Pasquotank, Roanoke, Savannah, Tar Pamlico, Watauga, White Oak, and Yadkin-Pee Dee. North Carolina’s river basins are depicted below:
Of the 17 total river basins in the state, eight (Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar Pamlico, and White Oak) pass through the state’s coastal plain as they drain into North Carolina’s estuaries and the Atlantic Ocean. Additionally, four (Cape Fear, Neuse, Tar Pamlico, and White Oak) of North Carolina’s coastal river basins are contained entirely within the state’s boundaries. Among the coastal river basins the most recently updated plans are for the Lumber and Tar Pamlico in 2010, and the Neuse in 2009. The plans are updated on a five year rotation and all river basins are now on their fourth cycle, although not all of the fourth generation plans have been completed (DWQ, nd).

The DWQ sets out the following goals and objectives for the basinwide water quality planning system:

**Goals:**

- Identify water quality problems and restore full use to impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

**Objectives:**

- Collaborate with other agencies to develop appropriate management strategies.
Assure equitable distribution of waste assimilative capacity.

- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

As described by DWQ the river basin plans are designed to tackle a variety of water quality and other environmental issues in each basin. Specifically the plans identify water quality stressors and target their sources. The Supplemental Guide to North Carolina’s Basinwide Planning (2008) from DWQ suggests that many stressors are closely tied to the human actions and land use in the basin with construction, stormwater outfalls, agriculture, and impervious surfaces identified as some of the most common culprits. DWQ reports that:

The plans include information on water quality improvements and problems, management strategies, activities accomplished by other federal, state and local governments, research, local watershed activities and DWQ’s permitting, monitoring, nonpoint assessment, planning and other activities (DWQ, nd a).

The plans go a long way towards bringing many of the leading coastal environmental concerns into consideration in one place, especially in regards to water quality and water resources generally.

The Ecologies of River Basin Planning in Coastal North Carolina

A discussion of the application of land use planning tools at a river basin scale in North Carolina will benefit from an examination of the structural ecologies of both spheres of management. Briefly investigating the ecology of both river basin and land use planning in North Carolina will also provide a more complete understanding of the existing methods and current conditions under which environmental management occurs in coastal North Carolina. The structural ecologies of any environmental policy or management issue can be mapped out in three segments; the bio-physical, human, and institutional ecologies.
The bio-physical ecology of a policy issue delineates the bio-physical boundaries within which the issue is considered. River basin planning in North Carolina as a whole has a bio-physical ecology which encompasses the entire state partitioned into the 17 individual river basins. For the purposes of this project, however, we can narrow the boundaries to the eight coastal river basins previously discussed in order to align the ecology with our focus on North Carolina’s coastal zone.

Human ecology is generally defined as the human constituents that comprise the population within the bio-physical boundaries or otherwise interact with or effect the environment therein. For river basin management in coastal North Carolina this includes the residents of the eight coastal river basins along with the visitors to the region who utilize its natural resources, particularly of the aquatic variety. The tourist industry is an economic leader in coastal North Carolina with visitors flocking to the state’s beaches every summer, nearly all of whom are concerned with the water quality and recreational availability. The fishing industry is no longer as big as it once was in coastal North Carolina but it still provides jobs and is of cultural significance to the area’s population and is largely dependent on water quality issues as well. Advocacy groups concerned with water resources fall into the human ecology category for river basin planning as well. These include many of the same groups that are active members of the human ecology of land use planning in coastal North Carolina, as discussed in the section on the human ecology of land use planning, along with many other smaller watershed based organizations.

While the human and bio-physical ecologies provide context and framing for environmental policy issues, it is the institutional ecology that gets to the crux of the matter. The institutional ecology can be defined as the institutions that govern or regulate the behavior of the constituents within the bio-physical boundaries of the system and issue being examined. In the case of river basin planning in coastal North Carolina this primarily means the NCDENR DWQ which is tasked with creating the plans, overseeing the process, and enacting and enforcing the rules created by the Environmental
Management Commission (EMC). The EMC is a 19 member rules making commission located within NCDENR which is tasked with protecting, preserving, and enhancing North Carolina’s water and air resources. Specifically, DWQ maintains a River basin Planning Unit which manages these responsibilities while coordinating with other DWQ sections with specific responsibilities for various water quality and pollution regulations as well as other state agencies, the relevant local governments, and federal agencies. There are 37 counties in the coastal plain in North Carolina spread across the eight river basins and each of those counties have a number of city and town governments as well, all of which are part of the river basin planning process. On the other end of the governmental spectrum the EPA is the relevant federal agency with oversight responsibilities for water quality and resource protection at a national scale as mandate by the CWA. This mix of governments across political boundaries and scales all of which still play a role in river basin planning in coastal North Carolina makes for a confused institutional ecology at best. One that might benefit from tools designed to generate greater cooperation and more fluid integration among the various pieces comprising the institutional ecology.

