ABSTRACT

INCLUSION OF KNOWLEDGE COMMUNITIES IN PLANNING PROCESSES: AN ANALYSIS OF GREEN INFRASTRUCTURE PLANNING IN MARYLAND, USA.

by

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Throughout the United States many natural areas are facing tremendous threats due to increases in population and haphazard development patterns. Recently, green infrastructure planning initiatives have emerged, providing a proactive approach to conservation planning. One area under particular stress is the Chesapeake Bay region of Maryland. Several counties within Maryland have created countywide green infrastructure plans that are based upon a larger state initiative. Although there is a guiding framework for developing these plans, little is known about how these plans are being created in practice and how the integration of knowledge held by the various knowledge communities, commonly involved in environmental planning practices, are included in the process. This dissertation fills this gap with an analysis of how knowledge communities are involved throughout the green infrastructure planning process as well as the role of the planner within planning practice. Qualitative methods are used to analyze each process whereby themes are presented based on inductive procedures. The cases are analyzed based on the inclusion of expert and experiential knowledge and each case is analyzed within the broader context of statewide green infrastructure planning. Although there is no "one

size fits all" approach to green infrastructure planning, the research finds that scientific data alone is not sufficient to create adoptable and implementable plans. The study recommends the (1) establishment of a guiding committee comprised of expert and experiential knowledge communities prior to goal setting and linking goals with those within the comprehensive plan; (2) inclusion of knowledge communities early and often in the process to foster support and establish measurable and attainable goals; (3) utilization of principles of landscape ecology and conservation biology to guide network identification while using the feedback gathered from experiential knowledge communities to lead to better integration of knowledge and more informed decision-making; (4) collaboration with agencies and neighboring jurisdictions to increase discourse and ensure the appropriate knowledge communities, possessing relevant data, are included in the process. Ultimately, the planner functions as the catalyst for this process and shapes how the knowledge held by these essential experiential knowledge communities is integrated within the planning process.

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By

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This dissertation is dedicated to my friend and companion Kai Madigan.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF CHARTS

LIST OF ABBREVIATIONS

CBNERR-MD	Chesapeake Bay National Estuarine Research Reserve in Maryland
COC	Citizens Oversight Committee
CREP	Conservation Reserve Enhancement Program
CZMA	Coastal Zone Management Act
ECOS	Environmental Council of States
GDP	General Development Plan
GI	Green Infrastructure
GIA	Maryland Green Infrastructure Assessment
GIS	Geographic Information Systems
LPPRP	Land Preservation Parks and Recreation Plan
MALPF	Maryland Agricultural Land Preservation Foundation
MD-DNR	Maryland Department of Natural Resources
MET	The Maryland Environmental Trust
NGO	Nongovernmental Organization
NOAA	National Ocean and Atmospheric Association
OCRM	Office of Ocean and Coastal Resource Management
POS	Program Open Space
RLP	Rural Legacy Program
SAV	Submerged Aquatic Vegetation
TCF	The Conservation Fund
TDR	Transfer of Development Rights
USEPA	United States Environmental Protection Agency

CHAPTER 1 - INTRODUCTION

The purpose of this research is to explore the role of knowledge within a specific type of conservation planning known as green infrastructure planning. The premise is that a better understanding of how this process occurs will allow future planning efforts to be initiated from a more informed perspective and create more implementable plans. The knowledge generated from this inquiry will inform planners and provide guidance for similar county-level initiatives.

This dissertation relies upon a comparative case study approach, using qualitative methods to elicit rich insight into existing planning efforts' planning processes. Additionally, this study aims to better understand the role of the planner as well as how collaboration has been utilized throughout the planning process. This research focuses on an inductive approach to establishing conclusions. In addition to an extensive analysis of state, county, and plan-specific documents, data were also gathered through in-depth semi-structured interviews with county planning staff as well as key informants at the state level. Cases in the study were selected as counties within the State of Maryland, possessing a green infrastructure plan, which fell within the state's designated coastal zone.

This chapter begins with an overview of the context and background used to frame this study. Following this is the problem statement, the statement of purpose, and accompanying research questions. Also included in this chapter is discussion around research approach, researcher's perspectives, and researcher's assumptions. The chapter concludes with a discussion of the rationale and significance of the study and definitions of key terminology used throughout the study.

Background and Context

As cities continue to grow, societies are increasingly faced with the dilemma of meeting the needs of current populations while protecting the integrity of the natural ecosystems that support present and future generations. Coastal areas are specifically challenged by the pressures of intense economic growth coupled with the required protection of fragile natural ecosystems. Conservation efforts have emerged throughout the United States that are aimed at preserving, protecting and restoring valuable natural areas, which are commonly referred to as green infrastructure. One area that is under particular stress is the Chesapeake Bay region. The Chesapeake Bay is facing numerous threats that jeopardize the sustainability and functionality of this valuable resource, caused by anthropogenic land-use changes. Although the Bay and its watershed encompass several states including New York, Pennsylvania, West Virginia, Virginia, and Delaware, the majority of the coastline of the Bay lies within the State of Maryland, which has recognized the need to preserve the Bay and restore areas where degradation has occurred. As a comprehensive strategy, a green infrastructure planning approach has taken root and is being implemented throughout the state, as well as within individual counties, in an effort to protect this valuable resource.

The Chesapeake Bay Watershed possesses deep ecological, economic and societal values. The State of Maryland has worked to protect the integrity of the watershed, bay, and other natural resources present throughout the state. In addition to various state initiatives working to conserve natural heritage, Maryland was one of the first states to conduct an assessment that identified lands critical to its long-term ecological health (Maryland Department of Natural Resources 2003). These lands are referred to as the state's green infrastructure. Green infrastructure is comprised of a natural interconnected network that supports a diverse array of

native species, maintains ecosystem functionality, and provides a healthy quality of life for humans (Benedict and McMahon 2006). In 2003, the Maryland Department of Natural Resources (MD DNR) conducted a statewide inventory of natural assets known as the Maryland Green Infrastructure Assessment (GIA), which identified remaining key ecosystems and areas for potential restoration. This assessment is intended to guide land management practices throughout the state (Maryland Department of Natural Resources 2003d). Counties throughout Maryland have gone beyond the GIA and have conducted their own analyses of the significant natural lands present within their county. These analyses have resulted in various plans, levels of adoption, and implementation strategies that have been employed by individual counties.

Green infrastructure is "our world's natural life-support system – an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks, and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for communities and people" (Benedict and McMahon 2006, 2). Green infrastructure planning is a collaborative effort that involves numerous stakeholders each possessing various forms of knowledge that may be used throughout the planning process (Green Infrastructure Work Group 2009). Since the inception of the Green Infrastructure Assessment, the counties have created individual green infrastructure plans using similar design methodologies while focusing on a finer scale than the statewide green infrastructure assessment.

The green infrastructure planning process includes four main steps including goal setting, analysis, synthesis, and implementation (McDonald et al. 2005). The identification of a green infrastructure network is grounded in scientific theory and is based on principles of landscape

ecology and conservation biology (Maryland Department of Natural Resources 2003d). In addition to the scientific component of the process, an emphasis on collaborative planning techniques is applied throughout the planning process (Green Infrastructure Work Group 2009; Youngquist 2009, 118). Within collaborative planning, various stakeholders are brought together representing different interests in an attempt to build consensus rather than majority rule (Healey 1997; Innes and Booher 1999). Communication plays a central role in collaboration and has come to represent the communicative turn of planning practice. The practices and institutions of a community are reflected in the information or knowledge that influences planning and actions (Innes and Booher 1999). As suggested in Friedmann (1987), planning is a professional practice by which knowledge is transformed into action in the public domain. As we begin to understand how knowledge and information are employed within the planning arena we can critically explore the process of planning which analyzes the incorporation of various stakeholder inputs.

Analysis of green infrastructure planning is in its infancy, with little scholarly research conducted to assess existing efforts and investigate the process under which this planning occurs. Although green infrastructure plans have been adopted and in some cases even implemented, there is a lack of consistency in adoption and implementation among various plans. Previous efforts by the planning community have evaluated the quality of plans created but have not examined the relationship between planning processes and success in attaining plan goals (Youngquist 2009, 118).

To begin to draw a correlation between the two, a better understanding of the role of knowledge from visioning through implementation is crucial. The examination of knowledge communities, which are the clustering or collections of members who support similar knowledge

claims, guides this process. Additionally, by using an existing plan quality evaluation framework and incorporating the component of knowledge communities into evaluation criteria, this analysis will reveal gaps in the process and improve future efforts.

Problem Statement

Current planning activities indicate that an increasing number of states, counties and regional organizations, throughout the United States, are adopting a green infrastructure approach to conservation planning. Although frameworks exist that describe this approach (i.e. (Benedict and McMahon 2006; McDonald et al. 2005) there has yet to be a study that examines the green infrastructure planning process in its entirety and how knowledge is used throughout this particular approach. As previously mentioned, the State of Maryland adopted a green infrastructure planning approach that has become the guiding policy for conservation efforts throughout the state. Additionally, the extent of success achieved by counties varies, and successful implementation is not consistently attained, despite being created based upon an acknowledged design framework. There are plans that are unable to be implemented due to lack of adoption of the plan as county policy. The process has the potential for including the integration of many knowledge communities possessing varying forms of knowledge. Because the implementation of these plans is often carried out by the groups involved in the process, there exists a need to better understand how the integration of various forms of knowledge and knowledge communities can affect green infrastructure planning and why certain planning efforts are experiencing higher levels of success than others. This research will support other counties in Maryland aiming to build upon existing planning efforts and lead to greater implementation of the original statewide assessment. Additionally, this research aims to guide

planning efforts beyond the scope of Maryland, and illustrate how the integration of multiple knowledge communities can lead to more informed decision-making.

Theories of communicative action and collaborative rationality provide the tools necessary to analyze cases in which multiple knowledge communities are involved in planning activities and can provide the basis for which we identify the role of various forms of knowledge and how this can affect plan success. The examination of how knowledge was used in the planning process for five green infrastructure plans allows findings to be drawn about the context under which green infrastructure planning is occurring in Maryland and examine what role knowledge communities play in plan adoption and implementation.

Although existing literature examines the quality of green infrastructure plans, there has been very little scholarship examining the process, acceptance, and adaptation of green infrastructure planning. Through a qualitative assessment of information provided by various knowledge communities, I explore the planning process from primary visioning stages through plan outcomes and implementation. A formal evaluation of green infrastructure plans and the conditions under which they were created illustrates the importance of involving various knowledge communities and the role they play in essential components of a green infrastructure plan. As I explore how plans were created and determined a standard of practice, I compare these findings to what planning theory prescribes as intended outcomes of the planning process. By understanding the role of diverse knowledge communities through collaboration and communicative action, this research explores the potential of future efforts to incorporate an enhanced level of community involvement, increased effectiveness in implementation design, and establish a better understanding of the relationship between planning process and the achievement of plan goals. This research is intended to assist county planners and members of

the green infrastructure community better understand the needs of a green infrastructure plan by providing an analysis of the overall process and the various knowledge communities integral to making plans successful. Additionally, best practices are identified and can ultimately be used to guide planning practice while meeting current and future needs to conserve the integrity of our ecosystems.

Research Questions

To provide a better understanding of the planning process, I examined how five Maryland counties created green infrastructure plans and how they included knowledge communities in planning activities. Based on collaborative exercises whereby a collective interaction among various groups occurs to support decision-making processes, an extension of the green infrastructure planning process would involve the presence of various knowledge communities that assist in facilitating the gathering of information and culmination of knowledge. The process occurs as these knowledge communities integrate information gathered from both technical experts and experiential or lay participants. Part of this integration relies on the planner to actively engage these various knowledge communities while the role of the planner can change throughout the planning process. In addition to examining the green infrastructure planning process, this dissertation examines the role of the planner in engaging various knowledge communities and explores the potential linkage between the integration of knowledge communities and the subsequent adoption and successful implementation of plans. Success for the purpose of this research is defined as plans being adopted either as formal county policy or by reference, and achieved implementation of stated goals or objectives within the plan itself.

The overall research goal is to examine how knowledge is used in the green infrastructure planning process. With that goal in mind, the following research questions have been developed and will be used as the magnifying glass for this study:

(1) How does the green infrastructure planning process translate into practice?

(2) How is knowledge used in a green infrastructure planning process?

(2A) How does integration of multiple knowledges occur?

(2B) How is knowledge linked to action?

(3) How do planners facilitate the integration of knowledge communities?

(4) What can future green infrastructure planning efforts do to improve the process and increase implementation?

Consistent with qualitative methodologies, data were initially collected in the form of documents pertaining to green infrastructure planning for county and statewide initiatives throughout Maryland. Upon approval from the East Carolina University Institutional Review Board, semi-structured interviews were conducted with planning staff and key informants who played a role in the planning process. These roles varied in terms of when they were involved in the process ranging from early stages (i.e. visioning, goal setting) through later stages (i.e. plan monitoring and implementation). This research uses a multi-case study approach using qualitative research methods.

Semi-structured in-depth interviews and document analysis were the methods of data collection. The information obtained from interviews combined with the analysis of relevant documents, formed the foundation for the overall findings presented in this study. Each of the interviews took place at the office of the interviewee, over the phone, or through Skype and lasted approximately two hours. All interviews were recorded and transcribed.

Rationale and Significance

The rationale for this research is based upon seeking a better understanding of the process surrounding a specific type of conservation planning to provide insight for future endeavors. A deeper understanding of how various forms of knowledge are used throughout this process, the role of the planner, how county efforts are integrated into larger-scale state initiatives, and how this type of planning correlates to other types of plans, offers guidance for planners adopting a green infrastructure planning approach.

A better understanding of this process will offer guidance to similar efforts and suggest ways to efficiently and effectively integrate various types of knowledge, improve success of existing and future planning efforts, and assist planners who are utilizing green infrastructure planning. As the benefits of green infrastructure are recognized and an increasing number of counties and states begin to engage in this approach to conservation planning, effective implementation will lead to the continued functioning and support of the many natural ecosystems that humans and the environment depend upon.

Definition of Key Terms

The following section is a definition of terms that will be utilized throughout this study.

Communicative action – concept that describes cooperative action that is undertaken by individuals that is based upon mutual deliberation and argumentation (Habermas 1984)

Collaboration – "the pooling of appreciations and/or tangible resources, by two or more stakeholders to solve a set of problems which neither can solve individually" (Gray 1985, 912).

Epistemology – The theory relating to varying aspects of knowledge such as what exactly are specific types of knowledge, how knowledge is acquired, and how we know what we know (Steup 2008).

Knowledge – The fact or condition of knowing something with familiarity gained through experience or association (Merriam-Webster Online Dictionary 2010d).

Knowledge community – Clustering or collections of members who support similar knowledge claims. There are two overarching categories of knowledge communities that are use for this assessment. Although there have been efforts examining the role of different forms of knowledge there has been little attention paid to evaluating and integrating varying types of knowledge (Khakee, Barbanente, and Borri 2000, 776-788). Green infrastructure planning is based upon the synthesis of technical knowledge, but county efforts are beginning to use a more collaborative approach to planning that integrates various types of knowledge extending from technical expert to experiential or traditional/local knowledge. The first knowledge community that I will use in my assessment is classified as expert knowledge and the second is experiential knowledge. These are also referred to as knowledge groups.

Expert – One with the special skill or knowledge representing mastery of a particular subject (Merriam-Webster Online Dictionary 2010b).

Experiential Knowledge – Knowledge that is gained through experience.

Lay Knowledge – Knowledge that is based upon experiential interaction.

Local Knowledge – "Practical, collective, and strongly rooted in a particular place… organized body of thought based on immediacy of experience" (Geertz 1983, 75).

Methodology

Due to the nature of this study, a qualitative approach was used. Careful attention was paid to choosing an area that has an established statewide green infrastructure assessment as well as identification of counties that fell within the state's designated coastal zone. The focus on areas in the coastal zone was aimed at comparing areas with similar ecological features and

potential threats to coastal resources. Because I am interested in the planning process for a specific geographic region possessing similar forms of knowledge, a qualitative approach was appropriate due to the small size of this sample and open-ended data was collected (Creswell 2009)

Furthermore, I implemented a case study approach to carry out my research. Data were collected, analyzed, and reported based upon an established case study methodology described in Yin (1984). Due to the expectations and goals of this study, a case study methodology was appropriate because of its ability to capture the richness of situations that are too complex to be studied solely through experimental strategies and or surveys (Yin 1984). In-depth interviews with planners for Prince George's, Anne Arundel, Baltimore, Talbot and Cecil County as well as key informants from consulting agencies and state officials were used as a primary data source in this study. Data were also gathered from a review of relevant literature, review of documents such as the statewide GIA, individual county plans, supporting technical reports, and any public records which include documents produced by outside consultants, public hearings, public forums, focus groups and media reports. The participants that were interviewed for this research all work within the same governmental framework and are afforded similar access to technical data and are familiar with the state's intention on following a green infrastructure approach to conservation planning. Their individual knowledge of the green infrastructure planning process varied as well as their technical expertise.

Overall, this data allowed me to examine the green infrastructure planning process for five coastal counties in Maryland and analyze how knowledge has been used within this specific geographic region during a particular planning process. Based upon the findings of this study, generalizations about the green infrastructure planning process are made.

The following sections of this study includes a review of the relevant literature in Chapter Two, a description of the methodology used throughout this study in Chapter Three, the findings of the five case studies in Chapter Four, an analysis and discussion of the cases in Chapter Five, and conclusions and recommendations for further research in Chapter Six.

CHAPTER 2 – PLANNING PROCESSES AND GREEN INFRASTRUCTURE

Knowledge and Planning Processes

The role of knowledge in planning has been a topic of discussion between planning theorists for almost 25 years after John Friedmann posed 'The Question of Knowledge' in his seminal work *Planning in the Public Domain: From Knowledge to Action* (Friedmann 1987). Planning, as Friedmann described has "emerged as a distinctive practice, with its emphasis on technical reason and social rationality" (Friedmann 1987, 21). Planning practice involves many participants who often share conflicting views on how particular problems should be addressed and have varying visions for the outcomes of shared resources. As conflict arises, planning is the means for establishing a democratic process by which these conflicts are debated and resolved. Planning activities have been suggested to consist of multiple interactions and ultimately produce and utilize knowledge of different forms (Crosta 1996, 106). Knowledge is used to inform decision-making processes and the value of knowledge within the planning world, as well as the value of incorporating the views and ideas of diverse stakeholders through collaborative processes, has been established in planning literature (Healey 1997; Rydin 2007; Alexander 2008; Innes and Booher 2010).

Knowledge is defined as "the fact or condition of knowing something with familiarity gained through experience or association; acquaintance with or understanding of a science, art, or technique" (Merriam-Webster Online Dictionary 2010d). Knowledge is inherently different from data or information where "data" is defined as "factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation" (Merriam-Webster Online Dictionary 2010a) and information is defined as "the communication or reception of knowledge

or intelligence" (Merriam-Webster Online Dictionary 2010c). Rydin (2007) illustrates the distinct difference between knowledge and data/information by establishing the causal relationship between action and impact distinguishes knowledge, and it is the "knowledge that supports the use of that data and information this is important" (Rydin 2007, 53).

In order for planning processes to occur, the knowledge held by various participants is commonly included resulting in the presence of multiple knowledges. Multiple knowledges are identified by individuals or groups that have acquired information and facts through various means, which may result in these members presenting diverse concepts of knowledge. Habermas (1968) wrote of the three fields of science including the natural, social and critical sciences and made a connection between interests, questions and knowledge. He contended that each of these fields generated different types of knowledge and is therefore grounded in different interests, requires varying approaches to defining reality, and asks different types of questions.

When these groups come together their knowledge claims may align with or refute the others, which creates an opportunity for the groups to combine ideas in order to create new knowledge. The planning process offers an opportunity for "joint learning and knowledge generation" between stakeholders (Berke et al. 2006, 275). Within this process, multiple knowledges often become part of the planning process. Following Rydin's summation that "the purpose of planning is to handle multiple knowledges"(pg. 55), we must focus on how these knowledges emerge.

The epistemology of multiple knowledges examines how various knowledges emerge through the planning process. Sandercock (1998) called for 'an epistemology of multiplicity' and suggested that knowledge can result from the following: dialogue, through experience, from local knowledge, by learning to read symbolic and non-verbal evidence, and through

contemplative or appreciative knowledge (Sandercock 1998; Sandercock 2003, 401). Planning theorists such as Rydin have suggested a pragmatic approach for handling the multiple types of knowledges and the subsequent knowledge claims held by planning participants. She centers her argument on the importance of testing knowledge claims within planning based on the work of Habermas (Habermas 1984) and his discussion of validity claims and communicative action. Knowledge claims are defined as 'a claim to understanding certain causal relationships' (Rydin 2007, 56). Within the planning process there are commonly various actors who have relevant knowledge claims. Rydin also suggests that deliberative processes such as collaboration as a way of handling multiple knowledges is inadequate due to the engagement between multiple knowledges, such as expert and lay, requires a certain degree of translation that often lacks in such practices (Rydin 2007, 55).

In an effort to illustrate the multiple knowledges that are present in planning processes there have been various knowledge typologies suggested (Rydin 2007; Alexander 2005). The typology created by Rydin (2007) groups knowledge into four types which include empirical, process, predictive, and normative. Empirical knowledge claims align with the term experiential knowledge, used throughout this study, whereby knowledge is attained through observation rather than theory. The process group suggests a link between process and planning practice resulting in some type of action taking place. Predictive knowledge is theoretically framed by expert groups and incorporates the potential integration of experiential knowledge. Normative processes occur through informed debate held within the public arena (Rydin 2007, 64). Earlier typologies such as Alexander's (2005) model identify three types of knowledge including, performative, systematic-scientific, and appreciative (Alexander 2005). Alexander's model incorporates both empirical and normative groups, established in Rydin's typology, into

the appreciative group. Performative knowledge is evident through communicative interaction and systematic-scientific knowledge includes substantive and procedural theories (Alexander 2008, 209). In addition to the knowledge typologies described here present within planning literature, work within social science literature has explored collective knowledges, which are commonly often referred to as knowledge communities or communities of practice (Lindkvist 2005). These communities can be established communities that share similar theoretical knowledge bases or formed ad hoc for the specific purpose of plan creation only.

The value of experiential participants has been established within planning literature (Corburn 2003; Healey 1996) and has been referred to as "an interactive process" (Crosta 1996, 120). It is generally accepted that there be an integration of experiential knowledge within local policy practice where the aim is to engage scientific communities with social values in an effort to gain a higher degree of public acceptance of certain policy approaches (Owens 2000). An analysis of planning practices suggest that lower levels of governance require less expertise and more appreciative knowledge (such as an understanding of values, and needs, and knowledge gained through personal experience) and as governance levels rise and planning activities become increasingly sectoral, greater expertise is needed and more substantive knowledge is used (Alexander 2005, 91).

When referring to the presence of multiple knowledges, the clustering of collections of members who support similar knowledge claims can be termed a knowledge community. A knowledge community can be defined as a group that shares common cultures, norms, or interests (Corburn 2003). Knowledge within planning is often characterized as belonging to one of two groups (1) expert knowledge, which includes professional, scientific, and technical knowledge and (2) experiential knowledge, which includes local and experiential knowledge

(Khakee, Barbanente, and Borri 2000). For this research knowledge communities are conceptualized as groups that have established knowledge claims through the same general method.

Communicative Action Within Planning

Collaborative approaches are often used for complex planning problems where multiple stakeholders are involved in the decision-making process (Healey 1997; Innes and Booher 1999; Innes and Booher 2010; Corburn 2003; Healey 1998). Communicative theory provides the framework that enables the evaluation of collaborative planning initiatives and is based upon the conveyance or exchange of information. Habermas (1984) suggests that evaluation of the communicative rationality of a process can be evaluated through a set of principles. Some of these principles includes a representation of all stakeholders during the decision-making process; the ability of all stakeholders to represent themselves and become fully informed; equal empowerment where external power influences are not present; allowing of adequate questioning and the goal of reaching consensus (Innes 1998, 52). Stakeholders as defined in Berke et al. 2006) are the "residents, neighborhoods, interest groups, power holders, decision makers, public officials, committees, businesspeople, nongovernmental organizations (NGO's), educational institutions, professionals, and constituencies affected by and able to affect community policies and plans" (pg. 275).

The actions of planners inherently cause subtle communicative effects (Forester 1980). As planners are engaged in the planning process, they are involved in communicative activities that shape and influence public action and decision-making (Innes 1998). Within this context, consensus building is a communicative activity that is often used by planners. In an effort to reach consensus, planners often educate the public on the importance of natural systems,

facilitate planning efforts, provide technical expertise and advocate for underrepresented groups. Consensus seeking activities are integral, relying on conversation and language transfer in an effort to include and induce participation by stakeholders that will talk through issues in an attempt to reach a common opinion or compromise between group members. Discourse plays a central role in this process but can pose problems when this is communication that is established by a central group made up primarily of experts, rather than that which is used to engage numerous stakeholders often involved in environmental planning dilemmas.

Within the planning arena, there are numerous actors that play an important role in the planning process. The knowledge possessed by these actors may be in the form of expert, professional, and experiential origins and all hold value in environmental planning. Research suggests that planning processes and planners often fail to capture the technical and political insights that are present in knowledge groups other than experts and/or professionals (Corburn 2003). However, it is often the local or experiential knowledge that contributes to the knowledge present in environmental decision-making (Krimsky 1984).

Across the environmental planning spectrum collaborative exercises such as scenario-building and focus groups are used to inform the decision-making process. Current collaborative efforts aimed at managing degradation occurring in the natural environment have resulted in a number of planning initiatives following a green infrastructure planning approach establishing broader, regional goals that focus on processes occurring at the landscape scale. Green infrastructure planning is proactive and is inherently based upon the collaboration of various stakeholders providing numerous opportunities for public participation.

Defining Collaboration

Because of the complexity, jurisdictional breadth, and political hurdles associated with environmental issues, it is common for agencies to work together to broaden the information that is used to inform decision-making and ultimately create plans. This often occurs through the collaboration between numerous interest groups that are involved in planning decision-making. An adoption of Gray's (Gray 1985, 912) definition is used whereby collaboration is " the pooling of appreciations and/or tangible resources, by two or more stakeholders to solve a set of problems which neither can solve individually."

Coastal areas are faced with the dilemma of withstanding and guiding pressures of intense economic growth coupled with the required protection of fragile natural ecosystems. Planning problems like these are essentially wicked and require strategic approaches that focus on the unique nature of such problems where the differing perspectives of stakeholders becomes an integral component of dealing with such issues (Rittel and Webber 1973). Wicked problems are difficult and sometimes impossible to solve due to externalities that are often challenging to recognize. Also, when a wicked problem is solved, it may create or reveal additional problems. A collaborative approach is commonly used when dealing with wicked problems and theory suggests that inclusion of those affected by the problem become participants actively involved in the planning process (Rittel 1972). As suggested by Sherry Arnstein in her 1969 work 'Ladders of Public Participation', all participation is not created equal and the degrees to which the public is involved in the planning process can differ dramatically (Arnstein 1969). When addressing planning problems that are fundamentally based upon technical and ecological information, such as those present in green infrastructure planning, there may be a difference in the level of public

participation included as well as an educational component that is unnecessary for other forms of planning.

There exists a wide breadth of literature focusing on collaboration within planning. (Margerum 2008) highlights four common characteristics within collaboration including the wide range of stakeholders represented, the engagement of participants in a process of consensus building, an overall objective to achieve consensus on problems, goals and proposed actions and a commitment to problem solving that is integral to collaboration. These characteristics are based upon a review of literature ranging from fields of public policy, environmental management and planning (Healey 1997; Innes and Booher 1999; Selin and Chavez 1995).

The Coastal Zone

This focus of this research surrounds the Chesapeake Bay in Maryland, United States. The Chesapeake Bay is a valuable coastal resource that faces numerous threats, which will be discussed later in the chapter. The coast, in general, is a highly complex physical environment and management of this resource has been the focus of interdisciplinary approaches (Charlier, Chaineux, and Morcos 2005). This interdisciplinary perspective allows for a collaborative environment that brings together knowledge communities from various disciplines and interaction with local knowledge communities. Through an exploration of the coastal zone, the following section provides a foundation for how collaborative activities such as green infrastructure planning are being employed in coastal areas as well as critical background information on this valuable ecosystem.

The Coastal Zone Management Act

Current management of the United States' coastal resources is controlled through the Coastal Zone Management Act (CZMA). The act was established in 1972 and is administered

by the National Oceanic and Atmospheric Association's (NOAA) Office of Ocean and Coastal Resource Management (OCRM) (National Oceanic and Atmospheric Association 2009). The CZMA includes a Performance Measurement System that utilizes various contextual indicators examining the status of coastal societies, economies, environments, and natural hazards on a national, regional and state level. Contextual indicator data are used in addition to performance measure data used by each coastal state and together provide information concerning state activities and pressures faced by coastal zones (National Oceanic and Atmospheric Association 2009). Data are collected and reported on an annual basis by the Office of OCRM.

In 2008, approximately 125 million people lived within the United States coastal zone (National Oceanic and Atmospheric Association 2009). There are 30 states in the US that are contained in the coastal zone with Maryland ranking tenth in population with approximately 3.8 million (66% of total state population) residents living in the coastal zone in 2008. The total population for Maryland in 2008 was approximately 5.6 million people. Changes in land use have changed the natural ecosystem within coastal areas and as development continues to rise, the threats imposed upon natural resources increases. Table 1 illustrates percent change in land cover between 2001 and 2005 for Maryland.