While river basin planning in North Carolina espouses many of the strictures of ecosystem based management it falls short in its application of several of the main tenants thereof. Specifically and most crucially river basin plans in North Carolina discuss the importance of interagency and intergovernmental cooperation and the role of integration across issues and disciples to the success of the plan and its goals, but the plans fall short in their implementation of the necessary integration and cooperation. Acknowledging the need for cooperation and integration is nevertheless an important achievement and the North Carolina DWQ and DENR are well positioned to take the next steps forward in pursuit of more effective and efficient environmental management in the state. These next steps may well involve bringing together river basin and land use planning.

More information on the EMC and its members can be found online at http://portal.ncdenr.org/web/emc
Land Use Planning in Coastal NC

North Carolina passed the Coastal Area Management Act (CAMA) in 1974 and had its Coastal Management Program (NCCMP) approved by the National Oceanographic and Atmospheric Administration (NOAA), under the CZMA guidelines in 1978. The creation of CAMA was spurred by the CZMA incentives as well as growing local concern with the threats from increasing development to North Carolina’s coastal resources (Norton, 2005a). CAMA’s purpose has been most succinctly summarized as:

...the public’s opportunity to enjoy the physical, esthetic, cultural, and recreational qualities of the natural shorelines of the State shall be preserved to the greatest extent feasible; water resources shall be managed in order to preserve and enhance water quality and to provide optimum utilization of water resources; land resources shall be managed in order to guide growth and development and to minimize damage to the natural environment; and private property rights shall be preserved... (LUPRT, 2000)

Both CAMA and the CZMA reflect an inherent contradiction in terms by deeming that coastal natural resources should be protected as well as utilized and developed. CAMA established several state agencies to pursue the goals of the legislation including the Coastal Resources Committee and the Division of Coastal Management which will be discussed in greater detail later. CAMA also designated the 20 counties that contain estuarine and ocean shorefronts as North Carolina’s coastal zone as per the direction of the CZMA that each state should set the landward extent of its coastal zone. These 20 counties are pictured here:
While CAMA clearly has fairly wide ranging goals, land use planning is a central tenant of the program. CAMA’s land use planning takes a hybrid approach with the state retaining direct regulatory authority for land use in designated areas of environmental concern (AECs) while mandating that the coastal counties institute local land use plans that adhere to state established guidelines and are subject to approval (Norton, 2005a).
The Ecologies of Land Use Planning in Coastal North Carolina

Having already explored the bio-physical, human, and institutional ecologies that comprise river basin planning in coastal North Carolina it will also be instructive to do so for land use planning. Once the ecologies of these existing environmental management programs have been detailed it will be possible to compare the programs and their ecologies fully and investigate the potential for combining them in the search for more efficient and effective coastal environmental management in North Carolina.

In the case of land use planning in coastal North Carolina the bio-physical ecology and its boundaries currently encompasses the 20 coastal counties that make up North Carolina’s coastal zone as defined by CAMA. An argument can reasonably be made that it would be more appropriate to consider coastal land use planning via a different and more holistic bio-physical boundary. At this point in time, however, for the current state of coastal land use planning in North Carolina the sphere of reference is clearly the 20 CAMA counties.

The human ecology of coastal land use planning in North Carolina consists of the residents of the 20 CAMA counties along with everyone who visits the region and uses the land and environment within the bio-physical ecology. These constituents both effect the natural environment through their use of land in coastal North Carolina and will in turn be affected by land use planning policies and regulations. Additionally, advocacy groups that seek to affect the issue in question fall into the constituent category. For coastal land use in North Carolina this includes a variety of organizations concerned with the environmental health and stability of coastal ecosystems and interested in employing land use planning management techniques in search of greater protection and support of the ecosystems found in coastal North Carolina. These organizations include the North Carolina Coastal Federation, North Carolina Coastal Land Trust, Neuse RiverKeeper Foundation, Cape Fear River Watch, Pamlico-Tar River Foundation, White Oak-New RiverKeeper Alliance, and North Carolina Conservation
Network among others. All of these organizations are committed to preserving coastal environments and resources and seek to do so in part through more effective land use planning.