Table 1. Maryland Land Cover 2001-2005 % Change

Land Cover Category	% Change
High Intensity Developed	9.50%
Medium Intensity Developed	2.52%
Low Intensity Developed	0.70%
Developed Open Space	-0.57%
Cultivated	0.00%
Grassland	27.75%
Deciduous Forest	-1.13%
Evergreen Forest	0.62%
Mixed Forest	-1.45%
Scrub/Shrub	-3.46%
Woody Wetland	-1.27%

Emergent Wetland	0.05%
Unconsolidated Shore	-18.92%
Barren Land	45.30%
Open Water	0.13%

(National Oceanic and Atmospheric Association 2009)

The conversion of forested areas into developed land tracks continues to increase and threatens the ecological integrity of Maryland's remaining ecosystems.

Maryland's Coastal Landscape

Maryland's coastal boundary follows the inland boundary of the 16 counties (and Baltimore City) that border the Atlantic Ocean, Chesapeake Bay, and the Potomac River estuary (as far as the municipal limits of Washington, D.C.) (NOAA Office of Ocean and Coastal Resource Management 2008). This also includes all local jurisdictions within the counties. The Maryland Coastal Program is based upon three surrounding themes including sustainable coastal ecosystems, sustainable coastal communities and the promotion of government efficiency (Maryland Department of Natural Resources 2009c).

The Chesapeake Bay Critical Area Protection Act (Natural Resources Article, §8-1807) was enacted by the 1984 Maryland General Assembly as a means to reverse the deterioration of the Chesapeake Bay. The jurisdictional boundary of the Critical Area includes all waters of and lands under the Chesapeake Bay and its tributaries to the head of tide as indicated on the state wetlands maps, and all state and private wetlands designated under Natural Resources Article, Title 9 (now Title 16 of the Environment Article). The boundary also extends to all land and water areas 1,000 feet beyond the landward boundaries of State or private wetlands and the heads of tides, designated under the same Article.

The 2000 Chesapeake Bay Agreement, of which Maryland is a signatory, calls for partners to permanently protect 20 percent of the land area in the watershed from development by 2010. For land conservation efforts, this goal has been met (The Chesapeake Bay

Commission 2010). The initial legislation, creating the Chesapeake Bay Program, included Virginia, Maryland, Pennsylvania, District of Colombia, Chesapeake Bay Commission and the U.S Environmental Protection Agency. Agreements were signed in 1983, 1987 and most recently 2000. The Chesapeake 2000 agreement affirms the commitment to protect this particular ecosystem and sustain a Chesapeake Bay Watershed Partnership through a pledge to achieve over 100 specific actions aimed at restoring the health of the Bay. Set forth in the agreement are various goals aimed at protecting and restoring living resources, vital habitat and water quality; promoting sound future land use policies and increased stewardship and community engagement. This effort serves as a rededication of the signatories to maintaining the integrity of the Bay (Maryland Department of Natural Resources 2003a).

While many of the goals within the Chesapeake 2000 agreement are being pursued, the focus has shifted more narrowly to pollution reduction, specifically the Total Maximum Daily Load (TMDL) or Bay TMDL. This effort, created in 2010, includes the Bay watershed jurisdictions of Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York, and the District of Columbia and is consistent with requirements of the Clean Water Act. There are several milestone goals (implementation actions and program enhancement actions) associated with this plan as well as a two-phase implementation plan. The milestones are tracked by the state's BayStat program (Maryland Department of the Environment 2012).

In addition to potential pollution, one of the most significant threats to the coastal areas of Maryland is climate change. Much of the area's natural resources, public infrastructure and land are at risk to the consequences of climate change including sea level rise, increased storm intensity, extreme drought and heat waves, and intensified wind and rainfall events (Maryland Department of Natural Resources 2009a). Overall, the state has been fairly proactive in

climate change initiatives and is a national leader for this cause. In 2008, the Maryland Commission on Climate Change issued a Climate Action Plan that outlined the effects of climate change on Maryland as well as recommendations for dealing with the effects of these changes (Maryland Department of the Environment 2008). Another initiative created in 2008, under the leadership of Maryland's Governor Martin O'Malley, is the Maryland Department of Natural Resources Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change. This strategy is a key component to the Climate Action Plan and contains the detailed actions required to protect the sustainable future of Maryland (Maryland Department of Natural Resources 2009a). The focus of this endeavor is to provide the tools and technical services needed by state and local governments in order to plan for climate change (Maryland Climate Change Advisory Group 2008).

Due to the geology and geography of the area, the Chesapeake Bay region is ranked the third most vulnerable to sea level rise in the United States, behind Louisiana and Florida (Maryland Department of Natural Resources 2009b). While the state has referred to sea level rise as the "ultimate planning challenge" they have recognized the need to begin advanced planning and the value in addressing sea level rise comprehensively on a long-term temporal scale. In 2000 the state created 'A Sea Level Response Strategy for the State of Maryland' which included four components including outreach and engagement, technology data and research support, critical applications, and statewide policy initiatives (Pfahl and Johnson 2000). Additionally this strategy set the tone for how Maryland was going to handle the anticipated impact occurring in future years as well as the goals set forth to accomplish state objectives and increase awareness for the public and government officials.

Chesapeake Bay Watershed

The Chesapeake Bay Watershed is the largest estuary in the United States and the third largest worldwide. The watershed encompasses coastal sections of six states including Maryland, New York, Pennsylvania, Virginia, West Virginia, Delaware and the entire District of Colombia covering approximately 64,000 square miles. There are 11,600 miles of tidal wetlands and islands, which make up the area's tidal shoreline. Within the watershed there are 100,000 tributaries including 150 major rivers (Chesapeake Bay Foundation 2009). The Watershed contains the Chesapeake Bay, which is a partially enclosed coastal water body that is separated from the open ocean and runs 200 miles north to south beginning at the mouth of the Susquehanna River to the Atlantic Ocean. The Bay extends from Havre de Grace, Maryland to Norfolk, Virginia and ranges from 3.4 miles in width at its narrowest point to 35 miles wide near the mouth of the Potomac River while the average depth is roughly 21 feet (Chesapeake Bay Foundation 2009). The Chesapeake Bay was formed approximately 12,000 years ago during the late Pliocene and developed through the Pleistocene and into the Holocene in response to coastal marine processes and major cycles of sea-level rise and fall (Hobbs 2004, 641-661).

Chesapeake Bay characteristics and threats

Anthropogenic influences have had a major impact on the vigor of the Chesapeake Bay Watershed. The land-to-water ratio within the Chesapeake is the highest amongst all coastal water bodies in the world at (14:1) which results in a significant impact on the overall health of the Bay due to the actions and decisions made concerning land use (Chesapeake Bay Program 2009). The bay consists a diverse range of highly ecologically and economically productive habitats including forests, wetlands, streams, rivers, shallow water, coastal bays, tidal marshes, aquatic reefs and open waters (Chesapeake Bay Program 2009). Within these habitat types, the

Bay is home to over 3,600 plant and animal species consisting of more than 300 fish species and 2,700 plant species. Some common plant species that can be found in the Bay include submerged aquatic vegetation (SAV), fourteen species of bay grasses, various cordgrass species, red maple and numerous willows. Common animal types include blue crab, various waterfowl, anadromous fish species, mammals, reptiles and amphibians (Chesapeake Bay Foundation 2009). Each of the habitats present within this ecosystem play an integral role in the continued ecological health of the Bay and provide specific functions that facilitate a species ability to survive.

The Bay consists of habitat for various wildlife and is a highly valuable coastal resource. The wetlands present provide numerous ecosystem services while performing valuable functions including filtering polluted stormwater runoff, absorbing floodwaters, and limiting erosion. Many fisheries depend on the Bay for their livelihood as well as continued economic integrity of many coastal villages. For many commercially important aquatic species, estuaries are important areas that are necessary for development at some point during a species lifetime. Estuaries also provide cultural values by providing aesthetic, recreational, tourism, economic benefits such as harbors, ports, and fisheries and provide jobs to numerous Americans (U.S. Environmental Protection Agency 2009b). Currently, 17 million people live within the watershed with estimates reaching over 18 million by 2020 (Maryland Department of Planning 2009). Concern exists regarding the ability of the Bay to withstand continued population growth.

The Bay is facing numerous threats that jeopardize its sustainability and future ecological functionality. The burdens placed upon the Bay are primarily anthropogenic in nature and as populations continue to grow we can only expect that these demands will persist. The worst problem facing the watershed is nutrient pollution, which has led to increased levels of

eutrophication and has had a major impact on aquatic species and water quality throughout the region. Additionally, landscape changes, over-harvesting of fisheries, invasive species, air pollution, land-use changes, increased impervious surface, population growth, haphazard development patterns or sprawl, climate change, and chemical contamination are all posing major stresses on the Bay and wildlife (Chesapeake Bay Program 2009).

Green Infrastructure Planning

Management of these factors is complex and is often approached on a landscape scale, crossing various jurisdictional boundaries, focusing on the whole system. A proactive, comprehensive, strategic management approach is suggested to ensure the sustainability, adaptability, and resilience of the Bay (Maryland Department of Natural Resources 2003b). Planning using a green infrastructure approach provides the necessary tools that can be used as a framework for planners guiding future decisions aimed at protecting, preserving, and restoring the Chesapeake Bay. Although various definitions of green infrastructure occur (U.S. Environmental Protection Agency 2009a; The Trust for Public Land 1999; The Conservation Fund 2009b), it is formally defined in *Green Infrastructure: Linking Landscapes and Communities* as:

> Our world's natural life-support system – an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks, and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for communities and people (Benedict and McMahon 2006, 2).

Although the Benedict and McMahon definition is used for this study, it is important to distinguish between other existing definitions. The U.S

Environmental Protection Agency focuses on green infrastructure as a management approach for stormwater management that is "cost effective, sustainable, and environmentally friendly" (U.S. Environmental Protection Agency 2010). Other definitions focus on the site level implementation strategies of green infrastructure such as Low-Impact Development (LID), conservation developments, and the interface between green and grey infrastructure (The Conservation Fund 2009).

Green infrastructure differs from conventional open space planning approaches mainly because it analyzes conservation values and actions in concert with land development, growth management and built infrastructure planning (Benedict and McMahon 2002). As the definition suggests, a holistic strategic approach to conservation is integral for maintaining this network of natural processes. According to Benedict and McMahon 2006, as a green infrastructure planning initiative is undertaken, there are some characteristics that should be present throughout the planning process to promote successful integration of the plan within the community. Plans should be broad and analyzed from a regional perspective, proactive, systematic, holistic, multifunctional, multiple scaled and better integrated with other growth management and development efforts. Green infrastructure planning is not reactive, haphazard, piecemeal, single purpose or single scaled (Benedict and McMahon 2002). Green infrastructure planning relies on the inclusion of multiple stakeholders throughout the planning process and focuses on collaborative development that includes the public in the planning process early and often (Benedict and McMahon 2006; Ahern 1995). The ten principles that are commonly used to frame the green infrastructure planning process are shown in Chart 1.

Chart 1. Ten Principles of Green Infrastructure Planning

- Connectivity is key.
- Context matters.
- Green infrastructure should be grounded in sound science and land-use planning theory and practice.
- Green infrastructure can and should function as the framework for conservation and development.
- Green infrastructure should be planned and protected before development.
- Green infrastructure is a critical public investment that should be funded up front.
- Green infrastructure affords benefits to nature and people.
- Green infrastructure respects the needs and desires of landowners and other stakeholders.
- Green infrastructure requires making connections to activities within and beyond the community.
- Green infrastructure requires long-term commitment.

Modified from: (Benedict and McMahon 2006).

It is common when acknowledging natural lands that the terms used to define these areas will differ. Some of these common terms include open space, green space, reserves, and conservation areas. Although the terms may differ, there are noted benefits of retaining natural landscapes including preservation of habitats and biodiversity, maintenance of ecosystem services and natural processes, protection from natural disasters, climate change mitigation, access for improved public health and recreation activities, benefits to quality of life, sense of place, and economic integrity (Beatley 2000, 5). Preserving an area's green infrastructure can provide a method and guiding framework for sustainability-driven goals sought by communities.

Green infrastructure has been accepted within the American political arena being identified as one of the five strategic areas applicable to providing a comprehensive approach to sustainable community development. The May 1999 report "Towards a Sustainable America" provided by the President's Council on Sustainable Development, reported that "green infrastructure strategies actively seek to understand, leverage, and value the different ecological, social, and economic functions provided by natural systems in order to guide more efficient and sustainable land use and development patterns as well as protect ecosystems" (The President's Council on Sustainable Development 1999, 1). Additionally, in 2007 the Environmental Council of States set forth in resolution number 07-10, the support of future green infrastructure initiatives as a valuable tool to protecting public and ecosystem health (Environmental Council of States 2007). The support of ECOS came only months after an agreement was reached between the U.S. Environmental Protection Agency and several organizations including the National Association of Clean Water Agencies, Natural Resources Defense Council, Low Impact Development Center, and the Association of State and Interstate Water Pollution Control Administrators which also supports green infrastructure initiatives that helped to protect drinking water supplies as well as public health through the protection of green infrastructure (U.S. Environmental Protection Agency et al. 2007).

Green Infrastructure History and Theoretical Framework

Upon the release of Rachel Carson's seminal 1969 work *Silent Spring*, a greater understanding and interest emerged concerning the relationship between human induced landscape changes and environmental health. She censured the activities of man by stating that "The most alarming of all man's assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials" (Carson 1962, 6). Works like *Silent*

Spring have brought to the forefront the degradation that is occurring to the natural environment and suggested that we become more cognizant of the decisions we make and the potential implications they may have on the environment.

Although green infrastructure is a relatively new term, the ideas that contributed to such planning efforts were developed over a century ago. Green infrastructure was initially included in planning efforts dating over 150 years ago (Benedict and McMahon 2002). The work of Frederick Law Olmstead, who explored increasing the connectivity within parks, began in the late eighteenth century and has since evolved into the modern greenway movement (Ahern 1991). The concept of connectivity presented in his work known as the "Emerald Necklace" in Boston has become integral to the design of the network used within green infrastructure planning. In 1969, Ian McHarg's *Design with Nature* set the path for future ecological planning and set forth the basic concepts that would later be used to develop Geographic Information Systems (GIS) (McHarg 1969). GIS is the primary tool used during the initial states of green infrastructure network design and allows planners and managers to view identified areas and overlay the identified network with other layers such as designated growth areas, transportation grids and parcel data. In the 1970's, R.T.T. Forman presented the idea of landscape mosaics and habitat cores that were necessary for the sustainability of numerous species by providing adequate space and habitat connectivity for populations (Forman 1995). These concepts helped to build the framework upon which green infrastructure planning is conducted.

Green infrastructure is a framework for conservation and development efforts, which are based upon concepts present within the fields of landscape ecology, conservation biology, and regional planning. Landscape ecology principles, including island biogeographic theory

and metapopulation dynamics, are used as the theoretical basis in green infrastructure network design. These theories provide the scientific suppositions that provide knowledge and tools for this planning approach. Based upon existing theories, a network containing hubs, corridors, and gaps is identified in an effort to recognize areas that possess the greatest ecological importance as well as those most threatened by development pressures (Weber, Sloan, and Wolf 2006). Hubs are generally larger areas that vary in shape of open space that possess the highest quality habitat area and are the main dwelling areas for many plant and animal species. They consist of reserves, managed and working landscapes, parks and open space areas and recycled lands. Corridors are areas that are typically linear in shape and connect hubs in attempt to provide a connected pathway for seed dispersal, animal migration, and nutrient cycling. Common corridors may be found in the form of conservation corridors, greenways, greenbelts, landscape corridors, and ecobelts (Benedict and McMahon 2006; Benedict and McMahon 2002; Williamson 2003).

Identifying a Green Infrastructure Network

The identification of a green infrastructure network is achieved through a combination of principles present within the fields of conservation biology and landscape ecology. As these fields continue to evolve and technologies used in network design, such as GIS, continue to develop, green infrastructure network design will follow these fields and progress as a technique used in conservation planning.

Conservation biology

Green infrastructure is comprised of various types of natural and restored landscapes that are combined in a network comprised of hubs and corridors. It may consist of open space, working landscapes, reserves, parks, and greenways but there is an additional emphasis on the

linkages and connectivity of these landscapes to protect the integrity of the functioning of natural systems. By using the principles present in conservation biology, green infrastructure hubs and corridors can be identified and designed. Conservation biologist Reed Noss summarized the following principles of conservation biology that are directly applicable to the identification, design and protection of modern green infrastructure networks:

- Large blocks of habitat, containing large populations of a target species, are superior to small blocks of habitat containing small populations.
- Blocks of habitat close together are better than blocks far apart.
- Habitat in contiguous blocks is better than fragmented habitat.
- Interconnected blocks of habitat are better than isolated blocks; corridors or linkages function better when habitat within them resembles that preferred by target species.
- Species well distributed across their native range are less susceptible to extinction than species confined to small portions of their range (Noss 1993).

Landscape ecology

Landscape ecology explores the interaction between patterns of spatial heterogeneity and ecosystem processes across a range of scales (Turner, Gardner, and O'Neill 2001). Although concepts present within the field of landscape ecology are still emerging into United States literature, landscape ecology has a much more extensive history in Europe (Nassauer 1997; Forman 1990). Landscape ecology was originally introduced by Carl Troll, a German geographer, in the 1950's and later defined in 1963 as:

> The study of the entire complex cause-effect network between living communities (biocoenoses) and their environmental conditions, which prevails in specific sections of

the landscape. This becomes apparent in a specific landscape pattern or in a natural space classification of different orders of size (in (Hersperger 1994, 14).

The fields of biology and geography had a major influence on the development of this field and have caused landscape ecology to be viewed as a truly interdisciplinary science. A seminal idea by leading scientists was the inclusion of society as a key component that ought to be included into scientific analysis (Turner 1989). The emphasis on the interaction of humans and their natural as well as built environment is integral to application of landscape ecology and has been viewed as a scientific foundation for planning, management, protection and conservation pertaining to the natural environment (Hersperger 1994). To effectively understand the interactions within any particular landscape, it is essential to understand spatial configuration and the importance of the arrangement of various natural components to analyze ecological processes present within any given landscape (Turner, Gardner, and O'Neill 2001). As stated in Turner (2001), landscape ecology incorporates the study of spatial heterogeneity, spatial-temporal scale, landscape configuration, fragmentation, edges and landscape cover types, the connectivity of various landscapes, geographic information systems, remote sensing, and patches (an area that differs from its surroundings) and matrices (background cover in a landscape often characterized by high connectivity). As these concepts suggest, together they combine the spatial elements of geography and the practical approaches rooted in ecological processes (Turner, Gardner, and O'Neill 2001).

Landscape ecology has evolved into a tool used by conservation biologists to assess the affects of habitat fragmentation on population. This emergence stems from the work of (MacArthur and Wilson 1967) in their seminal piece *The Theory of Island Biogeography.* Island biogeography was initially used to the explain species richness within an island but has been

expanded to include any ecosystem that is surrounded by an unlike ecosystem. Three tenants that are recognized to influence the number of species found in a particular ecosystem are immigration, emigration and extinction. Additionally, the theory of island biogeography had led to the creation of habitat corridors, which are critical components to green infrastructure planning, used as conservation tools to increase connectivity between habitats. Chart 2 illustrates the potential advantages and disadvantages of corridors present within human-dominated landscapes. Although critics have questioned whether corridors actually provide landscape connectivity (Simberloff and Cox 1987), empirical research has supported the value provided by such conservation tools (Beier and Noss 1998; Noss 1987).

Chart 2. Advantages and Disadvantages of Corridors

Potential Advantages of Corridors

1. Increase immigration rate to a reserve, which could
   A. increase or maintain species richness and diversity (as predicted by island biogeography theory);
   B. increase population sizes of particular species and decrease probability of extinction (provide a "rescue effect") or permit re-establishment of extinct local populations;
   C. prevent inbreeding depression and maintain genetic variation within populations.
2. Provide increased foraging area for wide-ranging species.
3. Provide predator-escape cover for movements between patches.
4. Provide a mix of habitats and successional stages accessible to species that require a variety of habitats for different activities or stages of their life-cycles.
5. Provide alternative refugia from large disturbances (a "fire escape").
6. Provide "greenbelts" to limit urban sprawl, abate pollution, provided recreational opportunities and enhance scenery and values

Potential Disadvantages of Corridors

1. Increase immigration rate to a reserve, which could
   A. facilitate the spread of epidemic diseases, insect pests, exotic species, weeds, and other undesirable species into reserves and across the landscape
   B. decrease the level of genetic variation among population or subpopulations, or disrupt local adaptation and coadapted gene complexes ("outbreeding depression").
2. Facilitate spread of fire and other abiotic disturbances ("contagious catastrophes").
3. Increase exposure of wildlife to hunters, poachers, and other predators.
4. Riparian strips, often recommended as corridor sites, might not enhance dispersal or survival of upland species.
5. Cost, and conflicts with conventional land preservation strategy to preserve endangered species habitat (when inherent quality of corridor habitat is low).

Modified from: (Noss 1987)

Ecosystem Services

Ecosystem services are defined as the products and services humans receive from functioning ecosystems (U.S. Geological Survey 2008). Large contiguous blocks of land are thought to be more likely to have functioning ecosystems and provide value to humans (MacArthur and Wilson 1967). While this is true, ecosystem functionality is a matter of quality and diversity of the functions provided, and a diversity of ecosystem services is often provided by larger, intact landscapes. Ecosystem services are provided by wetlands, forests, working landscapes and various open lands. These services include cleaning the air, filtering and cooling water, storing and cycling nutrients, conserving and generating soils, pollinating crops and other plants, regulating climate, sequestering carbon, protecting areas against storm and flood damage, and maintaining hydrologic regimes (Costanza et al. 1997; Weber 2007). Additionally these valuable lands provide various goods and services including forest products, fish and wildlife, recreation activities, aesthetic value, vital habitat, and enhance the quality of life and health of humans (Weber 2007). As ecological lands, such as wetlands and forests, are

lost due to development or degradation, there are costs incurred by society that are likely hidden and unable to be accounted for in the marketplace. As populations continue to grow and land use changes continually lead to loss of important ecological lands, it becomes increasingly evident that the damages done to ecosystem functionality is both difficult and expensive to repair and has a devastating effect on plant, animal, and human populations (Maryland Department of Natural Resources 2003c).

As the effects of changes in land use are becoming more well known, many states are adopting a green infrastructure planning approach in order to maintain the integrity of the natural environment and sustain the ecosystem services that it provides.

State of Practice

Throughout the United States various states have completed or are in the process of completing statewide green infrastructure assessments including Florida, Oregon, Washington, New Jersey, Virginia, Massachusetts, Delaware, and Maryland. There are numerous states that have integrated the concepts of green infrastructure planning into local efforts but may not use the term green infrastructure to define such efforts or have only completed assessments on a county or regional scale but not statewide (Youngquist 2009). Countywide planning efforts are emerging throughout the country and are created both internally by county planning organizations and outside agencies such as The Conservation Fund who are contracted to work with counties.

Maryland's Green Infrastructure Assessment (GIA)

The State of Maryland has been committed to green infrastructure planning and began efforts to identify a statewide network over ten years ago. In 2000, the Department of Natural Resource's Chesapeake and Coastal Watershed Service spearheaded the GIA's initial analysis

through the use of satellite and aerial imagery, land use cover maps, and environmental and biological databases developed within the state's Natural Heritage Program, the Maryland Biological Stream Survey, and the Forest Service (Conn 2009). Based upon this analysis Maryland produced a Green Infrastructure Atlas that identified greenways, water trails and green infrastructure through collaboration with various state agencies, private conservation groups and counties throughout the state (Maryland Department of Natural Resources 2003c).

In 2003, Maryland released their Statewide Green Infrastructure Assessment (GIA), which identified key remaining ecological lands and identified areas of potential restoration (Maryland Department of Natural Resources 2003b). The purpose of Maryland's Green Infrastructure Assessment is to:

1. Systematically identify and protect ecologically important lands;
2. Address problems of forest fragmentation, habitat degradation and water quality;
3. Emphasize the role of a given place as part of a larger interconnected ecological system;
4. Consider natural resource and ecosystem integrity in the context of existing and potential human impacts to the landscape;
5. Maximize the influence and effectiveness of public and private conservation investments;
6. Promote shared responsibilities for land conservation between public and private sectors; and,
7. Guide and encourage compatible uses and land management practices

(Maryland Department of Natural Resources 2003d).

The identification of the statewide green infrastructure was conducted through a multi-step process and heavily utilized technical information, specifically GIS-based resource assessment databases and used ecological thresholds developed by conservation biologists. The

primary step in the process employed in Maryland's GIA was the establishment of hubs which typically consist of unfragmented areas that range from several hundreds to thousands of acres in size and are viewed as being critical components to the maintenance of the state's ecological integrity. The size and shape of the hubs were based on the literature based habitat needs of particular targeted species or groups of species that required similar habitat. One of the key ecological thresholds that the state used was based on the habitat needs of Forest Interior Dependent Species (FIDS) primarily because forest habitat fragmentation was identified as one of the primary threats to ecological function and integrity in the state of Maryland. (you might want to define FIDS here –we were specifically targeting bird species and consider presenting the ecological thresholds that the state used – 250 acres min for hubs – in general). The functions these hubs provide for Maryland include habitat for various plant and animal species, protection of water quality and soils, and assist in climate regulation. Upon the establishment of area hubs, the identification of corridors commonly aligns as the second step in the process of network design. The state identifies corridors as linear remnants of natural lands that are used to connect similar hubs and that have a minimum width needed to allow the most sensitive wildlife, particularly Forest Interior Dependent Species (FIDS) birds, to move from hub to hub. The average size of all hubs in the state was approximately 2,200 acres (Maryland Department of Natural Resources 2003d). The third element in network design was the ecological ranking of hub and corridor elements in the network. Hubs and corridors that had the most ecologically important values were those that were larger, had more protected land and supported a diversity of ecosystem types, habitats and species. The prioritization step is important for targeting conservation actions to the most ecologically significant areas in the state.

Evaluating Green Infrastructure Planning

Analyzing green infrastructure planning is based upon four plan elements that are critical to the green infrastructure planning process and form the framework for plan development. Within each element, there are various components that make up the four overarching aspects. A standard practice for evaluating the quality of green infrastructure plans is presented in (McDonald et al. 2005) and for all planning types in (Berke et al. 2006). The following four groups are used in (McDonald et al. 2005) as the framework for specifically evaluating green infrastructure plans:

1. Goal setting: an essential first step – can be conducted at various scales and sets the framework for plan development where issues are identified, followed by an outlining of the planning process and ultimately defining plan goals – Consists of three criteria including plan foundations, stakeholder involvement and conservation vision.
2. Analysis: the setting of network design criteria and network suitability analysis based on landscape ecology, conservation biology and land use planning theories at the landscape level.
3. Synthesis: the creation of a planning framework that identifies priorities in terms of vulnerability threats and the feasibility of network construction to recognize implementation priorities, and relate to stated goals.
4. Implementation: through the integration of conservation priorities and implementation tools, a strategic framework is created aimed at assisting reaching plan goals. Implementation and funding strategies are explored (McDonald et al. 2005).

Due to the highly complex nature of green infrastructure planning, no two approaches or processes are likely to be identical. There is however a general framework that is utilized by individual groups following a green infrastructure approach. This framework includes forming

a group of stakeholders that will be involved throughout the process, identifying and inventorying resources, developing goals, evaluating potential options for achieving established goals, selecting the best option, monitoring outputs and outcomes and using the information to adapt management strategies for future efforts (Benedict and McMahon 2006). Again, this process is likely to vary from plan to plan but provides a general strategy for management efforts. A collaborative planning method is used throughout this process and is integrated with environmental stewardship and community education efforts aimed at increasing public support as well as stakeholder involvement included within the planning process.

Collaboration and consensus building processes suggested in (Healey 2003; Margerum 2002; Innes 1996) could be used as the basis for stakeholder involvement, which is suggested as a key component to green infrastructure planning (Green Infrastructure Work Group 2009; Benedict and McMahon 2002; Kambites and Owen 2006). As various stakeholders become involved in the planning process, we can examine where power lies in decision-making efforts. Booher and Innes (2002) examines the role of the planner within such collaborative frameworks and suggests that the planner is indeed not powerless and plays a substantial role in shaping the flow of power to mobilize and focus efforts that shape planning and policy as planners engage in collaborative planning discourses.

Community involvement throughout the planning process can provide numerous benefits that aim to provide community members with the opportunity to play an active role in formulating a vision for their community and benefit from turning that vision into practice. Practical reasons for involving community members throughout the process include combining local community knowledge with expert knowledge, meeting community needs more

efficiently through involving community members in plan design, and to lessen opposition and potentially engender support by neighboring communities involved in the design phase (Kambites and Owen 2006).

Crucial to the adoption of a green infrastructure plan, which is developed with the county or municipal comprehensive plan, is a collaborative component that aims to reach consensus through public participation. Due to the long-term vision of these plans, it is difficult to assess the effectiveness of achieving future outcomes and gain valuable public feedback on an issue whose effects are not directly evident to the general public. However, according to standards of good practice, the quality of green infrastructure plans could be evaluated and would function as a learning process that provides important planning lessons as well as guidelines for future efforts (Berke and Godschalk 2007). A high quality plan does not necessarily mean that successful implementation will occur and connections between plan quality and processes, level of stakeholder involvement and plan adoption have yet to be made (Youngquist 2009).

The process of creating and implementing green infrastructure plans has not been empirically evaluated to identify effective strategies or areas where improvements can occur. Although conservation-focused plans have become more evident in planning efforts, we still know little about the quality of the plans we are producing as planners (Berke and Godschalk 2007). A formal assessment of these plans and the political context under which they were created can provide insight into improving the planning process by incorporating an enhanced level of community involvement, effective implementation design and a better understanding of the role of the knowledge within green infrastructure planning initiatives.

Integrating Green Infrastructure within the Existing Planning System

Current literature suggests that as green infrastructure plans continue to be created, there should be a certain level of integration occurring within individual planning systems. Kambites (2006) stresses the need to embed this form of planning within existing planning systems in order to maintain continued functioning of the plan. The governmental framework in the Unites States is made up of three tiers including federal, state, and local governments. The federal tier possesses a regulatory component that is responsible for various laws including the Clean Water Act, Clean Air Act, Endangered Species Act, Coastal Zone Management Act. Significant investment and funding for state activities is provided by the federal government, as well as support for environmental initiatives such as providing data and resources. State activities are similar to those at the federal level, but have increased authority over development through planning, regulatory and fiscal responsibilities. In terms of development, the local government holds the greatest authority over development through the use of master plans, zoning and other forms of regulation (PlanSmart NJ 2009).

This governmental framework is often characterized by increased fragmentation amongst the tiers and poses a threat to the integration of green infrastructure planning into the planning process. Each tier is likely to have various agencies working to adhere to their own mission and achieve their own goals. If efforts to identify and protect a green infrastructure network occur at the state level, local authorities may approve development that occurs in a sprawling pattern therefore damaging the integrity of the statewide initiative. This problem may also exist in areas that are trying to employ a regional green infrastructure plan that crosses multiple jurisdictional boundaries. If the vision, goals and policies of the various jurisdictions are not similar then implementation of the plan may be jeopardized. Having a

green infrastructure plan that can be integrated within a variety of regional, state and local plans could be critical to ensuring that protection of an area's natural assets is achieved.

Summary

As populations continue to grow and land use changes continually occur, valuable ecological resources are faced with increased threats and the potential for loss and degradation. Maryland has adopted a green infrastructure planning approach as its primary strategy for handling conservation efforts throughout the state. Within the coastal region of Maryland, five counties have gone beyond the statewide assessment of green infrastructure to assess their individual natural resources and create specific plans that focus on long-term visioning aimed at protected the integrity of these identified ecosystems.

The process of creating green infrastructure plans requires the collaboration of various knowledge communities and key stakeholders. This requires the coordination of expert and experiential forms of knowledge by the planning community. How this integration occurs is integral to the planning process and needs further research. Although plans are created, they are not always adopted or implemented. As this planning strategy is increasingly utilized by planning agencies throughout the country, we must fully analyze the process and determine ways to improve future efforts.

This study utilizes an analysis of the planning process, using the framework defined in McDonald et al., to determine linkages, consistencies and gaps in the process. Particular attention is paid to how various knowledge communities were involved in each stage and what the role of various forms of knowledge played in plan development, if at all. The McDonald et al. framework is used to evaluate the structure of the green infrastructure planning process and this research builds upon the existing procedure of evaluating plan quality to incorporating this

with input needed by different knowledge communities and the subsequent relationship to early implementation.

CHAPTER 3 – METHODOLOGY

Introduction

More and more states are engaging in green infrastructure planning throughout the United States as a form of conservation planning (The Conservation Fund 2009b). Because there has been little research analyzing this process, the significance of this dissertation is to provide a greater understanding of the role of knowledge in green infrastructure planning so that future planners can better understand the various knowledge communities that could potentially work collaboratively to improve their plans and possibly lead to greater rates of plan adoption and acceptance.

This research is designed to examine a specific planning process and examine how knowledge influences action within planning. Current literature suggests a general methodology for a green infrastructure planning process, but a gap in knowledge exists relating to how a collaborative approach can be better integrated into planning activities and how the knowledge possessed by a wide breadth of stakeholders can be included to improve the planning process. This dissertation also explores how green infrastructure plans were created, thereby determining a standard of practice. The processes are then compared to what planning theory prescribes as intended outcomes of the planning process.

This dissertation entailed a critical review of how knowledge is used through green infrastructure planning in five coastal counties of Maryland. A better understanding of this process will allow future planning efforts to be initiated from a more informed perspective and help to achieve higher levels of success through effective implementation. Cases were selected based upon a review of existing green infrastructure planning efforts within the 16 coastal counties of Maryland and Baltimore City. There are currently five counties that have created

green infrastructure plans throughout the State of Maryland, which include, Anne Arundel, Baltimore, Cecil, Prince George's, and Talbot.

In seeking a better understanding of this particular planning process, the study will address four research questions: (1) How does the green infrastructure planning process translate into practice? (2) How is knowledge used in a green infrastructure planning process? (2A) How does integration of multiple knowledge's occur? (2B) How is knowledge linked to action? (3) How do planners facilitate the integration of knowledge communities? (4) What can future green infrastructure planning efforts do to improve the process and increase implementation?

This chapter describes the study's methodology and includes the following areas (a) rationale for research approach, (b) case study selection, (c) summary of necessary data, (d) overview of research design, (e) methods of data collection, (f) issues of trustworthiness, (g) limitation of the study, and a brief concluding summary.

Rationale foran Qualitative Research Approach

A holistic multiple case study approach was used for the design of research, due to its ability to capture the richness of situations that are too complex to be studied solely through experimental strategies or surveys. The research approach and methods used (document review/analysis and interviews) are suggested as being essential to generating rich and detailed data about a particular phenomenon being studied (Patton 2002). The case study research method is an "inquiry that investigates a contemporary phenomenon within a real-life context in which multiple sources of evidence are used" (Yin 1984, 23). Additionally, case studies are a preferred strategy for exploring phenomena that is found in a real world context (Yin 2009).

Although there are theories that reject the value of this type of research, there are justifications for instances when qualitative methods are advantageous. Resistance to a

qualitative approach is attributed to the assumed inability of qualitative researchers to rely on well-established and well-accepted procedures that can be used for analyzing data (Yin 2009; Mitchell and Bernauer 1998). While the approach does not offer statistical generalizeability, quantitative methods are not appropriate for this study because they are unlikely to capture the rich relationship between the numerous stakeholders, plans, and policies involved in this process. This research is inductive rather than deductive, whereby hypotheses and theories are generated during the course of conducting the research as the meaning emerges from the data.

The case study approach will compare, contrast, and analyze planning efforts in Anne Arundel, Baltimore, Cecil, Prince George's, and Talbot counties. Consistent with the case study methodology, data will be elicited from multiple sources using multiple methods. Data will be gathered from a review of relevant literature, key informant interviews, and primary document review providing for an evaluation of the history, initiatives, accomplishments, and role of knowledge and various knowledge communities present throughout the planning process.

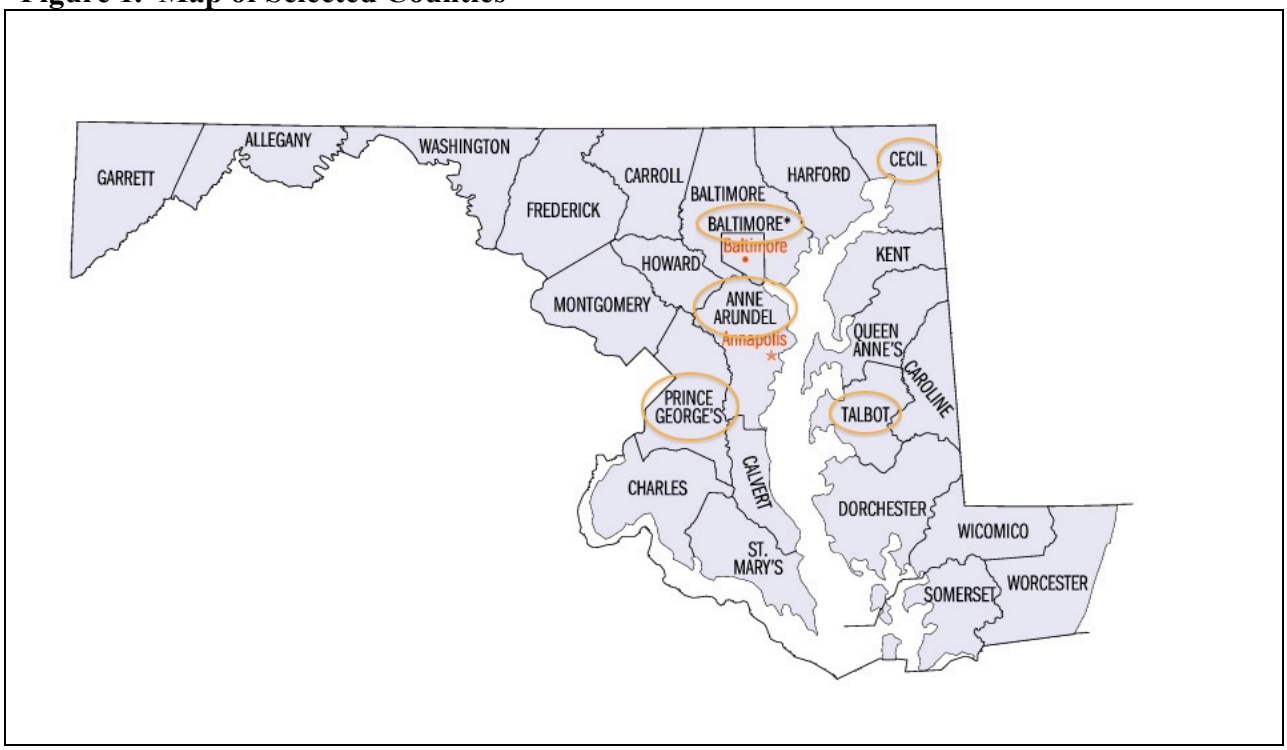
Case Study Selection

A purposeful sampling procedure was used to select this study's sample. The selection of cases was based upon a review of all statewide green infrastructure initiatives throughout the United States. I focused on states that had a statewide assessment to ensure there was a level of consistency between the states' position on green infrastructure planning approaches while operating under a similar political and planning framework. I also sought out states that have multiple counties, which have gone beyond a statewide assessment and have created individual county plans. Because a statewide assessment exists, there is a base of information that is available to all counties within that state and the technical information provided is similar. How the individual counties utilized similar technical information was critical to exploring how

multiple knowledge communities were integrated in the planning process. Furthermore, I wanted to focus on a state that had their green infrastructure assessment established for a minimum of five years to allow time for individual counties to expand upon the minimum statewide assessment and conduct individual county specific assessments. Upon reviewing the statewide assessments, I found there to be seven states that had such initiatives, which included Florida, Delaware, Washington, Oregon, Massachusetts, New Jersey, and Maryland. Based upon the selection criteria, Maryland was the only state that had both completed a statewide assessment and contained individual county plans conducted at a smaller scale where implementation is occurring.

The Chesapeake Bay is a critical natural resource to the State of Maryland, and all of the plans identified fall within the state's coastal zone. Within the State of Maryland there are 24 counties, 16 of which are classified as coastal by Maryland's Department of Natural Resources (Maryland Department of Natural Resources 2009b). After reviewing planning documents including comprehensive, master plans, outside agency documents and proposed plans for each county, there were five counties that had created a green infrastructure plan. I focused on plans that utilized a green infrastructure planning approach rather than all environmental plans including sensitive area plans. Although there are some consistencies within these plans, examination of these plans was based upon a process specific to green infrastructure planning, so that appropriate comparisons regarding similar technical data and goals could be made. A map displaying the selected counties is shown in Figure 1. The selected counties are circled.

Figure 1. Map of Selected Counties



Source: (E-Reference Desk 2008)

Overview of information needed to conduct the study

This multicase study focused on planning efforts within the State of Maryland and specifically within five counties that are employing some type of green infrastructure planning. In an effort to better understand the planning process relating to this type of conservation planning, the four research questions presented in section 3.1 were examined. The established framework for green infrastructure planning shown in Table 2, assisted in determining the information needed to conduct interviews and necessary documents. This framework was also used to code the data once it was gathered.

Table 2. Green Infrastructure Plan Framework

Plan Element	Process	Categories
Goal Setting	An essential first step – can be conducted at various scales and sets the framework for plan development where issues are identified followed by an outlining of the planning process	*1. Plan Foundation* *2. Stakeholder Involvement* *3. Conservation Vision*

	and ultimately defining plan goals – Consists of three criteria including plan foundations, stakeholder involvement and conservation vision	
Analysis	The setting of network design criteria and network suitability analysis based on landscape ecology, conservation biology and land use planning theories at the landscape level	*4. Network Design Criteria* *5. Network Suitability Analysis*
Synthesis	The creation of a planning framework that identifies priorities in terms of vulnerability threats and the feasibility of network construction to recognize implementation priorities, and relate to stated goals	*6. Network Design Model Enhancements* *7. Identifying Priorities* *8. Relationship to Plan Goals*
Implementation	Through the integration of conservation priorities and implementation tools, a strategic framework is created aimed at assisting reaching plan goals. Implementation and funding strategies are explored	*9. Decision-Support Tools* *10. Implementation Tools* *11. Conservation Funding* *12. Conservation Strategies* *13. Defining Development Opportunities*

Modified from: (McDonald et al. 2005)

The data sources for this study included semi-structured interviews with key informants from both the state planning and county agencies. These individuals were either closely involved in the creation of the green infrastructure plans or worked with agencies that provided assistance to the counties developing the plans.

In addition to interviews with key informants, the following documents were used as primary data sources (see Table 3).

Table 3. Document Sources by County

County 1 - Anne Arundel County

Document	Year	Type	Source
Anne Arundel General Development Plan	2009	General Plan	Anne Arundel County Office of Planning and Zoning
Anne Arundel County Greenways Master Plan	2002	Functional Master Plan	Anne Arundel County Office of Planning and Zoning

County 2 - Baltimore County

Document	*Year*	*Type*	*Source*
Baltimore County Forest Sustainability Program	2005	Strategy Guidelines	Baltimore County Department of Environmental Protection and Resource Management
Baltimore County Master Plan	2010	Master Plan	Baltimore County Office of Planning

County 3 - Cecil County

Document	*Year*	*Type*	*Source*
Cecil County Green Infrastructure Plan	2007	Natural Resource Assessment	The Conservation Fund
Cecil County Comprehensive Plan	2010	Master Plan	Cecil County Office of Planning and Zoning
Land Preservation, Parks, and Recreation Plan	2005	Amendment to Comprehensive Plan	Cecil County Office of Planning and Zoning

County 4 - Prince George's County

Document	*Year*	*Type*	*Source*
Prince George's Countywide Green Infrastructure Functional Master Plan	2005	Functional Master Plan	Prince George's County Planning Department & The Maryland-National Capital Park and Planning Commission (M-NCPPC)
Prince George's County General Plan	2002	General Plan	Prince George's County Planning Department & The M-NCPPC
Environmental Legislation to Implement the Green Infrastructure Plan	2010	Legislation	Prince George's County Environmental Planning Department

County 5 - Talbot County

Document	*Year*	*Type*	*Source*
Talbot County Green Infrastructure Plan	2004	Natural Resource Assessment	The Conservation Fund

Talbot County Green Infrastructure Technical Support Document	2003	Technical Document	The Conservation Fund
Talbot County Priority Preservation Area Plan	2010	Master Plan	Talbot County Office of Planning and Zoning
Talbot County Comprehensive Plan	2005	Master Plan	Talbot County Office of Planning and Zoning

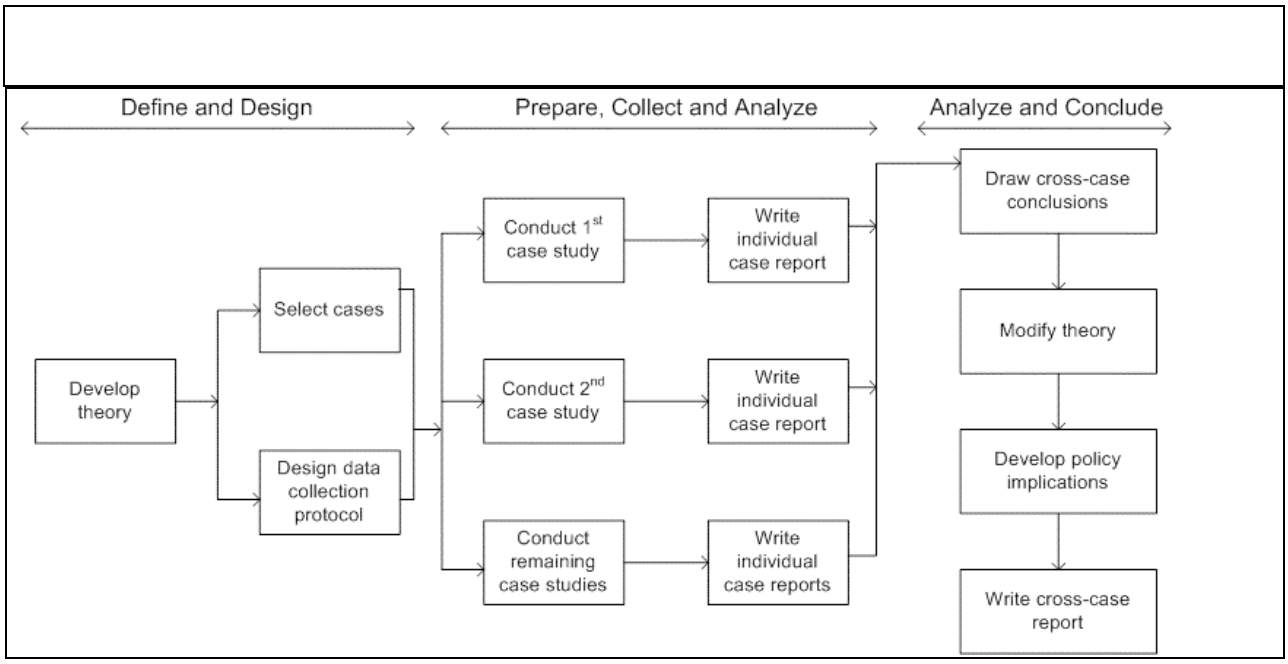
General State Documents

Document	***Year***	***Type***	***Source***
PlanMaryland	2011	Comprehensive Plan	Maryland Department of Planning
Maryland Statewide Green Infrastructure Assessment	2003	Natural Resource Assessment	Maryland Department of Natural Resources
Forest and Green Infrastructure Loss in Maryland 1997-2000, and Implications for the Future	2002	Land Conversion Assessment	Maryland Department of Natural Resources
Smart Growth Priority Funding Areas Act	1997	Legislation	Maryland Department of Planning
Rural Legacy Program	1997	Legislation	Maryland Department of Natural Resources
Program Open Space	1969	Legislation	Maryland Department of Natural Resources

Research Design

The research design that was used was adapted from similar case study methodologies shown in Figure 2.

Figure 2. Research Design



Modified from: COSMOS Corporation (Yin 1984)

The design of this research is based upon an epistemological inquiry of how knowledge is used in green infrastructure planning and how this relates to the planning process. Because the green infrastructure planning process is highly complex and requires the input from a wide range of stakeholders, a collaborative process was likely to assist in gaining community support as well as lead to increased rates of plan adoption by planning boards and increased levels of implementation. Based upon this initial premise, I selected counties in Maryland currently using some form of green infrastructure planning at a countywide scale and analyzed each unique planning process to explore if and how various forms of knowledge were used to carry out this planning activity.

Data Collection

The data collection protocol for this study is as follows: I began by collecting the various documents noted previously in Table 3. Following the collection of these documents, the

interview process began (see section 3.6 for criteria for interview selection). Twelve interviews were conducted that included the planners that led planning efforts, consultants directly related with planning activities, and public officials (See Appendix C for Interview Protocol). Any other relevant documents including print media were also collected during this stage.

Interview Process and Participants

Formal letters were sent to individuals who partook in the study and described the purpose of the study, an invitation for their participation, and requested a convenient date and time to conduct the interview (See Appendix B). The format of the interview was semi-structured where predefined questions and an allowance of time for follow-up, guided the open-ended interviews (Seidman 2006). Interviews were conducted either in person, by telephone, or through Skype and, upon receiving verbal permission from interviewees, all interviews were recorded and transcribed.

Interviews were conducted between August 2010 and March 2011. Table 4 is a listing of the interviews conducted and shows the agency that the interviewee represented, level of government, and how many people were interviewed from each individual agency.

Table 4. Interview Participants

Agency	Level of Government	# of Staff Interviewed
Maryland State Department of Planning	State	1
Maryland Department of Natural Resources	State	2
Anne Arundel County	County	3
Baltimore County	County	1
Cecil County	County	2
Prince George's County	County	1
Talbot County	County	1
The Conservation Fund	N/A Consultant	4
	Total Interviews	**15**

Data Analysis and Coding Scheme

Analysis is a flexible term for a process that requires (1) description of the data, (2) analysis (coding of text to reveal emergent themes) and (3) interpretation of the data by the researcher (Wolcott 2009). The challenge in collecting and analyzing this data is to make sense of large amounts of textual data and ultimately create a framework, which allows for the identification of significant patterns or themes. To analyze the individual case studies, a process of data reduction through coding was used to manage the high volume of textual data from document analysis and interviews. The data were analyzed through the use of codes established in an inductive approach where the themes emerged from the data (Strauss 1987; Dey 1993). Codes were developed theoretically prior to analysis and empirically as analysis occurred.

The identification of themes is one of the most fundamental tasks for a qualitative researcher (Ryan and Bernard 2003, 85). When discussing themes, they are abstract, fuzzy, constructs that are identified by investigators before, during, and after data collection (Ryan and Bernard 2003). Through the identification of themes, I explored how counties provided with comparable technical data (provided by the statewide assessment and various other resource related data) and similar coastal constraints used this knowledge together with experiential knowledge to develop green infrastructure plans. Because of the inductive nature of this study, analysis of data occurred throughout the entirety of this dissertation. A general typological analysis or thematic analysis was used in this study. Thematic analysis is a way of analyzing qualitative data and allows for a systematic method of encoding data to allow themes to emerge from the data without being imposed upon by the researcher (Boyatzis 1998).

Each county planning activity was individually as well as comparatively analyzed to explore the role that knowledge played in creating, maintaining and implementing this specific

type of planning endeavor. Data were coded based upon a previous theoretically related study (McDonald et al. 2005) (Table 5). As the study progressed, empirically derived categories emerged that were not captured in the initial framework (see Appendix F). These included planners roles, issues of scale, and participatory involvement of knowledge communities.

Table 5. Coding Scheme Based on McDonald et al. Framework

(GS) Goal Setting	(pf) Plan Foundations (si) Stakeholder Involvement (cv) Conservation Vision
(A) Analysis	(nd) Network Design (nsa) Network Suitability Analysis
(S) Synthesis	(ndme) Network Design Model Enhancements (ip) Identification of Priorities (rpg) Relationship to Plan Goals
(I) Implementation	(dsp) Decision Support Tools (it) Implementation Tools (cf) Conservation Funding (cs) Conservation Strategies (ddo) Defining Development Opportunities

Modified from: McDonald et al. 2005

The primary aim of using the McDonald et al. criteria was to explore the various plans based upon the same underlying process and establish the relationship between collaborative practices that were employed by the counties and the inclusion of experiential and expert knowledge communities. After collecting the data for each plan, an analysis of the individual county

planning processes, based on this framework, was conducted. Each of the individual codes was assigned a rating upon the conclusion of analyzing each county in its entirety (See Appendix F for full listing of code ratings). This included a review of both planning documents and interviews conducted for each individual county. Each code was then attributed with the following ratings: (0) No evidence in planning activities, (✓) Present in planning activities but not influential, and (✓+) Present and influential in planning activities.

The research questions are answered through a discussion of the findings and their relationship with theories pertaining to collaborative planning, knowledge communities, and the planning process. The analysis and synthesis of this data allows for reflection about the broader implications of this research and closes with the formulation of conclusions and the development of practical and research-related recommendations. Success of the plans is measured by level of adoption (formal, by reference), whether the plan has been incorporated as an element of the county comprehensive or master plan, integration of knowledge communities, if and how the plan is linked with related planning functions, whether the plan is included in the review process, and whether there has been measured achievement of plan goals.

Ethical Considerations

As with any research study where people are involved, there are ethical issues relating to the protection of the participants (Creswell 2009; Yin 1984; Patton 2002; Strauss 1987). Within social science research, the researcher is responsible for protecting and informing participants and, as part of the research process, potential participants voluntarily cooperate in the study. During the initial enlisting of participants, they were individually informed of the purpose and scope of the study. It was anticipated that no ethical threats would be posed to any of the participants in terms of well-being or professional position. Upon seeking approval from the

East Carolina University Institutional Review Board data collection and interviews, with key informants began.

To ensure the protection of participants, informed consent was crucial throughout the duration the data collection portion of the study. Each participant was provided a written consent that they would voluntarily proceed with the study and could choose to stop participating at any time during the process. The names of the participants remained confidential throughout the study with participants being identified using the county or agency they represent. Interview data were compiled and transcribed on my home computer.

Issues of Trustworthiness

Quantitative and qualitative research differs in how issues of trustworthiness are measured. Quantitative research tends to focus primarily on internal and external validity, generalizability, and reliability (Creswell 2009). Within qualitative research, the ability to establish trustworthiness is sought by the researcher (Marshall and Rossman 2010). Guba and Lincoln (1998) suggest that within qualitative research the establishment of trustworthiness is attained through credibility, transferability, confirmability, and dependability. The potential for bias exists throughout the dissertation process and by adhering to these safeguards for trustworthiness; it will help to minimize bias.

Credibility is synonymous with validity in quantitative research. Credibility is determined by whether the findings are accurate and credible from the perspective of the researcher, all participants, and the end reader (Creswell 2009; Marshall and Rossman 2010). This study will achieve credibility by: (1) improving information richness through continuously evolving the research process, (2) triangulation of methods including document analysis,

interviews, and other relevant data sources, (3) review by interview participants to ensure accuracy of written narratives.

Generalizabilty is not an intended goal of this study, but rather transferability. Transferability is defined as how the reader determines whether and to the extent that a particular phenomenon within a certain context can transfer to another particular context (Lincoln and Guba 1985). Because no two planning processes or instances are exactly the same, a substantial description of contextual information, background on each county, and details regarding their planning processes will allow the reader to extract transferable inferences that may be applicable to other planning efforts.

Dependability is similar to reliability within quantitative research. This refers to whether the findings of the research can be replicated in similar studies (Creswell 2009; Yin 2009; Lincoln and Guba 1985). It is important within this step that the findings are consistent with the data collected. To ensure dependability an "audit trail" of interview recordings and transcriptions, copies of all documents, and detailed records of the analysis process was created throughout the duration of the study. Similarly, in regards to confirmability, the findings of this study will be a result of the research rather than biases and subjectivity of myself. The audit trail mentioned for ensuring dependability will also be an invaluable tool for ensuring confirmability.

Summary

The goal of this research is to examine how knowledge is used in a green infrastructure planning approach. The application of qualitative methodologies is used for this study because it is a preferred strategy for exploring phenomena that is found in a real world context (Yin 2009). This study explores an existing framework that is currently used to guide planning efforts is used as the foundation to analyze the involvement of various knowledge communities. As I began to

analyze the process under which these plans were created and implemented, I followed appropriate methods of data collection, analysis, and reporting to gain a better understanding of the role of the planner in this process, how knowledge communities are involved, and how collaborative practices amongst stakeholders can ultimately influence the process. Each county was analyzed individually followed by a collective analysis where themes are identified. The establishment of themes was then used in the synthesis and analysis section of the study to relate to theories pertaining to collaborative practices, planning processes, and the inclusion of multiple knowledge communities.

CHAPTER 4 – CASE STUDIES

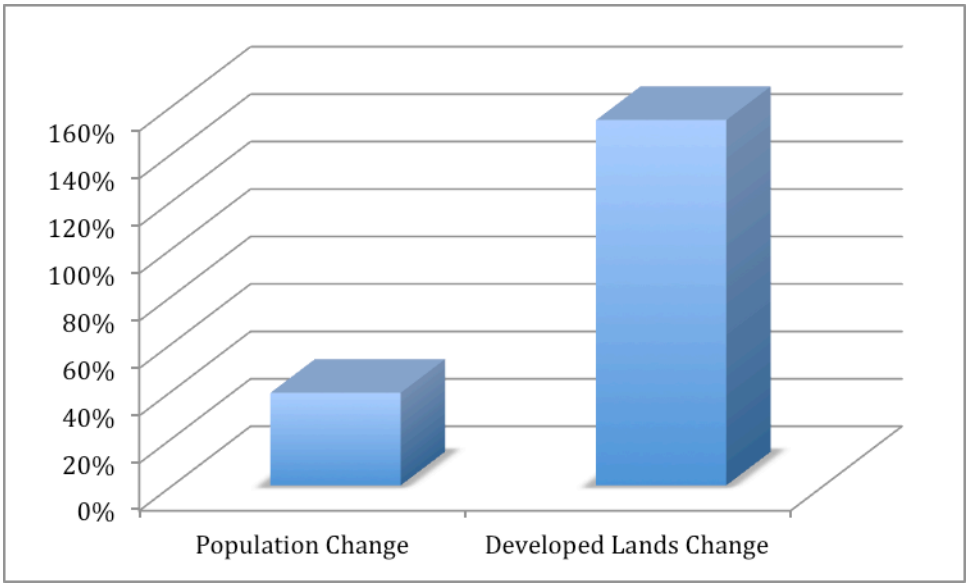
Maryland

The setting of this study takes place in Maryland, United States. Maryland was identified as an ideal location for this research because of the relatively progressive green infrastructure planning approach that has been adopted by the state as their primary mode of identifying and protecting areas with significant environmental importance or value. Due to the issues of scale surrounding some of the research questions, it was also important to choose a state that has gone beyond a statewide assessment of green infrastructure to countywide plans that promote the implementation of both state and local conservation goals. At the time of this study, there were five counties in Maryland that had created some form of green infrastructure plan either internally or with the assistance of outside consultants or agencies. These counties include Anne Arundel, Baltimore, Cecil, Prince George's, and Talbot. This chapter presents the findings from a review of the overarching Maryland Green Infrastructure Assessment, which served as the catalyst for each individual county effort. Additionally, this chapter presents the findings for each of the individual counties based upon interviews with key informants and is supported by a review of relevant documents.