There are a number of different federal and state agencies and local governmental roles played in the institutional ecology of land use planning in North Carolina’s coastal zone. The CZMA and CAMA give rise to the legal mandates supporting land use planning in coastal North Carolina and they also established the agencies that create the specific policies and regulations indicated in the acts and the ones that carry out the directives of the planning bodies. CAMA was created under the guidelines laid out in the CZMA and the NCCMP had to be approved and remains subject to periodic review by NOAA as directed in the CZMA. In North Carolina CAMA created the Coastal Resources Commission (CRC) to oversee the management and implementation of the program. CAMA also created the Division of Coastal Management (DCM) which was designated to serve as staff to the CRC and carry out the implementation of CAMA while providing support to local coastal governments in their planning efforts. Land use planning is the central component to the work done by the CRC and DCM under CAMA guidelines although there are other components of the act which the CRC and DCM also carry out (McPherson, 2009). CAMA further requires that all of the designated coastal counties create and implement local land use plans, subject to approval by the CRC (DCM, 2008a).

The CRC has 15 members all of whom are appointed by the Governor. Three of the CRC members are “at-large” while the remaining 12 must have expertise in a field relevant to coastal management issues. The DCM website describes the responsibilities of the CRC as follows:

The CRC establishes policies for the NCCMP and adopts implementing rules for both CAMA and NC Dredge and Fill Act. The commission designates areas of environmental concern, adopts rules and policies for coastal development within those areas, and certifies local land use plans. (DCM, 2007)

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4 More information on these organizations and their work can be found on their websites which are listed at the end of the cited references section of this paper.
5 A list of the current CRC members and their areas of expertise can be found online at http://dcm2.enr.state.nc.us/CRC/members.htm
The CRC also receives advice from the Coastal Resources Advisory Council, a 45 member body that supplies the CRC with local community and local government perspectives and technical insight and advice. The CRC formulates the policies and regulations but does not perform the day to day tasks of oversight and implementation, that task is assigned by CAMA to DCM.

DCM is housed within the NCDENR and serves as staff to the CRC. DCM has responsibilities pertaining to the other aspects of CAMA as well, including public beach access and the operation of North Carolina’s Coastal Reserve System. When it comes to land use planning in short the DCM is responsible for implementing the policies and rules established by the CRC. Among other assignments, DCM handles permitting and enforcement for the CRC established Areas of Environmental Concern. DCM also assists local governments in the formation of land use plans and also examines the final plans submitted for approval to ensure that they meet the guidelines and fulfill the requirements established by the CRC.

County and other local governments are responsible for creating land use plans that comply with the policies laid out by the CRC. County governments can choose to forgo a plan in which case DCM will create one for them. Other local governments including cities, towns, and other municipalities may create their own land use plans as long as they also meet the planning requirements. The local governments are afforded a great deal of responsibility and latitude in the creation of their plans. The CRC guidelines provide a format for the plans and require that a set of issues be considered during the planning process. The actual polices laid out in the plan are up to the local governments.

The CRC, DCM, and county and other local governments are the primary players in the institutional ecology of coastal land use planning in North Carolina. They are involved in the

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6 A list of the current CRAC members and their areas of expertise can be found online at http://dcm2.enr.state.nc.us/CRC/cracmembers.htm
formulation, implementation, and enforcement of land use plans and effect and govern the behavior of the human ecological system in coastal North Carolina through these plans.

**Land Use Suitability Analysis in CAMA Land Use Plans**

All CAMA approved land use plans must include a land use suitability analysis. Currently DCM provides guidance and some more general data to aid in the execution of the suitability analysis. Under the pertinent legislation (CAMA Land Use Planning 15A NCAC 7B .0702 (c)(5)) the land suitability analyses are required to consider:

(A) Water quality;

(B) Land classes I, II, and III summary environmental analysis

(C) Proximity to existing developed areas and compatibility with existing land uses;

(D) Potential impact of development on areas and sites designated by local historic commissions or the North Carolina Department of Cultural Resources as historic, culturally significant, or scenic;

(E) Land use and development requirements of local development regulations, CAMA use standards and other applicable state regulations, and applicable federal regulations; and

(F) Availability of community facilities, including water, sewer, stormwater, and transportation. (DCM, 2005)

To cover those requirements DCM provides data on 22 different factors which must be considered, they are listed below, note that the first four factors are treated somewhat differently as they are considered as binary factors as either suitable or not suitable for development with no middle ground.