State of Maryland's Green Infrastructure

The State of Maryland has faced a tremendous rise in population, and along with this rise came an increased rate of land-use conversion. However, development continues to outpace population growth (Chart 3). Between 1973 and 2010 population has increased 39 percent while developed land increased 154 percent from 654,000 acres to 1.6 million acres(The Maryland Department of Planning 2011).

Chart 3. Percent Change in Population and Developed Lands 1973-2010



Modified from: (The Maryland Department of Planning 2011)

These activities can have a tremendous impact on the natural lands that are found within these areas. Maryland commonly refers to these lands as its green infrastructure. In an effort to conserve these lands, Maryland has adopted a green infrastructure approach to conservation planning. This approach is used throughout Maryland at various scales ranging from large landscape-scale lands, municipal or county specific initiatives, and local site-specific instances aimed at recognizing and protecting green infrastructure. Some examples of green infrastructure found throughout the State of Maryland include the Assateague Island National Seashore, state and local parkland along the Patuxent River, and tidal marshes at Blackwater National Wildlife Refuge and Fishing Bay Wildlife Management area on the eastern shore. These are only a few of the areas of the state's identified green infrastructure.

The integrity of Maryland's green infrastructure has been threatened by development, which is increasing rapidly as suburban areas expand and residential homes are built in previously rural areas. Historically, much of this development has occurred in a scattered pattern

leading to fragmentation within the landscape and excessively sprawling areas. Since the early colonization of Maryland, the quantity of forest and wetlands has decreased by over 50 percent (Maryland Department of Natural Resources 2003d). This increased fragmentation of ecologically significant forests and wetlands has led to a great loss in biodiversity throughout the state. There are currently only 2,000,000 (approximately 25 percent of total acres) acres of ecologically significant land that has not been influenced by some type of human development remaining in Maryland's approximately 7,940,480 total acres. Nearly 6,211,200 acres are land and 1,728,000 are water. Three quarters of this state green infrastructure is currently unprotected (Maryland Department of Natural Resources 2003d). In an effort to protect the remaining green infrastructure, the state has focused conservation efforts on high priority green infrastructure areas, striving to maintain the ecological integrity of its natural resources for future generations; specifically its provision of ecosystem services.

The concept of green infrastructure was used and discussed in other states prior to Maryland. States such as Florida, Massachusetts, and New York were establishing green infrastructure methods and plans that would support a well functioning planning system helping to guide development and assist in planning decisions. It wasn't until 1999 that Governor Parris N. Glendening presented a new vision for his state. After celebrating his second inauguration, he focused on promoting what he called the " 3E's" -education, environment and equality. This vision set the stage for future protection of Maryland's green infrastructure. Governor Glendening made smart growth a priority. One of the greatest contributions of Glendening's Smart Growth Policy was the development of Priority Funding Areas (locally identified areas designated for growth) and the Rural Legacy Program (locally identified rural land conservation areas). Smart growth policies were a major component of his environmental package, which

included $70 million-$140 million in funding to preserve Maryland's forests, open space and farmland (Anonymous1999). Additionally he included $12 million for removing nutrients from the Chesapeake Bay as well as its tributaries in an effort to combat pollution caused by sprawling development. The Glendenning administration is also credited with passing the GreenPrint Legislation that authorized land conservation funding to conserve high priority land in the state's identified green infrastructure network (Defenders of Wildlife). This administration's vision set the stage for green infrastructure planning to be embraced by the State of Maryland as a statewide approach and vision for conservation of the states most valuable natural resources.

Prior to the state conducting an analysis of its green infrastructure, many counties were facing extreme pressure from rapid population increases and the subdivisions that soon followed. During this period some of the counties hit hardest were located in southern Maryland and included Calvert, Charles, and St. Mary's County (Shields 1999). As it became more evident that a comprehensive strategy was necessary to conserve and protect valuable ecosystems, the Maryland Department of Natural Resources (MD-DNR) began to focus on green infrastructure planning. Traditionally, Maryland's approach to land conservation was focused on the concept of greenways and linear river corridor conservation. Resource managers began to build awareness, that although the greenways and river corridor programs were very good, they were missing out on proactively protecting large pieces of intact habitat. It became highly evident that the issues of sprawl and habitat fragmentation were having a very significant effect on the integrity of the state's ecosystems. Based on planning efforts occurring in other parts of the country, Maryland recognized that it was important for green infrastructure to be identified prior to the development of strip malls and subdivisions (Interviewee MD-DNR1 2011).

Maryland Green Infrastructure Assessment

In 1996, Maryland based its initial green infrastructure activities on what other states and counties were doing, specifically in Florida. They extensively analyzed the Florida model and commissioned Baltimore County to be a test study for the overall state approach. Baltimore County was provided a grant by the MD-DNR and was on contract to help layout the potential framework and methodology (Interviewee MD-DNR1 2011). Initially, it was referred to as a geographic information system (GIS)-based methodology for establishing a Greenway corridor system in a fragmented forest landscape. Various ecologists within MD-DNR, as well as members of the United States Environmental Protection Agency (USEPA), spearheaded the initiative. This collective effort stemmed from a concern about fragmented landscapes and a need to proactively look at the landscape in context with existing planning conservation, restoration activities in a systematic approach (Interviewee MD-DNR1 2011). A MD-DNR staff member stated, "it was important to establish a framework that contains a system of ecological networks which gave meaning to how places and sites fit into the bigger picture from a landscape perspective" (Interviewee MD-DNR1 2011).

In the late 1990s Maryland began reviewing literature and available data pertaining to green infrastructure and performed a course-scale landscape analysis with imaging to include a wide range of ecosystem elements. Most of the data used for the assessment came from internal data sources as well as standardized national or state data sets (Interviewee MD-DNR1 2011). Data sets used for the assessment consisted of the U.S. Geological Survey's Multi-Resolution Land Characteristics Consortium (MLRC) data from the early 1990s as well as land-use land cover data from 1997, generated by the Maryland Department of Planning. Collaboration on relevant data sets to be used was conducted within MD-DNR and once maps were compiled they

were taken out to the county offices throughout the state and requests for alterations to the map were made by MD-DNR to these county offices. Within this analysis, a team of scientists used GIS data to identify a green infrastructure network. In order to adhere to this set of principles, a classification of lands located in the state became necessary. The assessment led to the identification of two distinct areas referred to by the state as hubs and corridors that were later mapped in the Maryland Atlas of Greenways, Water Trails, and Green Infrastructure (Maryland Department of Natural Resources 2000). The subsequent creation of a ranking system was necessary to assess hubs and corridors and to identify areas that held the highest ecological value in order to prioritize future conservation activities (Weber, Sloan, and Wolf 2006).

The network identification effort was carried out through a partnership with the MD-DNR's Chesapeake and Coastal Watershed Service, other state agencies, conservation groups, land trusts and representatives from individual counties (Maryland Department of Natural Resources 2003c). The atlas was published in four-year increments with the 2000 effort being the first to include green infrastructure. The document consisted of a description and maps of 23 counties and Baltimore City. This was also the first time that water trails had been included in the document. The maps within the document differed, whereby the greenway maps showed lands that were protected and owned by the government or a conservation agency as well as lands under easement to a land trust or under agricultural easement. The green infrastructure maps did not specifically focus on protected lands but rather were based on a statewide assessment of ecologically significant lands, regardless of the ownership status of the land (Maryland Department of Natural Resources 2003c).

The Atlas, which has not been updated since 2003, was intended to serve as a guide for land acquisition activities by the Maryland Department of Natural Resources. Once the model

was completed, it was reviewed and tested against similar approaches that are commonly used in identifying natural resource lands (Maryland Department of Natural Resources 2003c). The green infrastructure maps created in this document would later serve as the maps used the 2000 GreenPrint Program. The map for each county can be found in Appendix G. There have been two versions of GreenPrint, which occurred under the Glendenning and O'Malley administrations. The program was initially created in 2000 and was made into law on December 5, 2001 under Maryland House Bill 1379. This was a five-year finding bill that authorized funds used to directly acquire high value green infrastructure lands. When the bill sunset in 2006, the existing Program Open Space (POS) was used to provide funding to high value green infrastructure lands. When Governor O'Malley came into office in 2007, he initiated a GreenPrint Program (not related to Glendenning's Bill) that identified specific geographic land areas, based on high ranking green infrastructure, and requires that these areas be conserved through Stateside Program Open Space (Maryland Office of the Governor 2008). This new GreenPrint program established an interactive mapper that allowed all partners in land conservation to see where the lands were located on a map and provided information on property ownership so that direct contact could be made with landowners who's property fell within targeted areas. This reflects the most current treatment of green infrastructure and subsequent implementation at the statewide level.

When green infrastructure was introduced in Maryland, the timing of the rollout of the statewide assessment aligned with new national support for green infrastructure. In May 1999, the President's Council on Sustainable Development identified green infrastructure as one of several key strategies for achieving sustainability (Mell 2008). In 2000, a green infrastructure assessment and subsequent maps were released and sent out for public comment. The complete

Maryland statewide Green Infrastructure Assessment was published in May 2003 and has provided a tool for people throughout the state from land-use planners to conservation planners. The influence of the assessment is evident from planning activities undertaken at the Department of Natural Resources down to site level planning activities often required during the development review process, which has subsequently helped to guide land preservation activities throughout the state. The primary reason for doing this assessment was best stated by interviewee MD-DNR1 from the MD-DNR:

> The reason for this was concern about a fragmented landscape and the need to proactively look at the landscape and our planning conservation restoration activities in a landscape based systematic approach…this provided a framework for the ecological network and also gave meaning to how places and sites fit into the bigger picture from a landscape perspective (Interviewee MD-DNR1 2011).

The identification of the network was central to the landscape assessment that was published by the state in 2003. In order to help identify and prioritize statewide green infrastructure, the Green Infrastructure Assessment (GIA) tool was created.

The statewide GIA was a scientific exercise using spatial resource assessment data and GIS tools that were based on key data sets such as land use/land cover (LULC), National Wetlands Inventory, topographic data, streams, and road networks derived from established data sets (Interviewee MD-DNR1 2011). The analysis also relied heavily on spatial resource assessment data that was collected by various resource experts across the Maryland Department of Natural Resources. Principles of landscape ecology (multi-scale approach, pattern: process relationships, connectivity) and conservation biology (hub and corridor concepts) were used to guide the exercise and provided a consistent approach for evaluating land conservation and restoration

activities going forward (Maryland Department of Natural Resources 2003d). GIS was used to combine various layers of spatial data and was based upon McHarg's overlay method used for determining development suitability (Weber, Sloan, and Wolf 2006, 94-110). In addition to county-scale data, some of the data used were collected from local groups to include areas that were considered to be locally significant. Interviewee MD-DNR1 described the data that was used to create the assessment:

> Most of the data came from internal data sources and then standardized national or state data sets. We got a lot of information from different resources even from the department, which was challenging. Once maps were developed staff took the maps out to the county offices and had them review the maps throughout the state, while adhering to certain thresholds. Issues came up where counties felt they didn't have enough of their county included in the network. In those instances we did crank the thresholds down a bit in order to pull in some of the more locally significant green infrastructure features. (Interviewee MD-DNR1 2011).

The GIA was adjusted to account for changes based on local government input to produce the finalized GIA. It specifically attempted to recognize a "variety of natural resource values, how a given place fits into a larger system, the ecological importance of natural open space in rural and developed areas, the importance of coordinating local, state and even interstate planning, and the need for a regional or landscape-level view for wildlife conservation" (Maryland Department of Natural Resources 2003b).

The statewide GIA has been used as the basis for individual county efforts to identify their own green infrastructure, at a smaller scale, and provide tools for the implementation of conservation objectives. Although the Maryland GIA is used as a benchmark for counties

attempting to create their own green infrastructure assessment, some of the data are outdated (Interviewee MD-DNR1 2011). The use of newer data sets under the current administration is evident as well as the role of the current GreenPrint program:

> As the new administration came in, we were asked to define more precise refined land conservation targets. So we re-analyzed the green infrastructure and pulled in some other data sets but we really didn't reanalyze the green infrastructure we just defined where our state land conservation priorities were going to be. We formed an interagency team and our ecology team that had my group in it and that did green infrastructure. We also had the heritage program, which does rare, threatened, and endangered (RTE) habitats, and our Maryland biological stream survey. We also worked with the forest service being directed by the Bay Program to identify where in the state's forests were that were most important for protecting water quality. It was essentially a water kind of ecosystem approach protection layer (Interviewee MD-DNR1 2011).

As these groups came together, they were tasked with identifying the highest priorities for green infrastructure by focusing on aquatic biodiversity hotspots, RTE species and their habitats and forests important for protecting water quality. Once all of this information was gathered, it was merged and became a new data layer known as targeted ecological areas. These areas were then used to make up the new land conservation priorities for state. The creation of GreenPrint was described as an additional data tool that fit into the state's larger initiatives for identifying and creating a process for protecting green infrastructure. Although the scope of GreenPrint has changed (from a bill under the Glendenning administration to a program under the O'Malley administration) since its inception, there was a great deal of confusion amongst the interviewees in this study regarding the current role of the GreenPrint program.

Other Notable State Programs

Environmental planning in Maryland is sophisticated and there are various programs and planning criteria that help to guide planning activities. In addition to green infrastructure planning the following are some programs that are used to help restore, protect, and conserve natural resources in the state and provide leverage to implementing green infrastructure initiatives. These programs have focused on preserving open space and agricultural areas as well as engaging landowners in planning activities aimed at supporting the preservation and integrity of environmentally sensitive areas.

MD-DNR is actively involved in statewide land acquisitions and conservation endeavors. MD-DNR actively supports several programs that focus on conservation, which include Program Open Space (POS), Maryland's Rural Legacy Program (RLP), The Maryland Environmental Trust (MET), The Maryland Natural Heritage Program, etc. (Interviewee MD-DNR1 2011). Table 6 shows each of the state programs, which is related to green infrastructure planning throughout the state, as well as a short description of the aim of the program.

Table 6. Maryland Programs Related to Green Infrastructure

Program	Description
Program Open Space	Established in 1969, POS acquires outdoor recreation and open space areas for public use
Rural Legacy Program	Provides the focus and funding necessary to protect large, contiguous tracts of land and other strategic areas from sprawl development and to enhance natural resource, agricultural, forestry and environmental protection through cooperative efforts among state and local governments and land trusts
Conservation Reserve Enhancement Program	Established in 1997 CREP pays landowners to

(CREP)	protect environmentally sensitive areas on their property

The planning activities undertaken by MD-DNR are based upon green infrastructure and help to support Maryland's Smart Growth, GreenPrint, and BayStat initiatives (Maryland Department of Natural Resources 2011).

Agricultural lands are classified as part of Maryland's green infrastructure. Another program that is prevalent is the Maryland Agricultural Land Preservation Foundation. This program was established in 1977 and is supported by the State Department of Agriculture and assists in purchasing agricultural easements that restrict development for farmland and woodland (Maryland Department of Agriculture 2011).

These programs have all focused on specific resources but have been guided by the statewide GIA for directing these various programs (Maryland Department of Natural Resources 2003b). The statewide GIA is a resource assessment unlike these existing land conservation programs and has been used as guidance whereby these conservation programs are ultimately implementing the state's green infrastructure assessment. The option for public involvement within these programs is extensive and green infrastructure planning, at the county and local scale, supports these statewide programs.

Green Infrastructure Planning at the State Level

Green infrastructure planning has manifested into a larger statewide planning context for Maryland. The data derived from early green infrastructure mapping and the current GreenPrint program has been used for statewide planning efforts. Targeted areas for preservation from GreenPrint are used as part of the PlanMaryland initiative, which is the state's first development plan. GreenPrint is one cornerstone of a tripod for land use visions under PlanMaryland that

focuses on where the state conserves agricultural lands, ecologically significant lands and where the state grows by redefining their policies of smart growth into "growthprint" areas (Interviewee MDP1 2011). PlanMaryland is the first state comprehensive plan focused on sustainable growth and development. An interview with a member of the State Department of Planning explains the context of PlanMaryland along with its relationship to other programs such as GreenPrint, AgPrint, and GrowthPrint:

> Here in state planning we tend look at the world only if it's within or outside a priority funding area. We need to better target within our priority funding areas where most of the action is. We have areas where community development revitalization is going on which is why we are trying to do this new effort called GrowthPrint. You can bring all of these programs together: GreenPrint, AgriculturalPrint, and GrowthPrint to understand PlanMaryland, which is the first state development plan. It's really to a larger extent a geographic manifestation of what the PlanMaryland is about and this is how the concept of green infrastructure has manifested itself in Maryland and has grown (Interviewee MDP1 2011).

Green infrastructure is a concept that is taken seriously at the state level and is incorporated with other landscape scale initiatives. At the time of this study, GreenPrint and AgPrint have been publically launched but GrowthPrint has yet to be launched. The State Department of Planning staff member explains the current status of GrowthPrint:

> We've talked about it we've shared our rough draft map with local governments and it's been in a conceptual stage open for discussion. We have talked to the state growth commission about it and we have talked to all of the local planning directors about it so it's been out there but we have not given it any kind of official status yet and that might

change soon so stay tuned but the governor is interested in it so it might take a more formal form soon (Interviewee MDP1 2011).

The State Department of Planning has mapped Land Use/Land Cover data through GIS for 1973, 2002, 2030 (based on current trends), and 2030 (Smart Growth Policies) (Maryland State Department of Planning 2010). These maps are available in Appendix H. The maps show that with the implementation of smart growth policies (which encompass the state's GreenPrint or identified Green Infrastructure) the growth will be more concentrated in areas that have been identified as areas designated for growth.

PlanMaryland, which is the overarching planning endeavor, is a statewide development plan that aligns with the Maryland Smart, Green, and Growing initiative. PlanMaryland incorporates green infrastructure as something integral to the various "print" programs falling under the GreenPrint portion. The authority for this development plan is held under the Annotated Code of Maryland under the State Finance and Procurement Act section 5-601 – 5-615 and "provides that the Secretary of Planning prepare a State Development Plan containing recommendations for land use, major public works, circulation, and areas of critical state concern" (Office of the Secretary of State 2005, 5-601-5-615). The goal of PlanMaryland is to improve coordination and cooperation among state agencies and local governments and to leverage federal resources (Maryland State Department of Planning 2010). Like many of the county green infrastructure planning efforts, collaboration is a key component to PlanMaryland and the interaction between various agencies and stakeholder groups is presented in a timeline of PlanMaryland activities. The following table is a timeline of PlanMaryland and the subsequent actions taking place:

Table 7. PlanMaryland Timeline

Date	Action
November 2007	Maryland Department of Planning (MDP) held nine Smart Growth Listening Sessions (over 600 citizens and officials attended)
November 2008	MDP staff created a project schedule that set forth the two year effort to create the state growth plan and formally named the initiative PlanMaryland
November 2008	MDP began facilitating meetings with various state agencies to gain input for the state growth plan and sought concerns from these agencies
November 2008	MDP interviewed leaders of various stakeholder groups. The goal of these interviews was to get an initial understanding of current issues for a wide range of stakeholders and how this related to statewide growth and development
November 2009	From March 19 to June 16, 2009 MDP held 13 regional Public Forums. This was the second round of public outreach and hundreds of citizens gathered to discuss attitudes and opinions about Maryland's 12 Planning Visions
November 2009	MDP launched a Facebook page dedicated to PlanMaryland and provides updates and information
March 2011	PlanMaryland website is launched and is aimed at keeping stakeholders up-to-date on the progress of the plan and provided the preliminary findings of state analyses. Documents available on the site also provide constituents with an idea of the progress and direction of the initiative
April 2011	The first draft of PlanMaryland was released to the public
May 2011	MDP will open a 120-day period open for public comment for residents to submit comments to the draft plan. This period will end September 1, 2011

May – June 2011	There will be eight open houses throughout the state making up the second round of public forums. Staff will be present to answer questions and stakeholders are encouraged to ask questions and provide feedback
September 2011	MDP will perform plan revisions based on all prior meetings with state and local agencies and organizations as well as information gathered through all outreach sessions
October 2011	The final plan is scheduled to be completed and will be presented to the governor
October 2011	Secretary Richard Hall will deliver the final plan to Governor Martin O'Malley
April 2012	PlanMaryland Area Guidelines finalized

Adapted from: (Maryland State Department of Planning 2011a)

There is an extensive public participation and outreach component of the PlanMaryland initiative. Outreach and public participation includes interviews and meetings with stakeholders, public forums, and Internet surveys. All 13 forums were held at community colleges, colleges, or universities throughout the state. The forums have had over 600 participants, who have included residents, planners, architects, and public and elected officials. There has also been representation from eight state agencies and eleven NGO's and local governments (Maryland State Department of Planning 2011a). Some of the major comments from these forums that directly pertain to green infrastructure include the following:

- Public participation is working but no one is listening
- Buffer regulations are more restrictive than other places. Environmental protection regulations enacted by the State, the County, and the Federal are working
- People have good access to parks, open space, and recreational facilities

- There is a need for a Paradigm Shift –for regulatory/social norms to make the environment an equal partner
- Need for better communication of plans visually (Maryland State Department of Planning 2011b). Samples of comments from the individual forums are available in Appendix I.

From the 13 forums that were conducted only two of the forums contained specific mention of green infrastructure or the state's GreenPrint program. There were concepts within these forums that are relevant to green infrastructure and themes emerged from the topics and concerns discussed during these meetings. The need for better public participation, implementation deficiencies, and a greater need for coordination among state and local agencies were all mentioned in each of the thirteen forums.

Anne Arundel County

Anne Arundel County lies in the heart of Maryland and bears a close proximity to Baltimore and Washington, D.C. The county was founded in 1650 and is home to the capital of Maryland, Annapolis (Anne Arundel County Government 2010b). The county totals 588 square miles with 416 square miles of land and 172 square miles of water (U.S. Census Bureau 2010a). The population in 2010 was 537,636, which increased 9.8 percent from 2000 population data (U.S. Census Bureau 2010a). Anne Arundel borders the Chesapeake Bay on its eastern side and contains more coastline on the Bay than any other part of Maryland extending over 534 miles (Anne Arundel County Government 2010a).

Anne Arundel County is granted the authority of planning and zoning by Article 25A of the Annotated Code of Maryland (Maryland State Legislature 2009). The Office of Planning and Zoning is designated by the Anne Arundel County Code to prepare and maintain, with necessary updates, a countywide comprehensive plan that is used to guide growth and development (Anne Arundel County Government 2010b). Within the county the comprehensive plan is referred to as a General Development plan and was created in 1968. The plan was updated in 1978, 1986, 1997 and 2009. The 2009 General Development Plan was approved by the County Council, under Bill No. 64-09, on October 19, 2009. The 1997 General Development Plan recommended ways in which the county might better conserve the environment, which ultimately led to the creation of the Anne Arundel County Greenways Master Plan (Anne Arundel County Government 2010c).

In 2001, Anne Arundel County Technical Advisory Committee which included the Department of Recreation and Parks, Office of Planning and Zoning, a consulting team and other county resource agencies prepared the Anne Arundel County Greenways Master Plan (Anne

Arundel County Office of Planning and Zoning 2002, 1-79). The creation of this plan stemmed from the merging of three efforts that recommended the creation of a greenway network, which included the State of Maryland's greenways and green infrastructure assessment, the Anne Arundel County's 1997 General Development Plan and Small Area Planning program, and the Anne Arundel County's land preservation and recreation planning program. The plan was formally adopted as county policy in October 2002.

Anne Arundel County Greenways Plan

Beginning in 2001, Anne Arundel County was the first state to respond with its own green infrastructure plan after the State of Maryland began exploring green infrastructure. Although the plan is not called a green infrastructure plan, its methodology for producing the plan as well as the themes and primary objective all align with those of green infrastructure planning. At the time this study was conducted some records from the original planning process were unable to be attained because the activities occurred over ten years ago, and many of the documents such as meeting minutes were not retained. Interviews with principal investigators from both the county and outside consulting agencies were conducted and helped to fill some of the gaps in the data.

The initiation of the Greenways Plan was based upon recommendation within the General Development Plan (GDP) that existed in 2000. The County adopted its first GDP in 1968 and has had updates in 1978, 1986, 1997, and 2009. The GDP is the comprehensive plan developed for the county to guide growth and development. The Anne Arundel County Code designates the Office of Planning and Zoning to periodically update its GDP. The 1997 plan was the first of the states' GDP's to comply with the Resource Protection and Planning Act of 1992 as well as the "Smart Growth" legislation and the Smart Growth Priority Funding Areas Act of 1997. The

1997 GDP was the first of the states' comprehensive plans to include a generalized Land Use Plan, which was aimed at guiding where development should occur. There were many recommendations within Chapter 4 of the GDP that came from the greenways plan including the following:

- Identify environmentally sensitive areas for acquisition by the county;
- Identify and preserve greenways and open space through conservation easements;
- Develop a countywide greenways master plan and integrate it into regional greenway planning efforts (Anne Arundel County Office of Planning and Zoning 1997).

These recommendations have since been accomplished through the Greenways Master Plan.

Goal Setting

Anne Arundel County had a strong focus on including stakeholders in the greenway planning process and this was evident in the plan recommendations that came out of the 1997 GDP. Interviewee AAC1 describes this and how the Greenways Plan came to fruition:

> …the county was very good at involving recreation and parks, citizen groups, what we would call stakeholders into their general development plan update. We were part of the steering committee myself and the guy who was in charge of our planning who actually managed the acquisitions and development of the park plans. So we both were on the general development plan steering committee, which was very helpful, and I was also on the environmental steering committee for the environmental portion of it. One of the strong recommendations that came out of that plan was to develop a Greenways Master Plan. It was concurrent with the state developing its green infrastructure plan (Interviewee AAC1 2011).

The greenways plan was done concurrently with the state developing its statewide GIA. During this time there was a great deal of collaboration between planning staff at Anne Arundel County and at the state level. During the early stages of creating the Anne Arundel greenways plan the state was developing its statewide assessment but it had not been published yet. Interviewee AAC1 stated that planning staff "knew what was going on with the statewide plan" but needed their own plan that would have a "finer texture" or smaller scale than the state GIA. To assist in developing the plan, the county hired three outside consulting agencies that served as technical experts for the planning process. The planning effort was led by the Anne Arundel County Technical Advisory Committee, which included support from the following agencies:

- Anne Arundel County Department of Recreation and Parks
- Anne Arundel County Office of Planning and Zoning
- National Park Service
- Maryland Department of Natural Resources
- Maryland Greenways Commission (Anne Arundel County Office of Planning and Zoning 2002, 1-79)

Preparation of the plan took place between Spring 2001 and Spring 2002. There was a public involvement component of the planning process that included three informational newsletters, two sessions of public meetings held in the Fall of 2001 and Spring of 2002 and several meetings with various groups. There was also a project website that included a questionnaire where the responses were used to provide input for the Technical Advisory Committee. The questionnaire was available to anyone who wanted to respond and was available for public response for six months.

The goal of the plan was to create an interconnected network of open space (i.e greenways) that would prevent negative effects of development. The goal for the network was to:

> "Create an interconnected network of greenways in Anne Arundel County that protects ecologically valuable lands for present and future generations and provides open space, recreational, and transportation benefits and opportunities for people" (Anne Arundel County Office of Planning and Zoning 2002, 1).

A primary emphasis of this plan was the recreation aspect that was extremely important to the County Executive at the time (Interviewee TCF2 2011). Interviewee TCF2, who served as a consultant for the plan, described the feeling towards the plan being focused on recreation as well as the political support behind the plan:

> So the other thing that crept in was that the county executive at the time, who amazingly used this plan in her campaign in her reelection campaign, got an award from Governor Glendening, and she loved it. But she wanted to make sure that the people aspect, the recreation aspect was emphasized that it wasn't just ecological because if it's only adopted for the birds and the bees it may not sell politically. Throughout the plan is a, I wouldn't say an emphasis, but there is an aspect of it which is recreation but I would argue that it maintains, the integrity of the states intent. Rather than saying it's all about urban trails, we mentioned trails but I think that the plan was consistent with the states intent in my opinion (Interviewee TCF2 2011).

The plan defines greenways as "protected corridors of open space" (Anne Arundel County Office of Planning and Zoning 2002, 2). Although these areas are commonly associated with recreational use, the plan states that the county took a "primarily ecological approach to defining

greenways," and defines a greenway as "a hub or corridor meeting the minimum criteria for providing or connecting to existing or potential habitat areas for wildlife naturally occurring in Anne Arundel County" (Anne Arundel County Office of Planning and Zoning 2002, 2). The conservation vision of the plan sought to help achieve recommendations in various county, regional, and state programs including: Anne Arundel County's General Development Plan, Land Preservation and Recreation Plan, Small Areas Plans, the Chesapeake 2000 Agreement, and the Maryland GreenPrint Program. At the time of plan creation, each of these initiatives or programs included recommendations for greenways but the county felt there wasn't a consistent definition or approach (Interviewee TCF2 2011).

Analysis

The Anne Arundel Greenway plan was defined using an ecological approach utilizing the same hub and corridor system used in the statewide assessment. The county defined the average size of a hub as approximately 2,200 acres but some ecologically significant hubs were as small as 100 acres. The largest hubs were the Patuxent Wildlife Refuge and Jug Bay, which were over 18,000 acres. The design criteria for the plan focused on indicator species and the county selected locally occurring native bird, mammal, and amphibian species and used their habitat requirements to guide the selection of criteria for the ecological component of the greenways. There were six specific species that guided the process and included the downy woodpecker (Picoides pubescens), bobcat (Lynx rufus), white-tailed deer (Odocoileus virginianus), black bear (Ursus americanus), red fox (Vulpes vulpes), and red-spotted newt (Notophthalmus viridescens) (Anne Arundel County Office of Planning and Zoning 2002).

The selection of criteria was evaluated by a group of scientists and resource managers and was framed by concepts of conservation biology and landscape ecology. There was a set of

generalized findings that was concluded based upon the research conducted on the indicator species previously noted. The findings ranged from patch dynamics to habitat requirements for indicator species and this information provided the criteria that the greenways were planned around. Based on the findings the five following criteria were selected to identify potential greenways.

1. Habitat Value
2. Size
3. Connectivity
4. Future Potential
5. National and Countywide Trails (Anne Arundel County Office of Planning and Zoning 2002, 20).

The future potential criterion was based on the potential to create hubs and corridors where they do not currently exist, with particular attention being paid at critical connections (Interviewee TCF2 2011). Greenways were identified using the above criteria, which relied on scientific data. However, the process of selecting the greenways included various stakeholder groups that were not scientific experts but rather local stakeholders. This process included an analysis of different mapped information, existing studies, and aerial photographs of the county that were used to identify areas that met the criteria as well as areas where greenways could potentially occur in the future. Appendix J summarizes the list of sources that were used in the selection process. Input from the two public meetings were used during the selection phase and public participation included a workshop with local stakeholders that assisted in reviewing the initial concept greenways network (Figure 3).

Figure 3. Anne Arundel County Stakeholder Workshop

Figure 3. Courtesy of Clive Graham

Synthesis

The network that was established through this process was divided into 42 greenway segments that were named based on streams that were either adjacent to the area or ran through the greenway. Many of the information sources that were used were based on other state or county plans/programs such as Rural Legacy Program, Anne Arundel County Land Preservation and Recreation Plan, Chesapeake Bay Critical Area, and the Maryland Greenways Atlas. There was also a larger scale context, based on the Maryland Greenways Atlas, which included green infrastructure from neighboring counties including Baltimore, Calvert, Howard, and Prince

George's. Planning staff members felt that it was important during the design period that feedback from stakeholder meetings were incorporated into the network and used to guide and frame the protection of the proposed county greenway (Interviewee AAC1 2011).

Approximately 51% of the proposed greenway fell within protected areas which consisted of state, federal, county and City of Annapolis owned lands, agricultural and environmental easements, private conservation lands, and land that is designated open space by the county (Anne Arundel County Office of Planning and Zoning 2002, 26). The division of the greenway into segments, as noted previously, was a way of identifying priorities and was intended as an implementation or management strategy that would be used later in the planning process and allowed the individual segments to be treated as single greenways so that their function could be better assessed (Interviewee TCF2 2011). The plan also grouped each of the 42 greenway segments into 13 geographic groups to better manage connectivity within specific systems. The boundaries set by these geographic groups were designed to be changed at the implementation stage if necessary. These 13 plans allowed for a finer scale than the county plan provided and was viewed as a more desirable method for prioritizing protection needs during the implementation phase (Interviewee TCF2 2011).

The county greenways plan relied heavily on the statewide assessment and the network identified through planning activities conducted by the county aligned with those presented in the state's green infrastructure (Anne Arundel County Office of Planning and Zoning 2002, 1-79), (Interviewee AAC1 2011; Interviewee TCF2 2011). From a comparative perspective, all of the larger areas identified in the state's assessment were included in the county plan with additional areas added that held local and county - scale significance but were too small to be captured by the statewide assessment. There was however some possible greenway areas that

did not meet the strict criteria established by the county that was required for an area to be deemed a greenway (Interviewee TCF2 2011). It appears that the county planners and consultants responsible for creating this plan aimed to integrate the greenways network design into the larger statewide green infrastructure network that was previously established.

Implementation

The county greenways plan contained an extensive and detailed implementation strategy. The implementation component contained four specific strategies with 15 action items. The goal of the implementation strategies was to protect the identified greenway lands, encourage participation of private landowners, and to build a set of partnerships between the parties working to protect county greenways (Anne Arundel County Office of Planning and Zoning 2002). Throughout the implementation section there were four key strategies that were used to frame the implementation element for the proposed network which included; organization and outreach; planning and implementation; land protection and enhancement; and financing.

One of the products of the implementation element was the reorganization of the county structure that was better equipped to handle the greenways network that was relatively large in size and scale and more complex than other planning initiatives previously pursued by the county. The plan set forth a new structure that was intended to both create and manage the greenway network that was comprised of three levels. The three groups included a Greenways Program Manager employed by the county; a public component including local land trusts, greenway advocates, conservation organizations, etc; and an appointed Greenways Advocacy Committee (Anne Arundel County Office of Planning and Zoning 2002, 39). The plan acknowledged the initial input from county staff would drive implementation but that for implementation and future management to remain successful, there would need to be a

substantial public component that would play a role in planning activities. Upon the introduction of the plan to local citizens there was little resistance to the plan, which was seen as integral for successful implementation to occur (Interviewee AAC1 2011). Interviewee AAC1 described how the public reacted to the launch of the plan:

> There was skepticism, there was fear of government and there was the issue of takings. When we put lines on a map and say this is what we want to protect and if your property is underneath one of those shaded areas people got worried. We had to be very clear to people that this was not an acquisition project but rather an identification process. However that property got preserved was okay whether it was through dedication easements, development rate purchase, TDR (Transfer of Development Rights), whatever method was okay as long as the natural processes that we were trying to protect were insured (Interviewee AAC1).

Interviewee AAC1 went on to describe the outreach that was done by the county to educate the public on the plan as well as some general resistance that was faced by planners:

> We had to do a lot of education, we did a lot of public meetings and I think I was on the cable TV as much as anyone, we were on radio stations, newspaper articles, we went out to public meetings in every section of the county to try to describe this. There was a reluctance and fear present. We didn't actually get people opposing the plan because it was a plan, we had them opposing it because of their property rights (Interviewee AAC1 2011).

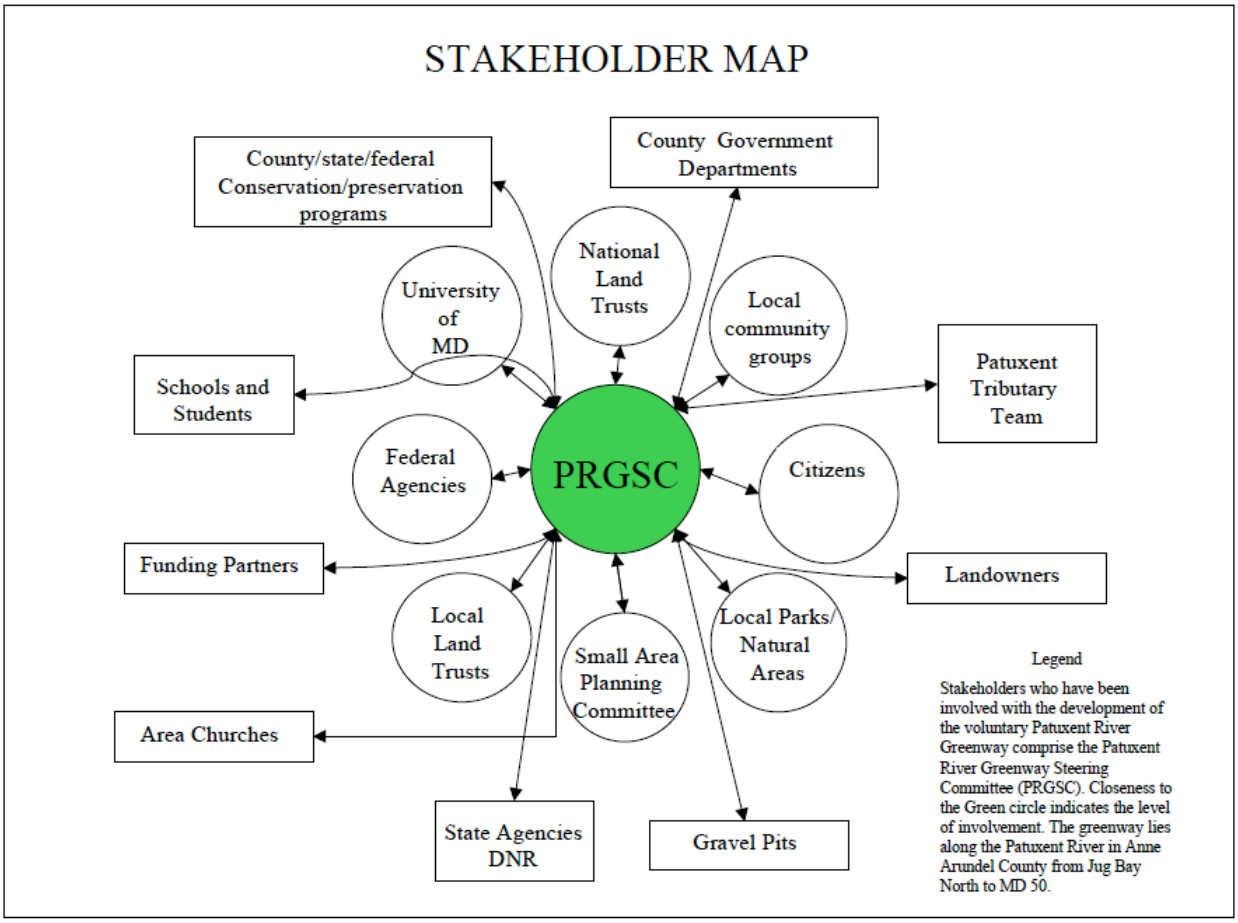
The time spent on educating the public provides evidence that the county understood that the future success of preserving green infrastructure didn't lie within the scientific or even conservation community but rather through the strength of public involvement. The plan noted

that in order to achieve the vision of the greenways network it would require a "considerable amount of localized on-the-ground planning and citizen involvement" (Anne Arundel County Office of Planning and Zoning 2002, 40). When asked during an interview, a planning staff member stated that the county knew the importance of having buy-in from local citizens and felt that this was very important to including local stakeholders early and often in the planning process and incorporate the knowledge provided by locals into the final plan (Interviewee AAC1 2011). Central to the inclusion of local stakeholders was the role that the program manager would plan in facilitating planning activities as well as integrating all of the knowledge acquired from local groups and the appointed greenways advocacy committee.

The plan outlined the expected role of the planning manager and suggested how this position would guide the planning process as well as ensure the overall success of the program. Some of the roles of this position included serving as a liaison to the County Executive and County Council on greenway issues; facilitate plan implementation and management; coordination of protection activities at the county, state, and federal level (specifically the state GreenPrint Program); participate in the development review process; conduct public meetings ranging from workshops to media relations; educate property owners and developers about greenways; and provide technical assistance to private landowners and groups (Anne Arundel County Office of Planning and Zoning 2002, 40).

Each of the individual greenways contain their own management plans with different groups of stakeholders involved throughout the planning process. Figure 4 illustrates a representation of the stakeholders involved directly with the Patuxent River Greenway and the participants that were included and actively involved in the identification of the greenway network as well as implementation.

Figure 4. Patuxent River Greenway Stakeholder Map



From: (Anne Arundel County Office of Planning and Zoning 2002, A-4).

This stakeholder map shows the extensive group of people and knowledge communities that were involved for only a portion of the county greenway network. This type of involvement was used for each of the 13 individual greenway plans.

Role of the plan

The Anne Arundel Greenway Plan was intended to be used as a primary component for the development review process. When speaking with the planner who oversaw the creation of the plan he stated the following regarding the intention of the plan and illustrated the long range vision that is critical for green infrastructure planning:

> Anne Arundel County actually has a very strong environmental component to its development review process and its long-range planning process and all of that because of a couple of factors. One is its proximity to the Chesapeake Bay which it has 432 miles of shoreline. Much of Anne Arundel County was under the jurisdiction of the critical areas commission. So Anne Arundel County had in its zoning laws specific regulations dealing with wetlands, sharing buffers, and steep slopes before they ever had a greenways plan. It looked at making critical connections where there were gaps, where there was fragmentation and the green infrastructure plan tried to develop a concept to connect those things, where it may have been connected in nature but already not protected. We were trying to develop a tool that would identify areas where development was appropriate and inappropriate, but also as a mechanism to protect those spaces, those gaps and those connections into the future (Interviewee AAC1 2011).

The original greenways plan remained in place until late 2010. In October 2010 the county published a Greenways Master Plan Implementation Report that summarized the progress made from 2002 through 2009. Additionally during the time since the completion of the greenways plan the county has updated its GDP, LPPRP, and completed several additional Small Area Plans.

The implementation report does not change the original greenways plan but rather provides an assessment of acres protected since the plans establishment, suggests where future activities should occur, and identifies opportunities for citizen involvement in the implementation stages of the plan. The report also lists several parkland acquisitions, agricultural and woodland preservation easements, and local land trust acquistions that have occurred since 2002 (Anne Arundel Department of Recreation and Parks and Anne Arundel

Office of Planning and Zoning 2010, 6). The report shows that unprotected greenway segments have decreased from over 49 percent in 2002 to 38 percent in 2009 due to implementation of the greenways plan.

Numerous implementation strategies have been accomplished since 2002. In 2002 the county set to establish a greenways program and, together with the Office of Planning and Zoning and the Department of Recreation and Parks, a Greenways Implementation Team was created. This team is responsible for implementation of the greenways plan, which includes, data management, public involvement activities, and planning activities. The team is also responsible for tracking the progress of the plan and updating the implementation reports for public information. In addition to the implementation team, the county thought it was very important to have several public involvement activities that would educate members of the community on the greenway efforts taking place as well as involve citizens in ongoing planning activities. Some of these events included the Land, Water, People conference in 2009, BioBlitz (2007 & 2009), Walk for the Woods (since 2006), Invasive Plant Control (since 2009), Patuxent Sojourn (since 2005), Cartop Boat Launch (2008), and Open Days at Hammond's Connection (2010) (Anne Arundel Department of Recreation and Parks and Anne Arundel Office of Planning and Zoning 2010, 12). Not only have these activities brought together the citizens of Anne Arundel, but many of these events involved neighboring counties such as Prince George's, Calvert, Charles, and Saint Mary's Counties along with several groups (Alliance for the Chesapeake Bay, Sierra Club, Patuxent Riverkeeper).

In the original plan adopted in 2002, the plan suggested the creation of a greenway's advocacy committee. Rather than create new committees the county found it to be advantageous to form partnerships with existing committees that already have established programs in place

and spend more resources on coordination among various advocacy groups rather than establishing new ones. Some of these partnerships included the South River Greenway Steering Committee, Dairy Farm Advisory Committee, Bacon Ridge Natural Area Stewardship Committee, Bog Committee, Coalition of Anne Arundel Land Trusts, and the Audubon Society MD-DC Chapter (Anne Arundel Department of Recreation and Parks and Anne Arundel Office of Planning and Zoning 2010, 13). These partnerships have led to the creation of several plans that have been useful for continued implementation of the greenways master plan. One plan in particular is the Jug Bay Wetlands Sanctuary Management Plan. The Jug Bay Wetlands Sanctuary is one of the most ecologically significant hubs within the greenways network, and this plan outlines land use practices, visitor management, and wildlife management polices for the preservation of critical wetland habitat that runs along the Patuxent River. The Sanctuary is a component of the Chesapeake Bay National Estuarine Research Reserve in Maryland (CBNERR-MD), which is a collaborative endeavor between Anne Arundel County, MDNR, and the National Ocean and Atmospheric Administration (NOAA).

The county also utilizes the master plan for daily planning activities specifically within the development plan review process. In an email correspondence with the long-range planner responsible for greenway planning I received the following response regarding how the county is currently using the plan:

> Yes, we use it in negotiating forest conservation provisions w/ developers during the development review process, in evaluating applications for agricultural & woodland preservation easements, in ranking properties under consideration for acquisition for preservation or passive park related purposes, and in partnering with local land trusts to preserve ecologically important sites (Interviewee AAC2 2011).

Within the county all subdivision and site development plans, as well as commercial development plans, must be reviewed as part of the development plan approval process. During this process the greenways network is consulted and in the case that development overlaps the network, county staff will work with the developer to encourage environmentally sensitive design and staff will also monitor the changes being made to the network (Interviewee AAC1 2011). County staff also noted that ongoing coordination with existing state and local programs that promote land preservation has been crucial for the implementation of the greenways plan. These include the Rural Legacy Program, Heritage Areas Program, and the Maryland Agricultural Land Preservation Foundation (MALPF).

Baltimore County

Baltimore County was founded in 1659 but there is little evidence regarding how the county was originally created. The population in 2010 was 805,029, which increased 6.7 percent from 2000 population data (U.S. Census Bureau 2010b). Baltimore County is located within the Baltimore-Washington Metropolitan Area and its county seat is located in Towson, MD. The county is located in the northern region of Maryland and contains both rural and suburban areas. There are 682 square miles within this county with 599 square miles classified as land and 83 square miles as water (U.S. Census Bureau 2010b). There is approximately 200 miles of tidal coastline that border the Chesapeake Bay and numerous publically and privately owned tidal and freshwater beaches (Baltimore County Environmental Protection and Resource Management 2009).

The Baltimore County Office of Planning is responsible for formulating the policies, plans and regulations that are implemented throughout the county (Baltimore County Office of Planning 2010b). The Office of Planning prepares a master plan for every 10 years and is responsible for overseeing the monitoring and implementation of this plan as well as zoning regulations. The office is also staff to the county Planning Board, Landmarks Preservation Commission and the Design Review Panel. In 2004 the county began the process of creating its countywide Forest Sustainability Program. The program was a pilot study that applied the Montreal Process Criteria and Indicators (MPCI) model that is used to measure the ecological and economic sustainability of forest resources (Department of Environmental Protection and Resource Management 2008). The project was conducted with numerous partners including the USDA Forest Service and members of the national Roundtable on Sustainable Forests.

Baltimore County is a growing area that lies within the middle of the urban corridor, most immediately between Washington, D.C and Philadelphia, P.A. The county contains the third largest population in the state with over 800,000 residents with distinctive urban and rural areas. The creation and adoption of master plans has remained a key component to planning activities in Baltimore County. The County began its creation of master plans in the 1960's and has adopted five master plans since 1967. The county was the first to delineate two separate land management areas classified as urban and rural and established an urban-rural demarcation line (URDL) in 1967 to promote growth in the designated urban areas and protect valuable natural and agricultural resources in the rural areas (Baltimore County Office of Planning 2010a). Subsequent plans were created in 1972, 1975, 1979, 1989 and most recently in 2010. The Master Plan 2010 supports concepts and policies that are consistent with Maryland's Smart Growth and Priority Places initiatives. The plan supports the Baltimore County Forest Sustainability Project, which has become one of the major environmental resource protection initiatives in the county.

Baltimore County Forest Sustainability Program

Baltimore County has been a leader in environmental planning for the last 50 years and was the first county in Maryland to do basic sediment erosion control in 1968. This was only the beginning of their commitment to preserving the valuable resources that lie within their county. Baltimore County is one of three remaining counties in Maryland that still have an environmental agency in place and contains no incorporated municipalities. Some of the major environmental resources located in Baltimore County are the numerous reservoirs, which make up the largest public water supply system in Maryland and provide drinking water to about a third of the state's population. There have been some notable environmental legacy issues

within the county consisting of high-density population growth with few environmental controls, large amounts of impervious surface, water quality issues, and Total Maximum Daily Loads (TMDL's – currently contain 21) (Interviewee BC1 2011).

The location of Baltimore County has led to a threat on the natural resources remaining in the area. With the rising population growth (197 percent increase between 1950 and 2010), an increasing urban economy, and low-density zoning aimed at protecting rural areas, there has been a steady increase of fragmentation and parcelization of the remaining forests in the county (Baltimore County Environmental Protection and Sustainability 2011b). This fragmentation has also led to a significant portion of these valuable resource areas to be less than 200 acres in size (see Table 8).

Table 8. Fragmentation of Baltimore County's Forest Resources

Baltimore County	Total Acres	Percent of County	Percent of Forest Land
Total Land Area (610 sq mi)	389,000	-	-
Forested Area	130,258	33%	100%
Forest area – private ownership	97,693	25%	75%
Forest area – public ownership	32,564	8%	25%
Forest in 200+ acre patches	57,313	14%	44%
Forest in 100+ acre patches	80,300	20%	65%
Forest in protective easements	14,000	4%	11%

Adapted from: (The Conservation Fund 2007b, 2)

While the geography of the county varies with portions of the county being located in the Atlantic Coastal Plain and the Piedmont region, the county has focused on forests and has subsequently established the Baltimore County Forest Sustainability Project (BCFSP). This project is identified as an exercise applying the principles of green infrastructure in an effort to identify significant areas in the county.

In addition to the BCFSP, Baltimore County played a critical role in the development of green infrastructure planning for the entire State of Maryland. In early 1995 the Maryland Department of Natural Resources (MD-DNR) approached Baltimore County as they began working on a pilot study for green infrastructure. MD-DNR aimed to work with a county that had an extensive data warehouse and GIS capabilities (Interviewee BC1 2011). Interviewee BC1 described the process of working with MD-DNR on the initial green infrastructure network:

> Maryland DNR came to us and said 'we are struggling with how to identify this network and map them on a fine scale.' We did two contracts to try to find some happy medium. We had GIS capabilities and they were hoping that we would be able to develop a method that we could use. We were trying to come up with an approach to look at an entire jurisdiction, like a County, and start assessing the forest covers, stream network, and so on in a watershed context. We picked the highest-ranking watersheds and then worked down to sub watersheds, patches, and individual properties. We were getting to a level (parcel) that identified the landowners we needed to work with. We did statistical testing on the method and we applied it to the whole watershed in the County (Interviewee BC1 2011).

This process allowed for Baltimore County to be involved in the early phases of green infrastructure planning in the State of Maryland and helped to set up the future conservation activities that the county would soon embrace. This also was important for identifying the stakeholders who could be involved in planning efforts (specifically the Steering Committee). By being involved in the initial phases of the statewide assessment, the county was also introduced into the Montréal Process case study, which had a major influence on their current forest sustainability program.

Montréal Process Criteria and Indicators

After the county worked with MD-DNR on the initial green infrastructure assessment, they were approached in 2001 by the US Forest Service to participate in a similar project titled *Linking Communities to the Montréal Process Criteria and Indicators*. The process was created in Geneva, Switzerland in 1994 and established an international effort to identify the criteria and indicators used for the conservation and sustainable management of temperate and boreal forests. Participation in the Montréal Process Working Group is voluntary with 12 participating countries around the world. Criteria are defined in the process as a "category of conditions or processes by which sustainable forest management may be assessed", while an indicator is defined as a "quantitative or qualitative variable which can be measured or described and which, when observed periodically, demonstrates trends" (Humphreys 1996, 139). The process identified seven criteria that are further defined by 67 indicators. The seven criteria are as follows:

1. Conservation of biological diversity
2. Maintenance of productive capacity of forest ecosystems
3. Maintenance of forest ecosystem health and vitality
4. Conservation and maintenance of soil and water resources
5. Maintenance of forest contribution to global carbon cycles
6. Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies
7. Legal, institutional and economic framework for forest conservation and sustainable management (Montréal Process Working Group 2005).

For each of the seven criteria, individual indicators were collaboratively developed to assess the progress made towards achieving sustainability in related forest management. Baltimore County

was chosen as a pilot test to determine whether the criteria and indicators that were ultimately established by larger agencies could be utilized by local communities in urban forest areas (The Conservation Fund 2007b).

The initial effort to introduce the MPCI was conducted in June 2003 in a forum titled Issues and Indicators. The purpose of this forum was to introduce the topic of sustainability and its linkage with forest systems and to determine whether the MPCI could be applicable for managing forests in Baltimore County (Department of Environmental Protection and Resource Management 2011). The Forum was co-sponsored by the US Forest Service, American Forests, Sustainable Measures, Inc., and Baltimore County DEPRM; where there were more than 60 members invited to participate in the forum. Participants represented various state and federal resource agencies, NGO's, conservation groups, and local consulting firms. There were three key questions that the forum aimed at addressing which included:

1. Are we all, collectively, managing Baltimore County's forest resources for sustainability that meets both public and private needs over the long-term, and what are the issues for achieving sustainable forests?
2. What are the indicators that we can all agree on that will help to measure collective progress towards that vision of a sustainable forest in Baltimore County?
3. Who needs to be involved in ongoing discussions and assessment of our progress? (Department of Environmental Protection and Resource Management 2011)

During the forum there were various presentations given to attendees on sustainability, the Montreal Process, and community indicators. Participants were engaged in mixed-group "carousel" sessions that were used to identify and prioritize important forest issues (Baltimore County Environmental Protection and Sustainability 2005, 72). This forum led to the creation of

the current steering committee that still oversees the management of MPCI for Baltimore County. For each of the seven criteria the attendees identified key issues, goals, and a set of unique indicators that could be used to measure the achievement of the identified goals (Baltimore County Environmental Protection and Resource Management 2003). A key issue that was a concern for the attendees, but did not fit into one of the seven criteria, was to develop a linkage of process, information, measures and decisions across political boundaries and landscape scales. This was ultimately not included in the program.

Following the June 10, 2003 Forest Sustainability Issues and Indicators Forum, The steering committee created the Draft Forest Sustainability Strategy. The Strategy is a comprehensive document and initiative that put forward the steering committee's Vision for achieving forest sustainability and contained an extensive amount of guidance and action items. The Strategy contained 10 Guiding Principles, 42 Goals, 86 subsequent Recommended Actions, and 63 Recommended Assessment and Data Analyses, which directly correlated to the support of 15 Ecological and Economic Issues for Forest Sustainability. The strategy was released on November 8, 2005 and at this time Baltimore County signed a memorandum of understanding with the USDA Forest Service, MD-DNR, and the American Forests to work collaboratively and cooperatively throughout the implementation stages of this strategy (Baltimore County Environmental Protection and Sustainability 2005).

The creation of this document involved a project manager (interviewee BC1), an Ecological Sustainability Sub-committee, and the Sustainability Indicators Sub-committee. The members of these subcommittees represented various resource agencies as well as consulting firms on local and regional or national scales. The creation of this document was collaborative and proactive in nature with a comprehensive management focus on Baltimore County's forest

resources. Although the document stated that it was intended to be of interest to "concerned citizens" (Baltimore County Environmental Protection and Sustainability 2005, 1) the primary audience was government agencies and leaders, such as the Planning Board, Baltimore County Council, and the County Administration. The steering committee that emerged from the 2003 Sustainability Issues and Indicators Forum included local citizens as well as government resource agencies and special interest groups. The members were volunteers and were sent correspondence through email. The steering committee meetings were open to the public but often were attended by existing forest or watershed organizations and agencies (Interviewee BC1 2011). The intended policy role for this strategy was for it to be adopted as an amendment to the Master Plan 2010, similar to earlier adoption of the Department of Environmental Protection and Resource Management (DEPRM) Groundwater Protection and Management Strategy as a Master Plan amendment in 1993 (Baltimore County Environmental Protection and Sustainability 2005).

The strategy was based upon nearly two decades of responsibility given to the DEPRM and expanded upon county policies and regulations already in place. The DEPRM involvement in the development of a methodology for the state's green infrastructure network, in concert with MD-DNR, initiated the relationship that led to the county becoming involved in the Montréal Process. Again, this strategy was guided by the seven Montréal Process Criteria noted above, and led to the 20-member steering committee creating a Forest Sustainability Issues Paper in December 2003. The goal of this Issues Paper was to summarize (1) the condition of the county's forest resources based on existing information, (2) issues, apparent to committee members, for the ecological and economic sustainability of forest resources, and (3) the potential for application of the Montreal Process for addressing these issues (Baltimore County Environmental Protection and Sustainability 2005, 3). The Issues Paper was developed using the

Montreal Process framework, the outcomes of the Forum, and knowledge gained through the discourse and research involved with the creation of this paper. The product of this paper was the Forest Sustainability Strategy document which proposed goals, recommended actions, and recommended assessments and data analyses for the fifteen ecological and economic issues selected by the steering committee as having the most relevance to forest sustainability for the county. Table 9 illustrates the fifteen issues.

Table 9. Key Issues for Forest Sustainability Identified in Baltimore County

Ecological Sustainability:

1. Forest cover loss
2. Forest fragmentation
3. Impacts of forest loss on water quality and quantity, and stream function
4. Conservation of biological diversity
5. Maintaining and increasing forests in key sensitive areas (riparian buffers, recharge areas, reservoirs)
6. Exotic, invasive plant and animal species invasion
7. Deer browsing threatens forest regeneration

Economic Sustainability:

8. Valuing forest ecosystem services
9. Increasing the contribution of forests to the reduction of greenhouse gases through carbon sequestration market mechanisms
10. Landowner attitudes toward forest management
11. Public education about forest sciences
12. Cost and legal barriers to sustainable forest management

13. Strengthening markets for local forest products utilization

14. Timber management for sustainable forests

15. Forest management plans for publicly owned forests

Adapted from: (Baltimore County Environmental Protection and Sustainability 2005, 5)

The strategy used the fifteen key issues to set up the strategy, which contained 42 Goals, 101 Actions, and 85 Assessments. One of the guiding principles used for this strategy specifically focused on data and the link between the process and outcomes. The fifth principle stated, "better data, better dialogue, better decisions" which has been used as a central tenet to the entire initiative by the county (Interviewee BC1 2011; Baltimore County Environmental Protection and Sustainability 2005, 22). This was a data-driven process and utilized data from various scales and sources. Data were incorporated using the county's geographic information system (GIS) and spatially overlaid forest data with other data layers such as zoning, public land ownership, conservation easements, streams, and cadastral data. Ultimately the county's forest resources were examined and analyzed on a landscape scale.