- Coastal Wetlands
- Exceptional and Substantial Noncoastal Wetlands
- Estuarine Waters
- Protected Lands
- Beneficial Noncoastal Wetlands
- Storm Surge Areas
- Soils with septic limitations
- Flood Zones
Water Supply Watersheds
Significant Natural Heritage Areas (proximity to)
Hazardous Substance Disposal Sites (proximity to)
NPDES Sites (proximity to)
Wastewater Treatment Plants (proximity to)
Municipal Sewer Discharge Points (proximity to)
Airports (proximity to)
Developed Land (proximity to)
Primary Roads (proximity to)
Water Pipes (proximity to)
Sewer Pipes (proximity to)

(DCM, 2005)

These factors have been selected by the CRC for inclusion and are detailed in the Land Use Suitability Guide produced by DCM and available on CD by county for local planners use\(^7\). The Guide and provided data include instructions on the use of ArcGIS software for the creation of the final product of the suitability analysis, a land use suitability map with suitability scores for the area. The land use suitability map must then be used to help guide future development plans under the land use plan itself.

The local plans, at both the county and municipal levels, may include more factors and be supplemented by more specific and detailed local data. Local planners and governments are also free to determine the relative weights that they apply to most of the factors included in the suitability analysis. The exceptions are for the first four factors in the above list which, as mentioned, determine an area as either suitable or not suitable for development. With so much flexibility built into the suitability analysis each plan tends to have a slightly different list of factors and weights and produces a map which often does not align well with neighboring or overlapping plans. This is a problem that plagues land use planning in coastal North Carolina generally, not just in the specific sense of suitability analysis.

\(^7\) The Land Use Suitability Guide is available at http://dcm2.enr.state.nc.us/Planning/user_guide_lsa2005.pdf
With the local land use plans that cover 97% of the bio-physical ecology of coastal North Carolina primarily concerned with localized issues, the region has become covered with a patchwork of land use plans that tend to lack consistency from one plan to the next. With all 20 coastal counties and at least 72 other local governments operating under their own land use plans there are more than 90 plans governing the land use behavior of humans in coastal North Carolina (DCM, 2008a). The patchwork land use planning currently in place however is based on a structure that could easily be adapted. The pieces are in place for North Carolina to quickly improve its coastal management and land use planning through enhanced integration and the extension of focus to include a more complete and holistic notion of the coastal zone in the planning process.

**North Carolina Coastal Land Use Planning in Practice**

The most direct governance of human behavior performed by the CRC and DCM under the auspices of land use planning concerns Areas of Environmental Concern (AECs). The CRC designates AECs in four categories: The Estuarine and Ocean System, The Ocean Hazard System, Public Water Supplies, Natural and Cultural Resource Areas. Development within an AEC requires a special CAMA permit and must follow the specific development rules for the given AEC8 (DCM, 2007b; DCM, 2008c). According to the DCM AECs are areas of ‘natural importance’ that ‘may be easily destroyed by erosion or flooding; or it may have environmental, social, economic, or aesthetic values that make it valuable.’ While AECs cover nearly all of the water resources in North Carolina’s coastal zone, only 3% of the land area in the coastal counties is in an AEC (DCM, 2008b). This leaves the coastal counties’ land use plans to guide development across 97% of the land area in North Carolina’s coastal zone. While the CRC must approve the plan, the policies imbued therein are designated at the county level and most often reflect local priorities and tend to favor economic development to the detriment of natural resource protection (Norton, 2005b). The fact that nearly all of the land area in the coastal zone is subject to non-integrated

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8 More in depth descriptions of AECs and their development rules can be found in the CAMA Handbook for Development in Coastal North Carolina. See references.
locally focused land use plans that fail to consider the impacts of land use on a wider or more holistic scale has led to a number of issues.

**Issues and Reviews of Land Use Planning in Coastal North Carolina**

The patchwork nature of land use planning in North Carolina has drawn critiques in the past. Researchers, NOAA reviewers, the CRC, and others have all called for improvements at one time or another. In 1994, 20 years after CAMA’s enactment, the North Carolina Coastal Futures Committee released a report detailing the ongoing damage to the state’s coastal resources which called for better local planning. The county land use plans were emphasizing local economic development so heavily, while paying only lip service to environmental protection concerns and land use suitability that the CRC eventually refused to approve a county land use plan in 1998. The CRC issued a moratorium on new plans while they convened a Land Use Planning Review Team (LUPRT) which investigated the state of the local land use plans over nearly two year period and made a variety of recommendations for their improvement in order to more fully implement the stated goals and objectives of the CAMA program.