The state's green infrastructure assessment was used as a guiding principle for the process and was specifically noted throughout the strategy. Much of the steering committee's recommended assessments and data analyses for the recommended actions directly correlated to green infrastructure principles and practices. The following table cites some of these consistencies.

Table 10. Green Infrastructure References

Framework	Issue	Relationship to Green Infrastructure
Ecological Sustainability	Forest Cover Loss	Assessment of forest resources and forested lands for significant ecological functions and values
Ecological Sustainability	Forest Fragmentation	Analysis of DEPRM and MD-DNR data on forest patch size distribution by

		examining the state's green infrastructure network map
Ecological Sustainability	Conservation and Biological Diversity	Assessment of terrestrial and aquatic habitats for species richness and evenness, seral stages, structural heterogeneity, forest-dependent wildlife, significant stressors
Economic Sustainability	Valuing Ecosystem Services	Perform spatial analysis of ecosystem services and identify where the greatest public benefit is provided

(Baltimore County Environmental Protection and Sustainability 2005, 52-73)

Mention of green infrastructure was also present during steering committee meetings. During the initial meeting on July 29, 2003 staff described the events that led up to the county participating in the Linking Communities Project citing participation and collaboration with MD-DNR on green infrastructure as well as their Coastal Zone Management Program's national Coastal Zone Management (CZM) performance indicators (Baltimore County Department of Environmental Protection and Resource Management 2003). In a later steering committee meeting on September 7, 2004 it was described to attendees how the Strategic Forest Lands Assessment (SFLA) was completed using data from the state's Green Infrastructure Assessment. The attendees were comprised of professionals as well as citizens who were involved in efforts throughout the county. The SFLA was completed by the MD-DNR and examined forest resources statewide using the economic and ecological value as well as a vulnerability assessment. The document was made available online for public review (Baltimore County Department of Environmental Protection and Resource Management 2004b). In a steering committee meeting held on October 19, 2004 attendees (specifically from the USDA Forest Service) presented to the group and led a discussion about how public-private partnerships and grass roots programs have been used to promote conservation, limit uncontrolled growth and promote sustainability within communities. The two speakers specifically cited how Maryland's

Green Infrastructure was a prime example of this practice and discussion began on the value of partnerships between individual citizens, NGO's and government agencies (Baltimore County Department of Environmental Protection and Resource Management 2004a).

The steering committee has been actively involved in all stages of this process including goal setting, analysis, synthesis and implementation. One of the goals of the Draft Forest Sustainability Strategy completed in 2005 was to open up the discussion with a broader range of stakeholders (Department of Environmental Protection and Resource Management 2011). On June 1, 2006 the steering committee held the 5E Forum at Oregon Ridge Park, which included 70 participants from 40 organizations who focused on special issues identified by the steering committee. Members from neighboring counties also took part in the forum and helped to present issues they were facing in their own county regarding the connectivity of shared resources. The 5E issues included the following:

1. Education
2. Ecology
3. Economics
4. Easement
5. Endicators (Environmental Indicators)

Attendees were broken out into discussion groups based on the 5E issues and identified the key strategy for each issue as well as selected recommended actions reached through consensus of group members. The group moderators compiled these outputs and each of the groups returned to present their findings. Following the forum, five ad hoc sub-committees of the steering committees were formed and were made responsible for selecting priority actions for implementation. The value of the steering committee was made evident in my interview with the

project leader for Baltimore County. Interviewee BC1 stated "the forums conducted by the steering committee provided a way for information on various topics to be shared among participants involved in the Forest Sustainability Program" (Interviewee BC1 2011). The steering committee and five sub-committees continue to regularly meet and have sustained growth each year. They have continued the dialogue with frequent email listings as well as an up to date website containing information for participants and citizens.

There have been two additional forums and workshops since the 5E Forum in 2006. Beginning in December 2007, the Roundtable on Sustainable Forests National Workshop was held at Oregon Ridge Park and was aimed at discussing the challenges of scale and identifying indicators and other data related to creating and maintaining sustainable forests. This Workshop was only one of an entire consortium of meetings and workshops sponsored by the Roundtable on Sustainable Forests that are held various times throughout the year across the United States. The engagement of stakeholders is critical for this organization and its continued function is based upon a strong participatory component whereby "champions" are encouraged among stakeholders to help drive the process and elicit support and participation from other members (Roundtable on Sustainable Forests 2010).

Baltimore County's Forest Sustainability Program together with the Mason Dixon Task Force held a second workshop on September 18, 2008 titled *Forest Sustainability for Local Governments*. This workshop included discussions with neighboring states such as Pennsylvania and Delaware. It was sponsored by the Roundtable on Sustainable Forests, USDA Forest Service, MD-DNR, and Baltimore County. There were 108 people that participated in the workshop representing 22 counties from the three attending states. This workshop was information driven and contained presentations relating to frameworks, data assessment and

tools, relevant case studies, and various presentations on the relationship with local governments and sustainable forest management. There was one specific presentation that dealt specifically with green infrastructure and was provided by the Metropolitan Washington Council of Governments (COG) and focused on green infrastructure in the Washington Metropolitan area. The presentation examined how a local government could use green infrastructure principles and how these specific practices relate to sustainable forestry (LeCouteur 2008). These meetings and workshops have provided a forum for continued participant involvement in the sustainable forests initiative within Baltimore County. These activities of civic engagement were cited by planning staff as a "primary component to implementation" and continued knowledge building and information sharing between governmental organizations and local stakeholders.

This focus on working with stakeholders in constructive meetings as well as collaborating with other agencies was a key topic of discussion during my interviews with planning staff. I asked interviewee BC1 to describe the collaboration that occurs between the county and any other agencies and he described this activity as occurring "quite often" (Interviewee BC1 2011). He also talked about how there has been a convergence between county staff and state/federal agencies and how now they interact directly with federal agencies on larger scale issues (i.e. forest resources and sustainability) and are able to directly collaborate with offices such as the US Forest Service when issues arise or simply for routine questions.

The implementation of the county's strategy was a primary focus from the onset of planning activities. Project leaders understood that this strategy was as much about education as implementation and planning staff was noted as saying they "… really needed to find a way to focus on education because otherwise it's just us always sitting here trying to champion something that people won't even understand" (Interviewee BC1 2011). The strategy has also

contributed to a number of tangible outcomes emerging from the strategy and has affected county policies, practices, and existing programs.

The primary output was the Forest Sustainability Strategy that has really been used as the primary action plan for the county and incorporated input from various stakeholder groups. In order for the strategy to be implemented all funding must be approved by the County Council and have included partnership projects, grants, and the DEPRM's capital budget (The Conservation Fund 2007b). This strategy is part of a larger master planning process conducted by the county. During the last master plan revision there were 12 citizen advisory committees that took part in the planning process. For the environmental component of the master plan, it was guided by new state requirements stating that local master plans must consider forests as sensitive areas. The Maryland General Assembly enacted House Bill 1141 Land Use – Local Government Planning that required local jurisdictions adopt a water resources element in their respective comprehensive or master plan (McIntosh et al. 2006). This was an extension of the Economic Growth, Resource Protection, and Planning Act of 1992, which required a sensitive area protection element in all county master plans.

Much of the implementation that has occurred in the county is in the form of assessment and monitoring programs. The county stated the following regarding these programs:

> The foundation for good resource management is adequate dialogue among stakeholders who are informed by relevant data and analysis. Although not necessarily a linear process, better data should lead to better dialogue, which should lead to better decisions (Baltimore County Environmental Protection and Sustainability 2011a, 1).

In 2007 Baltimore County released its first State of our Forests report, which used the Montreal Process to summarize existing county, state, and federal data related to the county's forest

resources. There were seven criteria taken from the Montréal Process Criteria that were used to frame the assessment with green infrastructure falling under the first criteria of Conservation of Biological Diversity. Although the Strategic Forest Lands Assessment conducted by MD-DNR in 2003 was cited as one of the primary data sources, the Maryland green infrastructure assessment was not. For the purposes of the Strategic Forest Lands Assessment, a green infrastructure network is summarized as "akin to an ecological backbone, a skeleton connecting the separate pieces of high value habitat" (Baltimore County Department of Environmental Protection and Management 2007, 14).

In addition to monitoring and assessment programs, Environmental Protection and Sustainability (EPS) also administers several programs aimed at encouraging citizens and community organizations to plant trees throughout the county to enhance environmental quality. These programs are as much educational as implementation strategies and have been cited by planning staff as a way that citizens can become part of the process and become empowered to be key players in helping to promote the county's strategy. Two of these programs included the Growing Home Campaign and the Tree-Mendous Maryland Program. The Growing Home Campaign educates homeowners on the benefits of planting certain trees and provides a savings voucher on the purchase of qualifying trees. There is an educational component on the county's website listing the recommended species, how to plant the trees, reason for planting, a benefits calculator showing the economic and ecological benefits of the tree, and participating locations where trees can be purchased.

The Tree-Mendous Maryland Program is a partnership between the Baltimore County Department of Environmental Protection and Sustainability (EPS) and the MD-DNR and provides free delivery of trees to citizens and community groups throughout the county. This is

a statewide program that was designed to give citizens an affordable and convenient way to obtain trees, plants, and shrubs and plant them on public lands and designated open spaces. This again is an example of a program cited by the county as a means to achieving their implementation goals through involving local citizens and making them active in the process. The role of the planner has been critical for implementation and has been evident from the very beginning of the process. Not only has the planner in this case been involved on a county and regional scale but also from a national and international perspective.

In an interview with the lead planner for this department showed the extensive involvement he has had with the process and is a leader in the county. He described his role, some of the issues of scale, and the importance of community support in the following excerpt:

> My role is to help make it happen and move forward. Within the broader context (National Sustainable Forestry initiatives) I represent local government and communities and I am really the only county person there. Mostly the national level people don't understand the counties and they wonder why the counties don't do anything. So what we have done, as a county, has blown their socks off a little bit. You can have all of the these fancy names for processes but really what it's about, as managers, we want to make the best decisions on behalf of the resources and our citizens and hopefully we were informed by good science and discussions so that people buy into what's being done and support it because you need the public's support to do anything (Interviewee BC1 2011).

This planning leader also cited that he believes that Baltimore County has had the success they've experienced because of a dedicated group of people that has made up the steering committee and participated in sustainable forest management activities throughout the county. This is in addition to the detailed amount of data that is available for planning activities in the

county. I asked this interviewee to further describe his role as well as the county's success and he described the following:

> You can lose an awful lot of support and one or two missteps can kill a whole program. I have been in agencies before where we call them false starts; where things go and then five years later your're back to square one. This is the most frustrating thing as a professional because you don't spend your life work on something for it to [not get implemented]. Our role is to check things out early and try to do some analysis and evaluation and produce recommendations about what makes sense to do and what is in our [county's] best interest. A big part of that is to understand the public interest. We help frame the issues and get dialogue going to help drive implementation, specifically through market mechanisms (Interviewee BC1 2011).

The efforts existing in Baltimore County have reached into neighboring areas such as Harford County and Baltimore City. Citizens from these counties are able to participate in Baltimore County's couponing program and the coordination of the program is maintained within Baltimore County. I also asked Interviewee BC1 to describe some of the challenges that the county has faced throughout the process and he described, "scale obviously is a big issue. Mostly we are finding for the kinds of management that we need to do, and required to do on certain permit programs, there is a lack of adequate data" (Interviewee BC1 2011). The lack of data available for implementation, supports counties extending beyond the statewide assessment to create plans at county or even parcel scales to support management of the identified resources. He went on to state that having a good GIS team has helped the county deal with this issue.

Talbot County

Talbot County was founded in 1662 and is one of the oldest centers of European settlement in the New World (Talbot County Historical Society 2002). The county is predominately rural with the county seat located in Easton. The population in 2010 for Talbot County was 37,782, which increased 11.7 percent from 2000 population data (Talbot County Historical Society 2002; U.S. Census Bureau 2010e). Talbot County is located in the Upper Eastern Shore region of the state and contains the most tidal shoreline of any county in the United States spanning over 600 miles (Talbot County Office of Planning and Zoning 2005, I-4). The total area of Talbot County is approximately 477 square miles with 269 square miles comprised of land and 208 square miles of water areas (Talbot County Historical Society 2002).

The Talbot County Comprehensive Plan is the guiding document for the planning efforts throughout the county. The 2004 Comprehensive Plan replaces the 1997 plan and was created by the Office of Planning and Zoning (Talbot County Office of Planning and Zoning 2005, I-3). The Comprehensive Plan for Talbot County is not a stand-alone document, but rather supports and is supported by other related planning documents such as the Chesapeake Bay Critical Area Plan, Forest Conservation Ordinance, Zoning Ordinance, and Floodplain Ordinance. Based on the values set forth in the 2004 Comprehensive Plan, the county worked with The Conservation Fund to establish a countywide green infrastructure plan (The Conservation Fund 2004a, 1). The Talbot County Green Infrastructure Plan was created in 2004 and intended to provide the county with a methodology that could be applied to help prioritize land conservation efforts based upon the value assigned to the natural resources. The plan would also serve as a tool that would assist County leaders in conservation and land use decisions (The Conservation Fund 2004b, 1).

Talbot County Green Infrastructure Plan

Talbot County completed its first countywide green infrastructure plan in July 2004. The plan has been adopted by reference in the county's most recent comprehensive plan. This was one of two of the five plans examined in this study that was prepared primarily by an outside agency. The plan was prepared by The Conservation Fund's (TCF) Center for Conservation and Development following a vote by the County Council in 2002 supporting an identification and prioritization, by the fund, of environmentally sensitive areas and important agricultural lands. The creation of the green infrastructure plan occurred closely after the release of the states' green infrastructure assessment and the adoption of the state's comprehensive plan. Because Talbot County has approximately 600 miles of shoreline and is almost entirely surrounded by the waters of the Chesapeake Bay, the coastal character and resources present in this county were predominant focuses of both the comprehensive plan and green infrastructure plan.

The county's first comprehensive plan was prepared in 1973 with updates occurring in 1990 and 1997. The current comprehensive plan is planned through 2024 and is not a stand-alone document, but rather supports and is supported by other planning program documents such as the Chesapeake Bay Critical Area Plan, Land Preservation and Recreation Plan, Forest Conservation Ordinance, and Stormwater Management Ordinance to name a few (Talbot County Office of Planning and Zoning 2005). The Talbot County Green Infrastructure Plan is also a plan that is supported by the comprehensive plan. The comprehensive plan acknowledges the green infrastructure plan as a means to strategically preserving the county's important ecological, open space, agricultural and forestry resources (Talbot County Office of Planning and Zoning 2005). The comprehensive plan sites the role of the green infrastructure plan by:

> … providing such a prioritization framework, the green infrastructure plan can be used as a decision-making tool to inform future planning efforts, focus conservation to insure maximum benefit and guide compatible ecologically sound development efforts. The Plan will also recommend implementation strategies for achieving natural resource preservation and restoration goals (Talbot County Office of Planning and Zoning 2005, 79).

Beyond this brief acknowledgement of green infrastructure and its role in county planning activities, there were no other instances where green infrastructure appears in the comprehensive plan. The comprehensive plan however did pay close attention to conservation and its relationship with agricultural resources throughout the county such as within The Maryland Agricultural Land Preservation Foundation (MALPF) program. There were also correlations between the state's Rural Legacy Program and the establishment of a Delmarva Conservation Corridor that would support agricultural easement acquisitions for the county (Talbot County Office of Planning and Zoning 2005, 82).

Goal Setting

Members of the planning staff approached The Conservation Fund to begin work on the green infrastructure plan shortly after the revisions on the comprehensive plan were completed. Interviewee TCF1 noted that TCF used information from the county's comprehensive plan revision to help with the establishment of goals as well as throughout the planning process in other capacities (Interviewee TC1 2011). Interviewee TCF1 described the process with a first step to evaluate the resources in the county based on GIS, that would later be used to identify conservation priorities for the county (The Conservation Fund 2004). TCF's objective for this plan was to:

> … provide efficient resource conservation evaluation and implementation strategies to assist County officials in best meeting the goals of their comprehensive plan while maintaining consistency and compatibility with its overall land use intent (The Conservation Fund 2004, 13).

There was no evidence of stakeholder involvement during the planning process for the county green infrastructure plan. There was no leadership forum or advisory committee that led the planning effort or generated momentum towards plan adoption. A member of the planning staff for the county (interviewee TC1) explained that a major problem for the county is determining who the stakeholders are and how they can/should be involved:

> …we are a rural county with about 30,000 people right now so trying to figure out who the stakeholders are for a project in a rural area is a little bit difficult to interpret sometimes (Interviewee TC1 2011).

Although the green infrastructure plan did not contain a participatory component, the comprehensive plan (which adopted the green infrastructure plan by reference) included a substantial citizen participation process and one of the predominant themes to emerge from this process was the conservation and protection of natural resources and open land as the highest priority for the county (Talbot County Office of Planning and Zoning 2005, 17). Additionally, even though the green infrastructure plan did not contain a public participation component there was a great deal of collaboration that occurred in plan creation. Table 11 is a list of the groups that provided data for plan development and/or provided assistance and input into the plan.

Table 11. Participants of Green Infrastructure Plan Development

• USDA Natural Resources Conservation Service
• David Burke and Associates
• Talbot County Department of Public Works

- Talbot County Office of Planning and Zoning
- Maryland Department of Natural Resources
- Redman/Johnston Associates, Ltd.
- Talbot County Council

Analysis

The creation of the Talbot Green Infrastructure network was very much a scientific exercise. Using GIS, TCF used three resource targets to rank the suitability and conservation importance of the lands within the county and ultimately identify conservation priorities. The resource targets included ecological resources, agricultural and rural landscape, and critical aquatic resources. Based on this data and proposed growth areas TCF was able to model a vision for conservation and was intended to assist the county in going beyond the analysis conducted by the state and projected that in order for the county to achieve their goals they would need to protect approximately 50 percent of its total land area (The Conservation Fund 2004, 3). Interviewee TCF1 describes how TCF approached the Talbot plan and the need for identifying a county specific network that captured some areas that didn't meet the thresholds within the statewide assessment:

> The statewide thresholds for delineating green infrastructure cores and hubs were large enough that there is almost no green infrastructure network West of Highway 50 because it was either more fragmented or the core areas were too small to be captured as significant by the statewide assessment. Part of our exercise at Talbot was to go and make sure that we were doing it at a county scale with appropriate cutoffs so that those areas West of Highway 50 that were providing ecosystem services were included. We were able to pull together the network at more of the county scale so the thresholds for

> core areas were lower, so it better demonstrated the value of county significance of green infrastructure (Interviewee TC1 2011).

This stage of the process was completed by technical experts who put forth a comprehensive resource evaluation based on three unique resource assessments including ecological, agricultural, and aquatic. Although there was little detail within the plan regarding how this analysis was conducted, TCF supplied the county with a technical support document that described detailed GIS data (i.e. shapefile attribute selection and descriptions) and decision model descriptions (The Conservation Fund 2003).

Synthesis

TCF combined the three resource assessments mentioned in the previous section. This prioritization methodology was intended to assist and inform a proactive approach to conservation (The Conservation Fund 2004). This prioritization strategy built upon the county's anticipated urban areas otherwise known as priority funding areas and was ranked based on resource value and level of priority. Within the plan a group of "focus areas" emerged and were defined as areas with concentrations of one or more of the county's essential resources. The plan focused on the three resources individually and provided a conservation priorities tool that was intended to:

> …enable the County to respond to different interests (landowner, agency, nonprofit organization and individuals) and customize assessments to respond to timely funding opportunities (The Conservation Fund 2004, 34).

The data used for this tool was both descriptive (i.e. land use type, ownership) and quantitative (i.e. cell ecological ranking, development threat, resource suitability model score, and MDNR Strategic Forestland Assessment scores). This GIS - based system allowed county planners to

access information on a parcel-by-parcel basis allowing for changing priorities and funding opportunities (The Conservation Fund 2004). By overlaying the data within this tool with the county and statewide assessment, county planners were able to identify areas that were within an identified hub or corridor and for development purposes can maximize connectivity and minimize fragmentation.

Implementation

The Talbot County Green Infrastructure Plan has had little to no implementation. Within the plan provided by TCF there is a set of implementation recommendations and potential resources that could be used by the county and assist in the future should they choose to implement the plan. The recommendations for implementation were presented in three tiers where the first provided an overview of funding sources available at a state and national level as well as ways of generating funds within the local community. The second tier suggested strategies for securing funds and ways that the funds could be used efficiently and productively for unique conservation goals of the county. The final tier focused on education and outreach efforts that would harness public support which is stated as being "crucial" for the planning effort (The Conservation Fund 2004, 36). Table 12 identifies some of the programs and funding sources that the plan stated would be beneficial for implementation.

Table 12. Funding Sources for Implementation

Maryland State Conservation Financing Programs:	**Federal Conservation Financing Programs:**
1. Program Open Space 2. GreenPrint 3. Maryland Agricultural Land Preservation Foundation (MALPF) 4. Rural Legacy Program	1. Coastal Zone Management 2. North American Wetlands Conservation Act 3. Farm Bill 4. USDA Wetlands Reserve Program

5. Water Quality Revolving Loan Fund	5. Farmland Protection Program

Adapted from: (The Conservation Fund 2004, 37).

While interviewing a planner from the county I asked him if and how these sources were used and what his role was in the process. The following response was provided:

> I would describe my role in the process could be described in one word: recommendations. A lot of what I am doing is trying to get the broad-brush things to go into the comprehensive plan, and try to find ways to implement some of the goals that are in the plan or the initiatives that the county council decides are important (Interviewee TC1 2011).

In terms of how this implementation is achieved, the interviewee spoke frequently of the MALPF program and how the county utilized this program. The following response was given regarding the effect green infrastructure plans (statewide assessment and TCF plan) have had on existing planning efforts:

> It (TCF Green Infrastructure Plan) was adopted by reference into our comprehensive plan. I use it in developing other policies and things like that, for example in the MALPF program for Priority Preservation Area's (PPA) (Interviewee TC1 2011).

I also asked this planner if and how the Green Infrastructure Plan's primary output, the "Conservation Priorities Tool", was being used by the county and in what capacity. I received the following response:

> We have not made use of the Tool for a few reasons:
>
> - It consists mainly of parcel data. The interface or ability to query information or manage priorities has not been created. GIS has evolved quite a bit in the years

since this work was completed and it would be easier to craft a functional application, but the County is not equipped to do so.

- Talbot's opportunities for conservation are limited. The MALPF program (our only direct conservation program) has its own priorities and criteria, as do the Maryland Environmental Trust and Eastern Shore Land Conservancy. We have generally agreed-upon preservation priorities and few cases where alternatives have to be prioritized or weighed.
- The pace of preservation and development have not necessitated such analysis, especially in recent years. The County Comprehensive Plan continues to direct development to the areas served by existing infrastructure and considers agriculture and open space to be the preferred use throughout most of the County (Interviewee TC1 2011).

Although the plan has not reached a point where extensive implementation is occurring, TCF recommended an education and outreach extension be made during the implementation phase that would gather public input and support through the creation of citizen advisory committees, focus groups, forums, and opinion polls. Ultimately, the green infrastructure plan has been used in an advisory capacity and there has been no follow up with public planning. The comprehensive plan appears to be functioning as the primary plan directing development and with the goal of the county to preserve the rural character; planning efforts are primarily guided by this document.

Prince George's County

Prince George's County was created in 1696, by the Council of Maryland, from portions of Charles and Calvert counties (Prince George's County Historical Society 2010). The population in 2010 was 863,420, which increased 7.7 percent from 2000 population data (U.S. Census Bureau 2010d). Prior to 1792 the county seat was located at Mount Calvert but has since been moved to the town of Upper Marlboro (Prince George's County Historical Society 2010). The county is 498 square miles with 485 square miles classified as land and 13 square miles as water (U.S. Census Bureau 2010d). The Patuxent River forms the county's eastern border with Howard, Anne Arundel, and Calvert Counties while the Potomac River forms the southwestern border with Fairfax County, Virginia (Prince George's County Government 2009).

In 1927 the Maryland General Assembly created the Maryland-National Capital Park and Planning Commission (MNCPPC). This is a bi-county agency that is responsible for acquiring, developing, maintaining and administering a network of parks as well as providing land use planning in both Prince George's and Montgomery counties. Planning in Prince George's is administered by one of the four departments of the commission known as the Prince George's Planning Department. The commission prepares and administers a comprehensive plan for the two individual counties, which it calls its General Plan (Maryland-National Capital Park and Planning Commission 2010).

The General Plan is used as a comprehensive guide for future development within the county and was adopted in October 2002 (Prince George's County Planning Department 2010b). The plan contains recommended goals for the area's environmental infrastructure suggesting for the creation of a green infrastructure plan that is prepared as a functional master plan. In 2005

Prince George's formally approved and adopted as county policy its first Countywide Green Infrastructure Functional Master Plan (Prince George's County Planning Department 2010a).

Prince George's County Countywide Green Infrastructure Plan

Prince George's County is located in the Washington Metropolitan Region and is bordered by two major estuarine water resources: the Patuxent and Potomac Rivers. County planning efforts are conducted by the Prince George's County Planning Department under the direction of the Prince George's County planning director. The County Planning Director receives assistance from a deputy director and five division chiefs and reports directly to the Prince George's County Planning Board (Prince George's County Planning Department 2010c). Prince George's County is one of two counties that make up the Maryland-National Capital Park and Planning Commission (M-NCPPC). This bi-county agency was created in 1927 by the State of Maryland and is responsible for acquiring, developing, maintaining, and administering a regional system of parks within Montgomery and Prince George's Counties, as well as providing land use planning (Maryland-National Capital Park and Planning Commission 2011). The Planning Department and the M-NCPPC is responsible for comprehensive planning efforts throughout the county and is presented in the form of a General Plan that makes recommendations for guiding future development within the county.

The M-NCPPC operates through the planning boards in both Prince George's and Montgomery counties. The Planning Board is the first group to approve plans such as general plans and functional master plans. Once the plan is approved it is presented to the County Council who will hold a hearing on the plan adopted by the Planning Board and may choose to approve the plan as it was adopted, approve the plan with amendments, or disapprove the plan and send in back to the Planning Board for revisions (Prince George's County Planning

Department 2010b). The County Council approved the most recent General Plan in October 2002. The 2002 General Plan was an extension of the Biennial Growth Policy Plan that was adopted by the County Council in November 2000. The Biennial Growth Policy Plan was the Final Report issued from Commission 2000 which was a broad-based advisory group that made recommendations regarding the future growth and development of the county. The plan was responsible for identifying an Environmental Overlay that included waterways, floodplains, wetlands, buffers, parks, and open space properties. The plan also stated that the county should:

> "Establish a green infrastructure system in the County that, in addition to the features shown on the Environmental Overlay, includes open space linkages, significant woodlands and open space, and sensitive species habitats. The definition of the green infrastructure (to be included as part of a new General Plan) should be coordinated with the state's greenway program and the strategic forest initiative. The green infrastructure designation would then be used as a basis for future acquisition and regulation" (Maryland-National Capital Park and Planning Commission 2002, 4).

In addition to the Growth Policy Plan many of the goals identified in the General Plan were from a countywide perspective and were driven by four guiding principles including: (1) public health, safety and welfare; (2) sustainability; (3) quality and; (4) meaningful public participation. While this plan was based on principles of Smart Growth (Prince George's County Planning Department 2010b, 2) the Development Pattern Element is a critical component for the structure of the plan.

The Development Pattern Element outlined a three-tier system comprised of a developed, developing, and rural Tier. Part of this system includes the identification of two-dozen centers and seven corridors where development is encouraged and guides planning efforts for the county.

The Developed Tier is an 86-square-mile area that borders Washington, D.C and contains approximately half of the county's households and almost half of the employment centers. This area is characterized by high urbanization and extensive impervious surfaces encompassing much of the land area as well as some streams. The vision for the Developed Tier was identified as "a network of sustainable, transit-supporting, mixed-use, pedestrian-oriented, and medium to high-density neighborhoods" (Prince George's County Planning Department 2010b, 31). The Developed Tier is followed by the Developing Tier, which contains approximately 237-square-miles of land area within the middle portion of the county. The Developing Tier is the main suburban expansion area for the county and contains just under half of the county's households and half of the employment centers. This area was experiencing the most amount of residential growth at the time the General Plan was created and due to the low-density housing and employment patterns that were emerging, the Developing Tier focused on environmental preservation and enhancement as a central factor used to guide future development. The vision for the Developing Tier was identified as "to maintain a pattern of low to moderate-density suburban residential communities, distinct commercial centers, and employment areas that are increasingly transit serviceable" (Prince George's County Planning Department 2010b, 36). The Rural Tier makes up approximately 32 percent of the county's land area and contained approximately 150-square-miles. This area of the county contains many of the county's existing farms, extensive woodlands, valuable natural resources (including streams and diverse wildlife habitat), and scenic landscapes. Much of the Rural Tier is comprised of public land, which includes parks and federally owned properties. Preservation of the remaining environmentally significant areas of this tier is important in guiding future development. The vision for the Rural Tier was identified as "protection of large amounts of land for woodland, wildlife habitat,

recreation and agriculture pursuits, and preservation of the rural character and vistas that now exist" (Prince George's County Planning Department 2010b, 40).

In addition to the Corridors, Centers and Tier System the General Plan identifies for concentrating development, there were also Infrastructure Elements that were identified in the 2002 General Plan. One of the primary elements was the Environmental Infrastructure Element and this element emphasized the "need to protect important environmental assets and make wise use of the county's resources" (Prince George's County Planning Department 2010b, 7). One of the recommendations of the 2002 General Plan was for the county to identify and protect its green infrastructure going forward following the hub/corridor network system. The goal of the Environmental Infrastructure Element was, "To preserve, enhance, and restore the natural environment and its ecological functions as the basic component of sustainable development pattern" (Prince George's County Planning Department 2010b, 57). The county found that a comprehensive approach was needed to protect the ecosystems within Prince George's County and turned to Green Infrastructure to form the basis for the environmental objectives, policies, and strategies. Within the 2002 General Plan there were a set of objectives put forth that were used as benchmarks for future success and guided the policies that emerged from the plan. The objectives were identified as follows:

- Protect, preserve, enhance and/or restore designated green infrastructure components by 2025.
- Protect and enhance water quality in watersheds by, at a minimum, maintaining the 2001 condition ratings of all watersheds countywide.
- Meet or exceed the following forest and tree cover goals within each Tier and countywide by 2025: Developed Tier—26 percent; Developing Tier—

38 percent; Rural Tier—59 percent; and countywide—44 percent.

- Promote an awareness of environmental issues related to land use through the provision of environmental education and/or stewardship programs (Prince George's County Planning Department 2010b, 58).

Following the identified objectives there were eight policies presented with their own set of subsequent strategies. This structure presented in the 2002 General Plan is what framed the green infrastructure plan created by Prince George's County. Directed by the 2002 General Plan the county began to create its own countywide green infrastructure plan. This was a large undertaking primarily because of the size of the county, which is encompasses approximately 500 square miles as well as having a population larger than five states (Interviewee PG1 2011). For this county they were facing state-level issues such as water quality due to much of the county being developed prior to stormwater management regulations. In the 1950's there was a building boom in the western part of the county and much of the area was built without stormwater management so at the time of the green infrastructure plan many of those areas were being redeveloped and the county was addressing surface runoff issues. Interviewee PG1 described how the county general plan helped to launch the creation of their green infrastructure plan and the uniqueness of this plan as a functional master plan:

> So in our general plan one of the strategies to implement the environmental goals was to develop a green infrastructure plan so after that plan passed in 2002 we started the process to do our green infrastructure plan that is a functional master plan. This means that it carries the same weight as a master plan of transportation or any other master plan for the different functional areas such as historic preservation, public facilities, and those

kinds of things. As far as we know it's the first of its kind in the country that was done as a functional master plan (Interviewee PG1 2011).

Interviewee PG1 also discussed the initial green infrastructure decision-making roundtable and the presence of a champion in getting their green infrastructure initiative started:

> … we had a champion of this issue, which is always a good thing to have someone who is in the community that is aware of green infrastructure planning and why it is important and how it can help in decision-making. He was a former mayor of one of our municipalities. We have 26 municipalities in our county; none of them have planning and zoning authority so all of the planning and zoning is done at the county level. But this particular municipality, the city of Bowie is a very large municipality and he was a former mayor so he was very respected, knowledgeable, and well known in the community. This was prior to our general plan update, which hadn't been updated since 1982. So, in 2000 we did a comprehensive update and a roundtable task force to start looking at issues that would inform the plan. Green infrastructure wasn't a term that was known in the community but it was certainly becoming a more known and valuable tool (Interviewee PG1).

Green infrastructure planning has occurred incrementally in this case as well as in others. The presence of a champion from the onset of planning activities was a key driver in getting green infrastructure included in the general plan update and the creation of the plan as a functional planning document provides an added facet to making this type of planning integrated within the daily planning activities occurring throughout the county.

Goal Setting

Following the approval of the General Plan in 2002 Prince George's County began to develop its green infrastructure plan. There were several guiding principles that framed the

creation of the county's green infrastructure plan. It is important to note that one of the guiding principles included that meaningful public participation occurred as part of the process:

- Identify a contiguous network of environmentally important areas.
- Set forth strategies to preserve, protect, enhance, and restore the network.
- Support the desired development pattern of the 2002 General Plan.
- Adopt and/or support effective implementation mechanisms.
- Support the county's Livable Communities Initiative.
- Ensure meaningful public participation (The Maryland-National Capital Park and Planning Commission 2005, 5).

The county identified that the purpose of creating a green infrastructure plan was to "guide development, green space protection, and mitigation activities and to implement a long-range vision for preserving, protecting, enhancing and/or restoring a contiguous network of environmentally important areas in the county by the year 2025" (The Maryland-National Capital Park and Planning Commission 2005, 5). Interviewee PG1 stated that it was important to identify the plan as not intending to hinder development but rather guide development (Interviewee PG1 2011). When the county began to work on their plan they wanted to focus on areas that contained "countywide significance." This concept was important to the plan because it was intended to guide implementation and remain within the limited resources available for the entire county and ensure that the most important features and areas were included in the network.

During the initial phases of the process the county "countywide significance" was determined based on the size of the network, connectivity, and contiguity. The three development tiers noted earlier were central to determining the size of the network whereby the network components in the Rural and Developing Tier were required to be 200 feet wide

minimum and no minimum width in the Developed Tier. In terms of connectivity, gaps were required to be less than 600 feet between environmentally sensitive areas. For an area to be considered contiguous the area needed to be adjacent to open bodies of water (i.e Patuxent River), downstream corridors, and/or designated as open space of an adjacent jurisdiction (The Maryland-National Capital Park and Planning Commission 2005). Additionally during the initial phase of the process the county identified four specific reasons why a green infrastructure plan was necessary for the county and included the following:

1. To provide a holistic view of important environmental ecosystems that should be preserved, protected, enhanced and/or restored in the county.
2. To guide development to ensure that both green space preservation and land development are located where most appropriate.
3. To coordinate and target mitigation efforts and limited resources including regional open space preservation efforts.
4. To protect and improve water quality, air quality, and plant, fish and wildlife habitat (The Maryland-National Capital Park and Planning Commission 2005, 6-7).

The plan was designed to be consistent with and supporting of existing state and local plans such as the following:

- 1992 Planning Act
- Maryland Smart Growth Initiatives
- Patuxent River Policy Plan
- Commission 2000 Recommendations
- Maryland Statewide Green Infrastructure Assessment
- 2002 General Plan

- Approved County Master Plans (The Maryland-National Capital Park and Planning Commission 2005, 9-15).

Analysis

Plan goals and objectives helped the county to define its green infrastructure network and framed the methodology for the subsequent creation of a countywide green infrastructure map. County level data was used during the plan preparation stage and to help assist in identifying and finalizing the mapping criteria, the county sought input from various focus groups who viewed draft scenarios, the plan review group, and any other interested parties. Throughout the planning process there was a public participation process that was central to the outputs produced by this plan. Some of these participatory methods included:

- Direct outreach
- "Urban Residents" survey
- Focus Groups
- Plan Review Group Meeting
- Website updates
- E-mail notices (Lammers 2011).

The network analysis process resulted in the creation of three network areas: regulated areas, evaluation areas, and network gaps. Table 13 shows how the green infrastructure network was defined.

Table 13. Definition of Green Infrastructure Network

Area	Containing
Regulated Areas	Streams, wetlands, buffers, the 100-year floodplain, and adjacent steep slopes that are currently regulated through the land development process

Evaluation Areas	Wooded areas, interior forests, and other unique habitats not currently regulated during the development review process
Network Gaps	Areas critical to the connection of the regulated and evaluation areas and are targeted for restoration where possible

Adapted from: (Lammers 2011, 9)

In order to identify these areas there were a number of data sources that were used by the county. This analysis was done primarily through GIS and focused on the following research to help determine the network. The following table (Table 14) are some of the data sources that were used by the county. There was extensive collaboration that occurred between the county planners and state agencies to acquire this data and create meaningful information that would ultimately be used to identify green infrastructure networks.

Table 14. Data Sources for Prince George's County

- Location of existing environmental resources
- Water quality data
- Air quality data
- Relevant issues for wildlife in the area
- Trends in development
- Trends in land use
- The state's Green Infrastructure Assessment
- Approaches being conducted by neighboring and other jurisdictions

(Lammers 2011, 17). See Appendix N for a specific listing of the information used for the purpose of developing the countywide green infrastructure plan.

The creation of the green infrastructure plan was to follow the county's Functional Master Plan Process, which is established by the Zoning Ordinance in the county and establishes

the process for preparing and approving a functional master plan. The County Council initiates the plans and following this initiation the following steps are followed shown in Table 15:

Table 15. Functional Master Plan Process

- **Public forum on the intent to prepare a plan.** This forum, held by the Planning Board, provides an opportunity for the public to comment on issues to be addressed by the plan.
- **Approval of goals, concepts and guidelines and a public participation program.** Following the public forum, the Council approves preliminary goals, concepts and guidelines to guide plan preparation, as well as a public participation program to be used in plan preparation.
- **Preparation of preliminary plan.** Prince George's County Planning Department staff, working with the public as set forth in the approved public participation program, prepares preliminary plan recommendations.
- **Joint public hearing.** The Planning Board and the County Council hold a hearing on the preliminary plan. Testimony may be given either at the hearing or in writing during the period that the hearing record is open.
- **Planning Board adoption.** After review of the hearing record, the Planning Board adopts the plan, with or without amendment. The adopted plan is then transmitted to the County Council, which may choose to hold an additional hearing.
- **Council approval.** After review of the hearing record (and the record of an additional hearing, if necessary), the Council may approve the plan, with or without amendments.

Adapted from: (Maryland-National Capital Park and Planning Commission 2002, 5).

The county began this process by getting buy-in from community members that this effort was valuable and should be employed by the county. The following process shown in Table 16

shows how the county created its green infrastructure plan and steps one through seven were conducted by planning staff and community involvement occurred once the draft maps were completed.

Table 16. Prince George's Green Infrastructure Planning Process

1. Identify Data Sources
2. Map the Elements of the Environmental Overlay
3. Review the State Green Infrastructure Assessment Methodology
4. Adapt the State Green Infrastructure Assessment Methodology to Local Conditions
5. Identify Hubs, Corridors, and Nodes
6. Produce a Draft Green Infrastructure Map
7. Verify the Draft Green Infrastructure Map
8. Produce a Revised Draft Green Infrastructure Map and Related Text

Adapted from: (Maryland-National Capital Park and Planning Commission 2002, 5).

Once the county began this process county staff compiled all of the above information and the county began a scenario-building exercise with various local stakeholders to identify a countywide network. Interviewee PG1 described how this analysis occurred:

> We used it (The Statewide Green Infrastructure Assessment) as a base plan for our original network designation. Then we used it in our scenario-building. We had really good GIS data when we started. We had been mapping resources for over 10 years before the beginning of this so we were pretty advanced as most communities go. So, we used the state green infrastructure assessment to add to the resources that we had already mapped. If the state thought it was important we included it in our network (Interviewee PG1 2011).

As noted in the previous quote, the analysis portion of creating the green infrastructure plan occurred primarily using GIS data and once maps were created, stakeholders were then asked for suggestions and comments. The creation of multiple scenarios was used to give participants the opportunity to explore how green infrastructure would be impacted based on various levels of inclusion of the natural resources in the county.

Synthesis

The county utilized focus groups that included local citizens and local professionals to gather information at the preliminary stages of the process and used the data gathered in the focus group meetings to help provide input for scenario-building exercises that were later used in a plan review group session. The focus groups were broken out into the following groupings:

- Agriculture and Forestry
- Building and Industry
- Citizens and Environmental Advocacy
- Interagency
- M-NCPPC and Parks
- Municipalities and Large Civic Associations

Participants of the focus groups were gathered through an introductory letter sent to potential participants with follow-up calls to participants. These participants were identified through local organization directories and previous mailing lists held by planning staff. The general format of these meetings followed a similar process that included an introductory presentation about the purpose, process, and implementation of the green infrastructure plan. There was also an introduction to several large maps displayed around the room that included varying attributes such as the current countywide Regulation Framework, 2002 General Plan, and State GreenPrint

areas for both Prince George's County and neighboring counties. Following the introduction to the concepts and the maps each of the individual groups were asked a series of discussion questions. Table 17 shows the questions asked to each of the focus groups.

Table 17. Prince George's County Focus Group Questions

Focus Group	Questions
Agriculture and Forestry	1. How do you think that agriculture and forestry preservation and green infrastructure planning inter-relate? 2. What preservation programs do you think would be conducive to implementing the green infrastructure plan? 3. What are your concerns about this type of planning process?
Building Industry and Chamber of Commerce Representatives	1. How can this plan enhance the implementation of the desired development pattern stated in the General Plan? 2. What implementation mechanisms do you recommend? 3. What are your concerns about this type of planning process?
Citizens and Environmental Advocacy	1. What types of environmental features and what specific environmental features are of countywide significance? 2. What parameters do you think should be used to determine the size of green corridors, hubs and nodes? 3. What mechanisms do you recommend for implementation?
Interagency	1. What plans for protection of environmentally sensitive areas have been done for areas adjacent to Prince George's County or within public land holdings? 2. Where are the opportunities for connectivity between jurisdictions or between public property and other lands? 3. What areas are of countywide significance in your jurisdiction (adjacent to Prince George's County) or

	within your public land holding?
M-NCPPC and Parks	Questions were not available
Municipalities and Large Civic Associations	1. Are all of the environmental features shown correctly? 2. What environmental features are of countywide significance? 3. What are the local opportunities for connectivity on a countywide scale?

(M-NCPPC 2003e; M-NCPPC 2003a; M-NCPPC 2003b; M-NCPPC 2003c; M-NCPPC 2003d)

Each of the groups then met individually to discuss their questions with the assistance of a moderator. Following the discussion question period, the focus group participants were invited to partake in a follow-up plan review group session where there would be reviewing different scenarios presented based on the information the county gathered during all of the focus groups and other research that was conducted.

The county also sent a survey to local residents that gathered general demographic information about the resource user and their interest in the county's park systems (natural areas) and the time spent in these areas. Respondents ranged in age from 14 to 77 and there were a total of 137 surveys returned representing 37 communities within the county. Following the survey and focus groups the county held a Green Infrastructure Plan Review Group Meeting in May 2004 (M-NCPPC and Prince George's County Planning Department 2004). The meeting had 37 participants who represented universities, government agencies, NGO's, special interest groups, industry, and interested citizens.

Attendees broke out into groups and were instructed to discuss a set of cards given to them by a group facilitator. The cards were labeled by various colors and the groups were instructed to choose a card that they agreed upon through consensus. Key discussion points were recorded by the facilitators and if consensus could not be reached on a card the facilitators were

asked to put the card aside and record the key issues discussed regarding the card. The groups were give a certain number of cards allowed that had specific information for addressing the noted topics. The cards were color coded based on the question associated with the card and there were specific allowances on how many cards could be chosen by the group ranging from one to unlimited. Once the combination of cards was agreed upon, the facilitator would turn in a "hand" from their group and gave a brief report-out on the discussions of their respective sessions. The card breakdown is shown in Table 18.

Table 18. Cards Used for Scenario-building

Card	Number Allowed	Topic
Blue	No Limit	What should be included in the mapping?
Green	One	How should the maps be refined?
White	One	How should we address regulated areas?
Yellow	One	How should we address non-regulated areas?
Pink	No Limit	Implementation Recommendations

Adapted from: (M-NCPPC and Prince George's County Planning Department 2004)

In addition to the cards in Table 18, participants were given blank cards to write in topics that they felt were not covered. Following the breakout sessions where participants chose cards within their group, they reconvened as a large group to discuss their decisions and any important discussions they had while in their breakout groups. The cards were used as a way for the groups to come up with a map that they felt to be an appropriate representation of the green infrastructure network. The county created six scenarios based on existing data sets and these were also presented to the participants of the Plan Review Group Meeting. The six scenarios ranged from a baseline map to a map identifying most of the natural areas in the county (See Appendix K). During the meeting the scenario that was chosen by the attendees was closest to

Scenario 5 and the final map approved by the county was closest related to Scenario 5 (Interviewee PG1 2011).

Implementation

On March 31, 2005 the Prince George's County Planning Board of The Maryland-National Capital Parks and Planning Commission adopted the Countywide Green Infrastructure Plan and the Prince George's County Council later approved it on June 14, 2005. It is noted within the green infrastructure plan that plan objectives identified are:

> "... not specific requirements but are indicators of how well the plan is being implemented. As each Biennial Growth Policy Update is prepared as required by the General Plan, an evaluation of the progress made on meeting these objectives will be prepared if the required information for updating is available" (The Maryland-National Capital Park and Planning Commission 2005, 27).

The plan described the implementation techniques that would be used to implement the plan including those found in Chart 4.

Chart 4. Implementation Mechanisms

Legislative Changes to Applicable Ordinances
Policy Guidance to be Included in Master Plans and Sector Plans
Guidance for State and Local Land Acquisition Programs
Direction for Mitigation and Development Incentives
Environmental Stewardship by Private and Public Landowners

Adapted from: (The Maryland-National Capital Park and Planning Commission 2005, 33)

The plan identified five specific policies and created specific strategies and recommendations correlating to each unique policy in an effort to increase effective implementation of the plan. Appendix L illustrates an example of a policy with associated strategies.

The plan was intended to be used as a conformance measure as land development applications were submitted to the county and play a role in the development review process (The Maryland-National Capital Park and Planning Commission 2005). Interviewee PG1 described how the plan is evolving through the implementation phase and how they are currently at the stage of implementing the plan recommendations:

> Once [the green infrastructure plan] was adopted it really shifted to a development review focus anyway because the plan had multiple recommendations for changes to the regulations. I am proud to say it was approved July 13, 2010 (Interviewee PG1 2011).

The changes in regulations occurred between 2007 and 2010. These changes included wider stream buffers, increased requirements for environmental information early on in the development review process, and changes to how the impacts were analyzed by the county. It was also recommended that as part of this implementation strategy, the woodland conservation regulations be updated as well (Interviewee PG1 2011). The plan also resulted in an implementation tool available on PGAtlas.com. PGAtlas is a GIS tool available from the county's website offering users the ability to select various plans and maps pertaining to all aspects of zoning and overlay them with parcel data. The countywide green infrastructure is available as part of the environmental component as well as the Chesapeake Bay Conservation Plan, Natural Resources Inventory, Stream Centers and Drainage, Vegetation, Watersheds, and area wetlands (M-NCPPC 2011).

The recommendations of the plan suggested an outcome that contained a mapping system showing areas of environmental concern. This has led to a Draft Environmental Legislation Package, which implements numerous recommendations of the Green Infrastructure Plan. Meetings on this package were held in October 2008 and April 2009 and included various

environmental groups, interested citizens, and the Maryland-National Capital Building Industry Association. The Draft Legislation gained approval of the Prince George's County Planning Board on July 29, 2010 and was intended to "provide guidance and direction on how to prepare environmentally related plans and documents for submission to Prince George's County in conformance with the appropriate sections of the County Code" (Maryland-National Capital Parks and Planning Commission and Prince George's County Planning Department 2010, I-I). The draft legislation was used to help achieve the eight objectives set forth in the green infrastructure plan (See Appendix M) and assist in the land development process and when making decisions regarding the acquisition of public lands.

Current Uses of Plan and Planners Roles

The Prince George's Green Infrastructure Plan along with the Implementation Legislation has been used in the development review process. Interviewee PG1 described the impact the plan has made on land development procedures and environmental planning in general for the county:

> The impact [of the plan] has been huge both on the long-term planning side and on the development review side. For long range planning, it's provided us with a guidance document, a map of physical depictions of the areas that we are most interested in. It's given the developing communities some settled expectations. They know if they are developing on a property that is outside of the network that there will be more flexibility with regard to impacts, but that if a property is within the network that we have the guidance to be looking at what resources should be protected and how that protection should go forward.

The planner from Prince George's County discussed further the role that the plan plays for development review and the importance of their plan functioning as a master plan:

> It is a guide and we use it as a guide. It has provided everyone with a clear picture of expectations and that's really difficult when you don't have either text or a map to guide decisions. In our case, the highest priority resources have been identified before development review occurs which has helped level the playing field so that everybody knows what the expectations are in a way that is really unique. I have worked in and with other jurisdictions and it's hard to know, if you didn't have guidance of a master plan, what resources are the most important (Interviewee PG1 2011).

This excerpt illustrates the large role this plan plays in the development review process. In addition to the plan playing a role in the development review process, many of the strategies of the implementation component focus on the protection of public lands and working with other jurisdictions to ensure a more regional focus on preserving green infrastructure in Prince George's County. Through researching this county and conducting interviews, it became evident that the planner plays a very important role in this process and in an interview with the lead planner on this project I asked her to explain her role and the impact planners have had on the process in an effort to better understand planners roles:

> My role in the process of developing the plan was I was the manager and also the primary author of writing of the plan. There was also a project manager involved. Of course there was a team effort and we got a lot of different professionals involved. We had landscape architects, engineers, planners, and transportation planners chimed in with regard to trails elements to make sure that we weren't in conflict with any other policies

and regulations. So, while I had a project manager, I was the supervisor of the project working directly with the stakeholders (Interviewee PG1 2011).

Interviewee PG1 went on to further describe her role in the process and how her role has influenced the process:

> I was a cheerleader, a cattle prodder, schmoozer, and motivator; there was no mandate to get this done. It was certainly a recommendation in the general plan but it didn't say in the next five years get this plan passed. It's certainly a passion of mine and protection of the environment takes a really long time you can't just jump in and say we should have wider stream buffers. You need a process that leads to everybody understanding that wider stream buffers are better, and so if we didn't have this plan in place I think making the changes to the environmental legislation would have been very difficult to get implemented (Interviewee PG1 2011).

The role of the planner in this particular instance illustrates that there is a certain level of commitment required by the planner involved in this type of planning effort. This can likely take many years, even decades to see the effects of planning activities and that may be a hard sell in counties facing budgetary concerns and high rates of growth and development such as Prince George's.

Cecil County

Cecil County is located in the far northeastern corner of Maryland. It was founded in 1674 by proclamation of the governor, Cæcilius Calvert, 2nd Baron Baltimore, and the county seat is held in the city of Elkton (Cecil County Tourism 2010). Population for the county in 2010 was 101,108, which increased 17.6 percent from 2000 population data (U.S. Census Bureau 2010c). The total land area of Cecil County is 418 square miles, of which, 348 square miles is land and 70 square miles is water (U.S. Census Bureau 2010c). The county borders the Chesapeake Bay on its southwestern corner and contains approximately 217 miles of shoreline (Cecil County Government 2010b).

The Cecil County Office of Planning and Zoning is responsible for the implementation of the county comprehensive plan through the administration of the zoning ordinance, subdivision regulations and the forest conservation regulations. The county comprehensive plan was recently amended in 2006 and became effective in January 2007. A 2010 comprehensive plan is currently in draft form and will be under review mid-2010 (Cecil County Government 2010a).

In 2007, county officials elicited the help of an outside agency, The Conservation Fund (TCF), to assist in identifying a countywide green infrastructure network and ultimately create a green infrastructure plan (The Conservation Fund 2007a). The resulting assessment was an extension of the statewide green infrastructure assessment, which was more accurate than the statewide assessment primarily due to the availability of more recent data and a much finer spatial resolution (Weber 2007). Although the plan is currently accepted by the county and used as an advisory document, it has not been formally adopted as county policy (Cecil County Oversight Committee 2009a).

Cecil County Green Infrastructure Plan

The Green Infrastructure Plan for Cecil County was created in 2007. The Cecil County Green Infrastructure Plan was the second plan examined in this study that was prepared primarily by an outside agency. The Conservation Fund created this plan and the subsequent analyses surrounding this plan (The Conservation Fund 2007a). The creation of this plan occurred just prior to the release of the county's updated county comprehensive plan in 2010. The rural character of the county framed the creation of the county's comprehensive plan and the 220 miles of shoreline and the resources associated with the Chesapeake Bay were central to the 2010 plan. As of 2011 the plan has yet to be adopted as formal county policy.

The county's first comprehensive plan was adopted in 1962 and was titled "The Master Development Plan". Creation of this plan started in 1959 and subsequent plans titled "comprehensive plan" were adopted in 1974 and 1990. The 1990 plan underwent several amendments with the most recent being adopted in 2006. The 2010 focused on a 20-year timeframe to 2030 and was formally adopted on April 13, 2010. Part of the comprehensive planning process included a Comprehensive Plan Citizen Oversight Committee, which was responsible for working with the Office of Planning and Zoning in developing a draft of the comprehensive plan. The most recent committee had 41 members who represented different groups within the general population and were all appointed by the Board of County Commissioners. The green infrastructure plan has been cited in the county's most recent comprehensive planning process even though the plan has yet to be formally adopted. (Cecil County Department of Planning and Zoning 2010).

Goal Setting

In 2005, The Conservation Fund began their analysis to create the Cecil County Green Infrastructure Plan. The work done by the Conservation Fund was supported by a County grant that was used to fund their study (Interviewee TCF1 2011). The Conservation Fund's involvement in the county's green infrastructure was the result of their participation in the 2006 Cecil Land Use Forums that was organized by concerned citizens regarding a growing interest in environmental awareness and the need for conservation in Cecil County (Cecil County Oversight Committee 2008a, 25). There were four forums held between January 9 and October 27, 2006 that included participation of 14 local civic organizations and smart-growth groups. Some of these groups included the Cecil Land Trust, Eastern Shore Land Conservancy, The Environmental Communication Foundation, and the Lower Susquehanna Heritage Greenways. The forum provided the initial interaction between the county and The Conservation Fund to begin working together to create their green infrastructure plan.

The county and The Conservation Fund provided the funding for the study. County Commissioners provided $25,000 and The Conservation Fund contributed $35,000 towards the creation of a green infrastructure study. The Conservation Fund's Strategic Conservation Program was responsible for creating and completing the county's plan as well as identifying and offering guidance of the interaction of the county's green infrastructure and their present and future growth (The Conservation Fund 2009a). The plan utilized a green infrastructure planning approach and included four distinct products which included, (1) Green Infrastructure Network Design, (2) Water Quality Maintenance and Enhancement Analysis, (3) Ecosystem Services Assessment, and (4) Implementation Quilt Analysis.

Analysis and Synthesis

The plan was an extension of the Maryland Statewide Green Infrastructure Assessment created by the Maryland Department of Natural Resources (MD-DNR) (Maryland Department of Natural Resources 2003d). For the identification of the green infrastructure network, The Conservation Fund used county land use data from 2002 and aerial photography gathered in 2005. In addition to this data plan creators examined land use trends from 1973 to 2002 and sought to identify linkages between an existing ecological network known as the Delaware Ecological Network, which borders the eastern portion of the county, and the network identified in the assessment of Cecil County's natural areas. A hub and corridor system similar to that identified within the statewide assessment was created and found that there was a "significant loss of green infrastructure" that occurred in the county over the past 30 years (The Conservation Fund 2007a, 7). The analysis also showed that the county's green infrastructure has become increasingly fragmented and that the continued approvals of development projects were exacerbating the fragmentation being imposed on the landscape.

The county's comprehensive plan was used to identify land use patterns for analysis of the green infrastructure plan. The comprehensive plan identified seven land use districts as well as an overlay for the Chesapeake Bay Critical Area whereby the specific areas designated for growth and development were outlined. Based on the assessment conducted by The Conservation Fund regarding the county's green infrastructure, most of the areas slated for growth and development overlapped "significantly" with the green infrastructure network (The Conservation Fund 2007a, 9). In an effort to convey the value of the county's green infrastructure to local stakeholders as well as planning staff, the Conservation Fund focused on the importance of ecosystem services. A section of the plan was dedicated to ecosystem services

and included a description of various types of ecosystem services and a comprehensive technical report with a valuation of the county's ecosystem services (Weber 2007).

Implementation

For the implementation component of the plan, a set of tools was presented as potential funding options to protect the green infrastructure network. Table 19 is a listing of the programs and incentives highlighted in the plan.

Table 19. Implementation Programs and Incentives

- Program Open Space
- Rural Legacy Program
- Maryland Agricultural Land Preservation Foundation
- Maryland Environmental Trust (MET)
- Maryland Historical Trust (MHT)
- Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP)
- Wetlands Reserve Program (WRP)
- Wildlife Habitat Incentives Program (WHIP)
- Farm and Ranch Lands Protection Program (FRPP)
- Environmental Quality Incentives Program (EQIP)
- Forest Legacy Program (FLP)
- Coastal and Estuarine Land Conservation Program (CELCP)
- Pension Protection Act of 2006
- Purchase of Development Rights Program (PDR)
- Transfer of Development Rights Program (TDR)

Adapted from: (The Conservation Fund 2007a, 29-35)

In addition to the sources noted in Table 19, the plan suggested the creation of a green infrastructure overlay with performance standards that could be used by county staff in the development review process for subdivisions and general development proposals. There were

also brief sections on bond funding, partnerships, and education outreach. The green infrastructure plan specifically noted within the education outreach section that:

> The Green Infrastructure Plan developed for Cecil County has not been vetted through an advisory group or public involvement process. The Fund recommends that additional public involvement and evaluation of the proposed plan and recommendations is undertaken. This may take the form of a citizen advisory group, focus groups, public forums hosted by the county or other local organizations or even an informal or formal opinion poll designed to gauge public acceptance of the proposed green infrastructure plan recommendations (The Conservation Fund 2007a, 42).