Research led by Norton that examined the state of land use planning in coastal North Carolina also found that local governments were relying entirely on the state for environmental planning and protection measures. Land use plans might have stated a commitment to natural resource conservation, as directed by CAMA and the CRC, but in practice the plans only made such allowances where the state mandated via AEC designations (Norton, 2005b). Norton’s analysis agreed with the earlier findings of the LUPRT which voiced concerns over local involvement and investment in the planning process and in a lack of consistency in planning throughout North Carolina’s coastal zone as well as a general failure of local land use plans to adequately meet the goals espoused by CAMA (LUPRT, 2000).

The LUPRT report’s most important adopted recommendations were for ‘simple, clear requirements for a ‘good’ plan’ and the creation of a ‘how to’ manual to help guide local governments
through the process of creating and implementing land use plans that effectively pursue CAMA’s goals (LUPRT, 2000). These goals were accomplished by 2002 with the release of the DCM Technical Manual for Land Use Planning and the revision of the CRC land use plan guidelines. No major analysis of the type performed by Norton or the LUPRT has been undertaken since the 2002 revisions went into place so it is difficult to say with any certainty what their true impacts have been. The newer planning guidelines are more robust and detailed and should be serving to better accommodate CAMA’s stated goals of balancing natural resource protection with economic development in particular through greater emphasis on land use suitability analyses. CAMA has succeeded in that it has become an embraced and de facto part of daily life in coastal North Carolina and it has promoted land use planning and albeit in a very narrow frame made important protections for particularly vulnerable environmentally areas and resources. This is a limited success at best however. As CAMA has failed to provide comprehensive and holistic planning for North Carolina’s coastal zone as evidenced by the separate and disconnected local land use plans that manage the vast majority of the state’s coastal zone. The areas in which CAMA needs to continue to improve have been highlighted by the series of recent reviews that have already been introduced.

The most recent Evaluation of the NCCMP by NOAA’s Office of Ocean and Coastal Resource Management (OCRM) commends CAMA’s long history and adaptive nature while recommending that periodic assessment reviews be undertaken to ensure that the program remains effective. These periodic reviews should also seek out redundancies and contradictions that may have been created within CAMA so that they can be addressed and the CAMA planning process can remain streamlined and fully functional (OCRM, 2006). The Evaluation also recommends that North Carolina work to improve the management of cumulative and secondary water quality impacts, which relates to an interesting and unfulfilled recommendation of the LUPRT. The LUPRT called for the extension of mandated land use planning to encompass the entirety of all coastal watersheds in an effort to better manage water quality
issues and to more fully address the interconnected environmental concerns in the coastal zone that trace back through the watershed.

Reviewers are in agreement that coastal land use planning in North Carolina can be done better. Plans with greater integration and consistency throughout the bio-physical ecology of the coastal region would provide more robust protection of resources, as well as encourage coordinated and more efficient development planning that will benefit the constituents of the region economically.

**Combining the Ecologies**

The CAMA land use planning process overseen by DCM and the basinwide planning process overseen by DWQ in North Carolina are well positioned for greater collaboration and synthesis due in part to their overlapping ecologies. Being able to leverage North Carolina’s existing environmental management infrastructure is a great advantage and is only possible because of the different departments’ shared ecologies. Particularly when examining the coastal zone, the bio-physical, human, and institutional ecologies involved in both land use and river basin planning in North Carolina enjoy many commonalities. These shared and overlapping ecologies create and offer the opportunities to adapt and improve coastal environmental management in North Carolina.

River basin and land use planning in coastal North Carolina are carried out across similar, but not perfectly overlapping, bio-physical ecologies. While there are river basins across the entire state, when the area of concern is restricted to the coastal zone the bio-physical ecologies of land use planning and river basin planning in North Carolina cover the same area. They divide this area differently however, with land use planning relying on political boundaries for subdivisions while river basin planning follows the naturally occurring river basin boundaries. These differing sub-boundaries are overlapping though and should not prove an obstacle to collaboration, particularly not when the right tools are employed in order to take advantage of their similarities.
The institutional ecologies are similar as well. Both land use and basinwide planning derive their authority from the state government via legislation and each takes its rules from a legislatively established committee. Further, federal legislation helps to drive both sets of institutional ecology. The committees have different, but compatible, missions and responsibilities. The EMC in directing basinwide planning and DWQ in carrying it out are primarily concerned with water quality, while the CRC and DCM are specifically tasked with governing land use. Since water quality is highly dependent on the land use of surrounding areas however these missions are highly related and often interconnected both land use and water planners often acknowledge the impacts that their decisions can have each realm. The committees and divisions are also all located within the NCDENR offices adding more strength to their connections with ultimate state oversight and financial responsibility tracking back to the same agency.

The human ecologies involved are the same. Both river basin and land use planning effect the population of the coastal zone as well as those people who travel there for recreation, employment, and other reasons. Land use and water quality are both important to the local constituents and are in turn determined in large part by their actions. Again advocacy groups make up a part of the human or constituent ecologies and again most of the advocacy groups active in coastal North Carolina that are concerned with land use are also concerned with water quality. Many of them are in fact interested in land use within river basins and watersheds.

These overlapping ecologies are part of the reason that North Carolina is so well positioned to take a step towards more effective and efficient coastal environmental management by integrating land use and river basin planning through the use of land use suitability analysis procedures. In areas where these two planning spheres are not already built on related ecological bases bringing them together would be a difficult task at best. Success in any new environmental management operation depends in
part on the ease with which it can be instituted. Building upon existing structures, especially ones with overlapping ecologies is an excellent way to smooth and aid the process.

Proposal and Conclusions
Given the existing management structures in North Carolina a land use suitability analysis component could easily be configured to bring together the River basin planning and CAMA programs and create a more fully integrated and effective coastal management scheme for the state. The necessary changes to existing programs, legislation, and regulation would be fairly minimal and can reasonably be expected to be enacted without much difficulty. Nearly all of these changes can be made by the EMC and CRC under their existing mandates as rules changes which greater streamline the potential process. These changes should be simple enough as to not create overly burdensome new responsibilities for the involved state agencies and local governments. In the simplest and most straightforward terms the application of an integrated land suitability analysis process at a river basin planning level that can then be used to guide local land use plans in the coastal zone will allow North Carolina to take a step forward in the integration and effectiveness of the state’s coastal management system.

Rules Changes
The EMC would instruct DWQ’s river basin planners to include land use suitability analysis in all future basinwide plans for the four river basins entirely contained within North Carolina. Some of the current basinwide plans already discuss the importance of existing land use plans under the CAMA requirements and the planners at DWQ and DCM are already familiar with land use suitability analysis due to its inclusion in CAMA land use plans. The general structure of the analysis could be imported from the current CAMA Guide and be based upon largely the same data and consider similar factors. Doing so would limit the immediate availability of data for land use suitability analyses as DCM currently compiles the data for the selected factors only for the 20 CAMA counties. Most of the data is however
available even if it is not already conveniently located in the same place. The exception is that noncoastal wetlands classification as used in the current CAMA suitability analyses has only been performed by DCM for the 37 coastal plain counties. Since this project is concerned with coastal management being able to perform land use suitability analyses on a basinwide framework for the land that also falls within the 37 coastal plain counties in North Carolina would still be a significant accomplishment. The specifics of the final design of the analysis would be decided by DCM planners who work on CAMA plans along with the DWQ planners who work on the basinwide plans. Along with other planners and representatives of agencies and divisions responsible for many of today’s pressing coastal environmental issues most all of which are housed within DENR in North Carolina. The analysis process will result in the creation of a land suitability guide map similar to the one currently required for CAMA land use plans.

The CRC would then issue a rule that all county and local CAMA land use plans are to use the basinwide land use suitability analysis results for guidance in their construction. This represents only a slight change in the current CAMA land use plan requirements. Instead of being given the data and instructions on performing a local land use suitability analysis local planners will be given the end product of the suitability analysis.

**Obstacles**

The primary potential obstacle would be from county and local governments worried about losing control of the land use planning process. While there is a modicum of legitimate concern here it is obviated by the benefits provided by the changes. As the state takes responsibility for the land use suitability analysis it will make less work for local planners. If county and local governments are worried about being left out of the process, or fear that their concerns will not be taken into consideration, or that they have access to important local knowledge and information crucial to the suitability analysis process then their input can be included in the initial basinwide suitability analysis.
Since North Carolina state law limits the CRC to determining if CAMA land use plans have remained consistent with the CRC guidelines for land use plans they cannot directly mandate that the basinwide land suitability analysis be employed in overlapping CAMA land use plans. The CAMA land use plan guidelines could however, instruct the local planners to consider land suitability across the river basin in an ecosystem wide format as presented in the basinwide land use suitability maps. A more discerning legal analysis will be required to determine the exact wording of the new CAMA land use planning guidelines to include the basinwide land use suitability maps.

Including the basinwide land suitability analysis for guidance though, may prove at least partially effective in improving coastal land use planning. Even if they are only employed as a guide or starting point at least the information will have been presented to the local planners in an ecosystem management based format at a basinwide scale. With luck, the provided suitability maps may be directly incorporated into local plans. Providing already completed land use suitability maps for the river basin to the local planners will eliminate the burden of performing the analysis locally, which may prove a great enough incentive for the direct use of the basinwide land suitability maps.

**Implementation**

The changes can be rolled out incrementally as new plans are developed and existing plans work through their update rotations and are revamped. Making the changes gradually on the existing schedule for basinwide and CAMA plans is another way to help the transition proceed smoothly. Immediate extra work will not be required of planners and managers who are already extremely busy.

As each of the four river basins which lie entirely within North Carolina run through their planning cycles the land use suitability analysis will be added to the planning process and a land use suitability map will become part of the plan. Once the basinwide suitability analysis has been completed and the suitability map incorporated into the basinwide plan, CAMA land use plans that fall within the basin will utilize the suitability maps as the land use plans move through their update rotation.
Among the basins, the White Oak enjoys the greatest potential to benefit from the proposal and to make the necessary changes smoothly. Timing, size, and location all play a part in deciding where to start making the changes and moving coastal environmental management in North Carolina forward.

**Moving Forward in the White Oak Basin**

With a draft plan currently under way and due for public review in November 2011 the time is ripe for the White Oak basinwide plan to adopt a land suitability analysis requirement similar to that of CAMA land use plans. The other three basins entirely in North Carolina are not scheduled for plan updates for several years as they have just recently completed the last cycle – Neuse, 2012; Tar-Pamlico, 2016; Cape Fear, 2016.

In addition to the timing of the basinwide plan preparations, the White Oak basin’s size and location also make it an excellent choice for testing the proposed changes. With parts of six counties and just under two dozen municipalities in the basin the White Oak is a small basin politically. This smaller size carries over from the institutional ecology into the human and bio-physical categories as well, with a smaller physical watershed and land area and a smaller population than most of the other river basins in the state. While it is the smallest coastal river basin both politically and geographically it still has 23 different CAMA land use plans in use by different counties and municipalities in the basin. Being small does not mean that the White Oak basin has escaped the fragmentation and narrow focus that plagues land use planning in coastal North Carolina. The counties and municipalities that lie within the White Oak basin appear in the following map along with the new HUC based boundary for the White Oak basin that is used for DWQ’s basinwide planning program. Jones County appears on the map since it is within the White Oak basin but it should be noted that it is not one of the CAMA counties and therefore does not have a CAMA land use plan.
As the only one of the four basins which lies entirely within the coastal plain the White Oak will see the most complete use of a land suitability map for the basin in CAMA land use plans which are already required for the entire basin. As described in the 2007 basinwide plan for the White Oak many of the coastal communities in the basin are continuing to experience population growth and land use change (DWQ, 2007). As the basin undergoes more development the importance of land use plans will only increase. With much of the development pressure focused close to water along the basin’s streams, rivers, sounds, and ocean coastlines it will become increasingly important to recognize the connected impacts of development throughout the basin and to develop plans that consider land use in the basin holistically.
The White Oak basin plan also includes a chapter on the importance of land use planning to achieving water quality protection goals. More so than any of the other river basin plans the White Oak is already poised to incorporate land use planning as a tool for broader environmental management. Further, the previous iteration of the White Oak basin plan (DWQ, 2007) discusses the need to generate Land use plans that fulfill their potential for water quality protection through proactive planning. Specifically the plan finds that current CAMA land use plans fail to protect water quality through adequate planning for future growth and recommends that the compounded effects of development be considered at a watershed scale.

It is therefore not a stretch to incorporate a land use suitability analysis in the White Oak basinwide plan moving forward. The plan currently acknowledges land use planning and discusses its importance and the need for land use planning to become more proactive in terms of future land use and more integrated throughout watersheds across political boundaries. Including land use suitability analysis is a logical step in the progression and development of the White Oak river basin plan.

Beyond the White Oak Basin

A successful implementation in the White Oak basin of land use suitability analysis to extend land use planning to a river basin scale and create a more fully integrated system of coastal environmental management in the basin will serve to pave the way for the program’s expansion. First to the other coastal river basins that lie entirely within North Carolina and then to the other basins that stretch through the state’s coastal plain. While there is not a land use planning structure in place beyond the 20 coastal CAMA counties in North Carolina the land use suitability analysis may still prove useful as a piece of the basinwide planning process throughout the state. A land suitability analysis can help planners, environmental advocates, and developers alike to make decisions as to the location of projects and the conservation of certain areas as they work throughout the state. The land suitability analysis could also serve to pave the way for the eventual expansion of land use planning beyond the 20
CAMA counties. If the program were to prove successful in North Carolina it could be expanded to other states looking to improve the effectiveness and efficiency of their coastal management programs as well. Regardless of its future applications beyond North Carolina’s coastal zone, integrated land use suitability analysis at a river basin scale will help to improve the state’s coastal management program.

**Benefits**

There are a number of immediate benefits created by the employment of a land use suitability analysis at a river basin level in order to more fully integrate coastal management in North Carolina. In addition to increasing integration, and moving towards a more inclusive and holistic system of environmental management, the changes are also simple to make.

The simplicity of the proposed changes, while not explicitly a benefit, is a strong part of the argument in favor of moving forward with the use of land use suitability analysis at a river basin scale. These changes do not necessitate the creation of any entirely new projects, plans, or tools. Instead they take an existing one and apply it in a slightly different and expanded role which makes for a much easier transition and keeps the amount of work and expenditures to enact the changes to a minimum. None of the planners and managers working on environmental issues in coastal North Carolina will need to learn new skill sets or have to figure out how to navigate a new level of bureaucracy. This fact alone makes a huge difference in the feasibility of actually making these changes and achieving success in improving coastal management in North Carolina. By shifting just one component of the CAMA plan requirements, the move keeps most of the responsibility for land use planning with the local community. This will serve to ease the transition and aid in gently moving towards a more meaningful and effective biophysical ecology for environmental management and land use planning in coastal North Carolina. There are several more direct benefits that the adoption of these changes may bring about.

In moving the land use suitability analysis to a bio-physical river basin boundary land use planning in coastal North Carolina will begin to take a more holistic approach and move away from the
existing fragmented nature of planning based on purely political boundaries. This move will allow land use planning in coastal North Carolina to take advantage of the integrative and holistic properties inherent in its structure and laid out via ecosystem-based management as applied in the basinwide planning process. By taking advantage of existing management structures North Carolina can continue to build upon its solid base of coastal environmental planning while adopting techniques that will allow for greater effectiveness and efficiency in the process.

Another advantage is present in combining and adapting pre-existing management schemes in that it brings together the planners and managers already working on coastal environmental issues and creates an opportunity for them to collaborate in forming a template for guiding future human development in the coastal zone. Both river basin and land use planning will benefit greatly from this increased collaboration which will allow managers and planners to share knowledge and data while reducing redundancies and contradictions in their respective plans. With greater cohesion comes greater efficiency which is good for both environmental protection and economic development.

The integrative, collaborative, and holistic approach to land suitability analysis will also allow a setting in which other constituents can easily contribute and be heard as well. Stake holder participation and buy in is after all part of the EPA’s definition of watershed approach to management and part of what makes environmental planning successful. Additionally residents, developers, conservationists and other advocates will gain a valuable tool in the basinwide land suitability analysis maps that result.

The benefits of these changes clearly outweigh the potential negatives and the use of existing management structures and personal keeps the cost low which should make the feasibility of the proposal that much greater. Employing a land use suitability analysis as part of the river basin plans and integrating that same analysis with CAMA land use plans is also an important step in the direction of addressing the concerns about North Carolina’s coastal management program raised by Norton (2005a,
2005b), the LUPRT report (2000), the 2006 NOAA review (OCRM, 2006), and the Nicholas Institute’s report on the future of water (2007). All of which called for greater cooperation and coordination between local Land use plans and a utilization of a watershed approach. By using the basinwide land suitability map for guidance in the creation of local land use plans the local plans will see a greater level of cohesion and coordination with the neighboring plans. Additionally the use of a basinwide land suitability analysis map in the construction of CAMA land use plans will move the local land use plans towards a more complete consideration of the impacts of development on water quality and natural resources.

Employing integrated land use suitability analysis at the river basin scale in coastal North Carolina will serve to bring together the two central environmental management systems in effect in the state’s coastal zone. In doing so, coastal environmental management in North Carolina will enjoy greater efficiency and effectiveness and take full advantage of the potential for holistic and integrated management inherent in land use planning systems. With a little work we can improve North Carolina’s coastal management systems and ensure of both human and environmental sustainability and success.
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**Constituent Advocacy Organizations**


Neuse RiverKeeper Foundation - [http://www.neuseriver.org/](http://www.neuseriver.org/)

Cape Fear River Watch - [http://www.cfrw.us/](http://www.cfrw.us/)