The Green Infrastructure Plan created by The Conservation Fund in 2007 was not the first time an outside agency included green infrastructure in a plan created for the county. In May 2005 Cecil County adopted the Land Preservation Parks and Recreation Plan (LPPRP). The LPPRP is required to be updated by each county and submitted to the State of Maryland every six years and is intended to focus on recreation and parks, agricultural land preservation, and natural resource conservation (Cecil County Government 2005, 3). There was a public participation component to the development of the LPPRP which included two meetings held between May 2004 and May 2005 and included members from the Board of Parks and Recreation, Agricultural land Preservation Advisory Board, Board of County Commissioners, municipalities, and members of the general public. The state and county government also reviewed a draft plan and public hearings were held reviewing the draft plan and responses to comments received from the Maryland State Department of Planning. The LPPRP plan was adopted by the Board of County Commissioners in May 2005 and became an amendment to the county's comprehensive plan. An interview with the consulting agency responsible for assisting

in the creation of this plan described how green infrastructure was incorporated into the 2005 LPPRP:

> We did the Cecil County land preservation parks and preservation plan in 2005. There is a section on green infrastructure that predates The Conservation Fund and it talks about green infrastructure really from the state's perspective. It talks about using the states Greenway Atlas and it looks at the state map so we did that in 2005 and then somewhere, I'm guessing 2006 or 2007 the County contracted with The Conservation Fund to do the green infrastructure study (Interviewee TCF2 2011).

Early on in the plan the authors note the large contiguous areas that have remained intact and have not been subjected to extensive fragmentation from development and noted the Greenways Atlas created by the state in 2000 as well as the incorporation of the concept of greenways into the Comprehensive Plan in 1997 (Cecil County Government 2005, ES-4). Greenways were however incorporated into the Comprehensive Plan in 1997 based on the data used for the Maryland Greenways Atlas (Cecil County Government 2005, V-4). Although the plan did not include its own analysis of the green infrastructure present in the county it did state the following in support of building upon the statewide green infrastructure assessment:

> Some natural resource and watershed inventory and assessment work has been completed by the State and by others that, in combination with the State's green infrastructure, provides a basis for achieving the State's and County's natural resource protection goals (Cecil County Government 2005, V-6).

The plan also describes some of the weaknesses regarding the planning process and its relationship with green infrastructure:

> Greenways are integrated into the County's planning process through the Comprehensive Plan and the zoning and subdivision ordinances. However, green infrastructure, watershed protection and restoration strategies and related initiatives are not. The Planning Commission recommended revisions to Comprehensive Plan include a watershed protection element. The County needs to develop better integration between these watershed protection and restoration goals and the comprehensive planning process (Cecil County Government 2005, V-14).

To overcome this deficiency, the plan recommended that under the authority of planning and land use future planning practices should "integrate greenways and the state's green infrastructure concepts more comprehensively into the County's planning and development review processes" (Cecil County Government 2005, V-17).

Even though the green infrastructure plan has not been formally adopted as county policy, mention of the plan is occurring in other planning efforts. During the recent update of the County Comprehensive Plan there were various instances where the adoption of the green infrastructure plan was discussed in public meetings and stakeholder meetings. All of these discussion occurred after the plan was created and occurred in accordance with the Comprehensive Plan Citizen Oversight Committee (COC) meetings leading up to the most recent plan in 2010. There were also various subcommittees that met under the COC that separated preservation and land-use into two distinct subcommittees. Green infrastructure was identified as an important value possessed by the county and the county employed a scenario-building process to examine these values utilizing a specific decision-making process titled Choosing by Advantages. This process aimed to align the goals and objectives of stakeholders with various activities affecting the county. There was an objective analysis that brought the goals and

objectives together and potential scenarios were then created (Cecil County Oversight Committee 2008a, 9). Members of the scenario-building team represented Cecil County Government, Maryland Department of Planning, Maryland Department of the Environment, and the National Smart Growth Center.

Green infrastructure was one of the data sets that were used to understand the trends and constraints present in Cecil County. Each of the seven subcommittees was responsible for its own unique set of plan elements. Each subcommittee was charged with drafting goals and objectives prior to meeting as a group and was to be used during the scenario-building process. The Agriculture, Preservation, and Minerals Subcommittee was responsible for the green infrastructure element and aimed to "prioritize the existing green infrastructure hubs and corridors, and focus efforts to protect as many of the high priority areas as possible" (Cecil County Oversight Committee 2008a, 18). The subcommittee was comprised of ten participants with professional affiliations and 14 concerned citizens. This subcommittee also focused on protecting, preserving, and restoring the natural resources present in the county pertaining to water quality, ecosystem services, sustainable forestry, rural vistas and viewsheds, wildlife, agricultural lands, and mineral extraction areas.

Several of the Citizen Oversight Committee's discussed green infrastructure during their meetings. These committees also made recommendation for how green infrastructure could be integrated with the comprehensive plan calling for: adopting the green infrastructure plan, protecting green infrastructure wildlife corridors, creation of a "natural resources district" that applied to priority natural resource areas, and identifying and designating "restoration focus watersheds" (areas where water quality enhancement was encouraged) (Cecil County Government 2005, 7-15). However, there was concern that "significant potential conflicts"

existed between these recommendations and recommendations for development in Growth Areas, and agricultural areas (Cecil County Government 2005, 7-15).

During the initial Citizens Oversight Committee meeting on July 16, 2008 staff from The Conservation Fund attended and gave a presentation of the green infrastructure plan created for Cecil County. While some of the subcommittee members specifically cited the green infrastructure plan in support of concepts such as the creation of a Natural Resources Conservation District, others shunned the idea and said "the Green Infrastructure Study would gut the growth corridor" (Cecil County Oversight Committee 2008a, 45). Green infrastructure was a common discussion point during the initial meeting and concerns were raised such as the following:

- Route 40/I-95 Corridor has the biggest concentration of Green Infrastructure. What happens as we develop the corridor?
- How can we ensure that our Forest Conservation areas count towards Green Infrastructure?
- Does the county want to channel growth away from the Green Infrastructure?
    - Can we follow the Ebenezer Howard approach and have Green Belts between the towns along the growth corridor?
    - If we were to move the growth away from the existing corridor where would it go? (Cecil County Oversight Committee 2008a, 66).

During a COC meeting in October 2008 there were discussions about green infrastructure and its relationship with the various scenarios that were presented in a scenario-building meeting held by the county and ERM consulting group. ERM was questioned by COC members as to whether the Green Infrastructure Plan was used by ERM in creating the various scenarios and ERM

responded that the plan's data was used in addition to other relevant documents to create the scenarios (Cecil County Oversight Committee 2008b, 7). The interaction between the identified green infrastructure and potential development was the primary discussion topic and concern was raised a COC member:

> There's a whole lot of acreage of land that you haven't included that is zoned by the federal government. The Army Corps of Engineers dredge areas but they are managed by DNR under memorandums of understanding. Garrett Island is actually a part of the Black Water National Wildlife Refuge. We should identify these areas. I would be much more comfortable with the fourth scenario if we actually started designating our green hubs. Right now we have our rural suburban areas for development. If we put this maximum area up there and that's the plan we go with, we've eliminated our green infrastructure plan because we have no green hubs. We need to prioritize, list and map them. That way we can determine what our development density should be in those green hubs (Cecil County Oversight Committee 2008b, 40).

Similar to the concern raised by the above COC member, much of the discussion at these meetings focused around disagreements regarding how the network should be designated. Discussion between group members related to the inclusion of hubs and corridors was also central to the meeting discussion as well as confusion regarding the shading of the cells ranging from light green to dark green.

In May 2009 the Agriculture, Preservation and Minerals subcommittee presented its goals for the comprehensive plan. There were multiple points to each of the goals with action plans such as adopting the green infrastructure plan to general concepts that should be supported going forward by the county. The first goal is presented in Table 20 with the action items following.

Table 20. Cecil County Comprehensive Plan Subcommittee Goals

1. Identify and protect sensitive environmental lands, our network of green infrastructure hubs and corridors, and areas critical to the health of our watersheds, wildlife habitats, and the Chesapeake Bay. a. Adopt the 2007 Cecil County Green Infrastructure Plan b. Adopt the State of Maryland Goals for Natural Resource Land Conservation, including the following: c. Expand and connect forests, farmlands, and other natural lands as a network of contiguous green infrastructure d. Protect critical terrestrial and aquatic habitats, biological communities, and populations. e. Manage watersheds in ways that protect, conserve and restore stream corridors, riparian forest buffers, wetlands, floodplains, and aquifer recharge areas and their associated hydrologic and water quality functions. f. Support a productive forestland base and forest resource industry, emphasizing economic viability of privately owned forestland. g. Encourage conservation (and restoration where practical) of ecological connections and natural resource systems throughout Cecil County's urban. suburban & rural areas

Adapted from: (Cecil County Oversight Committee 2009e, 1)

In addition to the above noted goal, there was another goal to create a Natural Resources District that encompassed higher priority green infrastructure areas and to create the "capability to work with officials at all levels to develop a systematic approach to protecting green infrastructure" (Cecil County Oversight Committee 2009e, 2). There were eight specific goals that supported the protection of green infrastructure for the county in addition to relevant green infrastructure concepts such as protecting and promoting connectivity of the landscape and support of the 2005 LPPRP.

As the COC meetings progressed in the process, the focus on green infrastructure

diminished. The discussion shifted to one of language relative to green infrastructure and concern over proper wording for green infrastructure going forward (Cecil County Oversight Committee 2009c, 9; Cecil County Oversight Committee 2009b, 5) and whether or not the Green Infrastructure Plan should be used as an advisory document (Cecil County Oversight Committee 2009d, 8). A suggestion was also made that the Green Infrastructure Plan be redeveloped/refined in concert with the development of watershed protection plans for stormwater management (Cecil County Oversight Committee 2009b, 58). This would result in a reassessment of the green infrastructure in the county and ultimately result in the creation of a new plan.

Although the green infrastructure plan has not been formally adopted it has been used in other planning efforts by the county. The green infrastructure plan was used by the Cecil County Comprehensive Plan Water Resources Subcommittee as a data source to help develop their Water Resources Element Plan, which is required by the State of Maryland.

Comparison of Cases

Each of the five counties studied presented various ways for knowledge communities to be integrated within the general green infrastructure planning process. This process was similar to the framework presented in McDonald et al. (2005) and was relatively consistent between the five counties. Where these county processes differed was mainly in the related planning functions that each county chose to link with their green infrastructure plan and to what extent experiential groups were involved in planning processes. Table 21 provides a concluding summary of each individual plan and its current status.

Table 21. County Plan Information

County	Plan Created	Primary Agency Responsible for Plan Creation	Related planning function linked to green infrastructure plan	Inclusion of Knowledge Communities	Adopted
Anne Arundel	2002	County Planners and Consultants	Parks and Recreation	Goal Setting, Scenario's, Feedback from local residents during synthesis, Implementation tools created with assistance from experiential groups	Yes - By reference
Baltimore	2004	County Planners and Steering Committee	Sustainable Forestry	Goal Setting, Focus Groups, Forums integrating expert and experiential groups,	Yes - By reference
Cecil	2007	The Conservation Fund	N/A	Focus groups during implementation stage	No
Prince George's	2005	County Planners	Development	Goal setting, Scenario building workshops, feedback during syntheses, focus groups, collaboration with local development groups for implementation during development review process	Yes - Functional Master Plan
Talbot	2004	County Planners and The Conservation Fund	Agriculture	Goal setting and implementation stages working with local agricuculture agencies	Yes - By Reference

Although this table illustrates the basic plan elements, it does not capture some important lessons learned from these case studies. The first being that although green infrastructure planning is a process that relies heavily on scientific data, that scientific data and analyses alone are not enough to create implementable plans. Experiential knowledge communities (see Appendix E for listing of expert and experiential knowledge communities involved) need to be involved early and often in this process for plans to maintain a level where implementation is even possible and having these groups involved as early as the goal setting and visioning stage, supports plan

implementation. Secondly, the comprehensive plan plays a critical role in supporting the initiation of a green infrastructure plan and can be used to leverage planning activities. In addition to the comprehensive plan, linking plans with related planning functions that are important to the overall county goals such as recreation in Anne Arundel County, sustainable forestry in Baltimore County, and agriculture in Talbot County provides the plans a foundation and greater relationship between planning goals and subsequent action.

After researching each of the individual county plans and the green infrastructure process, Chandler's model for questions that can be asked regarding whether a plan is implementable was modified and applied to the five cases (see Table 22).

Table 22. Is a Plan Implementable?

	Plan attributes						
	Realistic	*Specific*	*Linked with related functions*	*Citizen focused*	*Understandable*	*Problem/Solution Specific*	*Current*
County							
Anne Arundel	Yes	Yes	Yes (parks and recreation)	Yes	Yes	Yes	No
Baltimore	Yes	Yes	Yes (sustainable forestry)	Yes	Yes	Yes	Yes
Cecil	Yes	No	No	No	Yes	Yes	Yes
Prince George's	Yes	Yes	Yes (development)	Yes	Yes	Yes	Yes
Talbot	Yes	No	Yes (agriculture)	No	Yes	No	Yes

Modified from: (Chandler 1995)

Although this model was created for analyzing comprehensive plans, there is value in using the questions to analyze a green infrastructure plan. There are several plan attributes that can be assessed to determine whether a plan is implementable including the whether the plan is realistic, specific to green infrastructure, linked with related planning functions relevant within the county such as sustainable forestry or agriculture, citizen focused, understandable to everyone, addresses as specific problem and offers relevant solutions, and is current with the needs and activities relevant to the existing administration. For a plan to be considered implementable, it should achieve each of these plan attributes.

In addition to measuring whether the plans were implementable, the cases also suggested ways of measuring success of the individual plans (Table 23).

Table 23. Measuring Plan Success

	Elements of Plan Success					
	Adopted	*Element of Comprehensive Plan*	*Integrated Knowledge Communities*	*Linked with related functions*	*Review Process*	*Measured achievement of plan goals*
County						
Anne Arundel	Yes	Yes	Yes	Yes (parks and recreation)	Yes	Yes
Baltimore	Yes	Yes	Yes	Yes (sustainable forestry)	Yes	Yes
Cecil	No	No	No	No	No	No
Prince George's	Yes	Yes	Yes	Yes (development)	Yes	Yes
Talbot	Yes	No	No	Yes (agriculture)	Yes	No

Some of the ways that success could be measured is whether or not the plan has been adopted. Although some plans are adopted as county policy (Prince George's County) the plans may also be adopted by reference through other plans such as the county comprehensive or master plan. Many of the successful plans have been incorporated as elements within the comprehensive plan and provide leverage for future implementation. This extends to whether the plan is being used to direct implementation of other related planning functions important to the county such as development (growth tiers in Prince George's County) or preservation of agricultural lands in Talbot County. Another measure of success includes whether the plan has been used during the development review process or in other reviews such as regulatory and/or mitigation efforts. Some of the plans had specific goals (Prince George's County) that could be used to measure whether plans have been successful. Without these measurable goals it can become very difficult to analyze plan success. Finally, a large element of measuring success would be to analyze the integration of knowledge communities in the planning process and incorporate experiential as well as expert groups.

CHAPTER 5 – ANALYSIS AND INTERPRETATION OF MARYLAND GREEN INFRASTRUCTURE PLANNING

This chapter portrays the green infrastructure planning process for five counties in Maryland. The discussion illustrates the range of activities that can occur throughout the green infrastructure planning process, including the acknowledgement and integration of multiple knowledge communities throughout the various stages of plan creation and development. The discussion reveals that there is no "one size fits all" approach for creating a green infrastructure plan and supports the value of including multiple knowledge communities early and often in the planning process. This chapter presents examples that demonstrate how counties striving to create and implement a green infrastructure plan can include multiple knowledge communities in the process and supports the value in recognizing multiple knowledge claims surrounding this process, which may not be based solely on scientific data. Although scientific data helped set the stage for analysis and effective implementation, this process has gone beyond a scientific discourse to include multiple knowledge communities that are often not categorized as experts.

The McDonald et al. framework provided a model for analyzing the green infrastructure planning process in Maryland and helped to identify the relationships between the various knowledge communities present and their subsequent roles. The research questions are revisited and answered within the framework of the four main planning stages, which include goal setting, analysis, synthesis, and implementation. The study was based on the following research questions:

(1) How does the green infrastructure planning process translate into practice?

(2) How is knowledge used in a green infrastructure planning process?

(2A) How does integration of multiple knowledges occur?

(2B) How is knowledge linked to action and outcomes?

(3) How do planners facilitate the integration of knowledge communities?

The findings in Chapter 4 presented green infrastructure planning in Maryland and organized the information necessary to satisfy these research questions. This chapter analyzes and synthesizes the findings and is organized by two analytic categories, which were established based on the coding of the data. These categories were created to manage a large volume of qualitative information and provide a grouping under which the research questions could be appropriately analyzed. After all data, including interviews and documents were coded, an initial review of the data revealed that the codes aligned under two broad themes. The first involved planning processes and the second, planners' roles. These two overarching themes formed the two analytic categories where the research questions are addressed bounded within either of the two following categories:

1. The Relationship Between Knowledge and the Green Infrastructure Planning Process (Research Questions 1, 2, 2A, & 2B)
2. Planners Roles in Green Infrastructure Planning (Research Question 3)

The analysis component of this research seeks to determine patterns occurring and connecting these patterns to the two analytic categories. Based on the analysis of these patterns, themes emerge from the data. An analysis of the emergent themes was then compared and contrasted with relevant theory and existing literature. The structure for Analytic Category 1 followed the general green infrastructure planning process: Analysis was ordered based on the identified stages of goal setting, analysis, synthesis and implementation.

The theoretical framework of analysis was based on existing literature on knowledge and planning (Innes and Booher 2010; Alexander 2008; Rydin 2007; Randolph 2004; Corburn 2003;

Mazza 2002; Khakee, Barbanente, and Borri 2000; Innes 1998; Crosta 1996; Friedmann 1987; Habermas 1968). The analysis takes into account literature on the green infrastructure planning process, inclusion of multiple knowledge communities through communicative action, and planners' roles. The interpretations of the findings expose what the inclusion of multiple knowledges communities may look like within a green infrastructure planning approach as well as the planner's role within planning processes with respect to current issues of scale.

Analytic Category 1: The Relationship between Knowledge and the Green Infrastructure Planning Process

Through a review of the Maryland counties in this study that have created green infrastructure plans and the processes under which theses plans were created, the results illustrated how data and information were used to create knowledge and inform decision-making. As stated by Rydin (2007), planning practice utilizes knowledge as a means of progress and is central to the achievement of change through planning activities (Rydin 2007, 53). As a planning activity, green infrastructure practice is based on the principles of landscape ecology and conservation biology integrated within a planning process of goal setting, analysis, synthesis, and implementation. Similar to the ideas of Lindblom (1990), within green infrastructure planning, scientific or technical knowledge only provides a part of what is required for sound judgment and decision-making. Experiential knowledge held by non-experts is particularly important for creating support for a proposed plan and adds value to the decision-making process. Although green infrastructure planning is consistent with general planning processes, it contains a specific technical element that may not be present within other forms of planning. Because of the technical information required to complete a green infrastructure plan, and a lack

of consistency regarding the goals of the plans, the way that participants were included in the process varied.

Multiple knowledge communities were not used in the same capacity by each of the counties (see Appendix E). There was not a uniform procedure that emerged from the data regarding the use of multiple knowledges and each county endeavor involved members not classified as experts (i.e. concerned citizens, development communities) differently in the process. The timing of the plans relative to the most recent update of the comprehensive plan and the existence of a steering committee influenced how various knowledge communities were involved in the planning process. Based on Rydin's knowledge typology and the four different types of knowledge (empirical, process, predictive, and normative), various forms of knowledge have all been used and integrated into the various plans but the degree to which they have been used varied. There were also variations in how this knowledge was generated and the role of the planner in each situation.

Goal Setting

The first stage of the green infrastructure planning process included the identification of issues, the creation of an outline for plan development processes, and the consequent plan goals were decided upon (McDonald et al. 2005). As Maryland conducted a statewide green infrastructure assessment prior to the creation of any of the individual county plans, this provided support of green infrastructure by Maryland and set the stage for individual counties to begin their own assessments of green infrastructure and begin plan development. Based on the cases studied, goal setting was an integral part of the planning process where the integration of multiple knowledges communities varied amongst counties.

Analysis of the statewide assessment does not suggest that community members were included in the goal setting stage of creating the statewide network but it does provide evidence that the individual counties were used as experiential knowledge communities who helped determine areas that were considered locally significant. Traditional planning is often described as being a technocratic process whereby scientific knowledge is viewed as superior to experiential knowledge (Khakee, Barbanente, and Borri 2000) but in the instance of the statewide assessment experiential knowledge in the form of county knowledge was used and resulted in a network that was more representative of the ecological areas important to the counties of Maryland.

A county's comprehensive plan plays a critical role for the initiation of a green infrastructure plan that is ultimately adopted as county policy. For counties such as Prince George's and Anne Arundel the comprehensive plan paved the way for the creation of green infrastructure plans. The creation of a green infrastructure plan was based on the direct call for green infrastructure planning in each of the respective plans (Anne Arundel County Office of Planning and Zoning 1997; Prince George's County Planning Department 2002). The Prince George's County 2002 General Plan states as one of its objectives to " protect, preserve, enhance and/or restore designated green infrastructure components by 2025" (pg. 3) and the Anne Arundel County 1997 General Development Plan recommended that the county "develop a countywide greenways master plan and integrate it into regional greenway planning efforts" (pg. IV). In the counties where the most recent comprehensive plan was updated after the creation of the green infrastructure plan, two of the three counties (Baltimore and Talbot) have adopted the plan either formally or through reference. However, in Cecil County where the plan has yet to be formally adopted, they have used the comprehensive planning process to leverage their

existing green infrastructure plan and is using the comprehensive plan update as a forum for involving members of the community, which didn't occur during the creation of their green infrastructure plan. For the other counties, the information gathered through extensive meetings with multiple knowledge communities during the comprehensive planning process provided valuable information to the counties when the time came to create their green infrastructure plans. Interviewee PG1 from Prince George's County recounts how information from their comprehensive plan update informed their process for initiating their green infrastructure plan:

> In 2000 we did a comprehensive update and a roundtable task force to start looking at issues that would inform the plan. Green infrastructure wasn't a term that was known in the community but it was certainly becoming a more known and valuable tool. In our general plan one of the strategies to implement the environmental goals was to develop a green infrastructure plan so after that plan passed in 2002 we started the process to do our green infrastructure plan that is a functional master plan. This means that it carries the same weight as a master plan of transportation or any other master plan for the different functional areas such as historic preservation, public facilities, and those kinds of things. As far as we know it's the first of its kind in the country that was done as a functional master plan (Interviewee PG1 2011).

In addition to the comprehensive plan, the presence of a champion was another driving force during the visioning and goal setting activities that occurred in the process. As noted in Randolph (2004, 29) the three ingredients for success in environmental planning processes include good technical information, a strong constituency, and a champion. Based on the interviews there were two counties that specifically noted the importance of a champion at the time of plan creation and were cited as being critical for the creation of green infrastructure

plans. Interviewee PG1 from Prince George's County recalled the role of a champion in their planning process as follows:

> … we had a champion of this issue, which is always a good thing to have someone who is in the community that is aware of green infrastructure planning and why it is important and how it can help in decision-making. He was a former mayor of one of our municipalities. We have 26 municipalities in our county; none of them have planning and zoning authority so all of the planning and zoning is done at the county level. But this particular municipality, the city of Bowie is a very large municipality and he was a former mayor so he was very respected, knowledgeable, and well known in the community (Interviewee PG1).

The planner from Anne Arundel County also noted the role of a champion in their planning process and how this person focused the plan on issues that they knew were important to constituents and would aid in plan adoption stating:

> The other thing that crept in was that the county executive at the time, who amazingly used this plan in her campaign in her reelection campaign and it was unbelievable. She got an award from [Governor] Glendenning and she loved it. But she wanted to make sure that the people aspect, the recreation aspect was emphasized and that it wasn't just ecological. Because if it's only adopted for the birds and the bees, it may not sell politically.

The case studies suggest that the champion does not need to be an individual outside of the planning staff as it occurred in Prince George's and Anne Arundel counties but that a champion may also occur as a planner closely related to the plan or a group or committee that paves the road for a green infrastructure plan to be created. For instance in Baltimore County, the lead

planner worked together with the Steering Committee to create the vision that guided all subsequent activities relating to sustainable forestry.

Based on the findings the creation of a committee or forum was useful for integrating these participants representing multiple knowledge communities. Central to the goal setting stage is that participants representing various interests are directly involved in the establishment of goals and subsequently, their involvement from the goal-setting phase onward increases the discourse and communication amongst the stakeholders. For example, in Baltimore County, the Steering Committee identified as one of their goals to "open up the discussion with a broader range of stakeholders" (pg. 12). As a result a forum with over 70 participants from 40 different organizations was able to provide input in the planning process and "provided a way for information on various topics to be shared among participants involved in the Forest Sustainability Program" (pg. 12).

Similarly, in Anne Arundel County a steering committee was also established before the creation of the plan and was supported by Interviewee TCF2 who was a consultant for the project:

> The county was very good at involving parks and recreation, citizen groups, [stakeholders] into their general development plan update. We were part of the steering committee from the beginning, myself and the guy (interviewee AAC1) who was in charge of our planning who actually managed the acquisitions and development of the park plans. [We were both on the] general development plan steering committee, which was very helpful. I was also on the environmental steering committee for the environmental portion of it (Interviewee TCF2 2011).

The research illustrated that the earlier the steering committee or forum was involved in the planning process, the greater support counties had for their plans as well as greater hands on involvement from various stakeholders. This was likely the problem faced by Cecil County that only created a green infrastructure committee after the plan was already created. Because experiential groups were not involved in the goal setting stage and creation of the plan, it was likely that there were disputes among participants and ultimately the inability of these groups to reach consensus.

Although processes did engage stakeholders after the goals had been set (see Appendix E) and achieved successful implementation (as is the case in Prince George's County), it is generally suggested that the engagement of stakeholders in planning activities occurring "early and often" in the process has led to more informed decision-making and higher rates of implementation (Burdge and Robertson 1990; Voinov and Gaddis 2008). In the management of complex natural resources, Voinov and Gaddis (2008) found that having stakeholders involved early and in as many planning activities as possible such as in goal setting, the development of scenarios, and the development of policy alternatives leads to better knowledge during the decision-making phase (pg. 201). It seems that for green infrastructure planning the goal of participation and the creation of a steering committee is to gain agreement on the proposed plan and generate knowledge as a group from goal setting onward. The success of the steering committee in engaging multiple knowledge communities is an indicator of a more informed goal setting and decision-making process resulting in plans that have a greater likelihood of implementation.

The level of implementation that is associated with the plans appears to be related to the establishment of measureable long-term goals from the onset of their plan. This also seems to be

consistent with the counties that actively engaged stakeholders throughout the planning process. Because many of the plans are implemented at the local level, as explained by Interviewee MD-DNR1 from The Maryland Department of Natural Resources (MD-DNR), having the support from stakeholders in creating the goals seems to be an indicator of future success of the plan. The information used in the creation of goals is skewed in the direction of related planning functions used to guide plan creation.

Table 24. County Green Infrastructure Plan Goals and/or Policies

County	Goals and/or Policies
Anne Arundel	Enhance the beauty of the County's landscape by reducing the fragmenting effects of development and preserving valuable open space
	Provide adequate habitat to support healthy populations of a diversity of naturally occurring plant and animal species
	Help guide the location of development so that negative effects on ecologically valuable lands are minimalized
	Link communities to a countywide network of open space
	Provide off-road transportation opportunities
	To increase recreational opportunities
	Improve water and air quality
	Improve the economy by maintaining and increasing property values and by attracting visitors
	Encourage the ethic of stewardship of the land in the County
	Help achieve the recommendations of County regional and state plans and programs including the Anne Arundel County's general development plan, land preservation and recreation plan, and small area plans, the Chesapeake 2000 agreement, and Maryland Greenprint program
Baltimore	10 Guiding Principles, 42 Goals, 86 Recommended Actions, and 63 Recommended Assessment and Data Analyses in support of 15 Ecological and Economic Issues for Forest Sustainability.
Talbot	Identify areas of high conservation value for the protection of important ecological resources, aquatic systems and working landscapes to allow for prioritization of land preservation efforts
	Spatially represent the environmental and agricultural goals outlined in the Talbot County comprehensive plan and provide a mechanism for quantitatively ranking land areas based on these priorities

	Recommend implementation strategies and funding sources that leverage existing state and federal programs and introduce innovative local conservation mechanisms
	Provide a dynamic, adaptable methodology that evaluates various conservation opportunities efficiently and effectively by measuring relative benefits and allows for the incorporation of new data as it becomes available
Prince George's	By the year 2025, ensure that 75% of the green infrastructure network acreage meets the definition of countywide significance
	90% of the land acreage purchased for environmental preservation using public funds should be located within the green infrastructure network
	In new subdivisions in the Rural Tier, and outside of approved growth centers and corridors in the Developing Tier, ensure that 100% of impacts to regulated areas are limited to unavoidable impacts, such as those for road and utility crossings
	By the year 2025, less than 25% of countywide net losses of woodland cover should occur within the green infrastructure network
	By the year 2025, improve water quality in it each major watershed to elevate the Benthic Index of Biological Integrity rating of the watershed by at least one category using as a baseline the 1999 - 2003 biological assessment of the streams and watersheds of Prince George's County completed by the Department of Environmental Resources (DER)
	By the year 2025, improve the stream habitat in each major watershed to elevate the habitat reading of the watershed by at least one category using as a baseline the 1999 - 2003 biological assessment of the streams and watersheds of Prince George's County completed by DER
	Each year, strategically target 100% of all site forests mitigation acreage into the green infrastructure network and/or adjacent to streams outside of the green infrastructure network. 50% of the forest mitigation acreage should be, targeted to improving water quality by establishing, enhancing, and/or restoring riparian forest buffers
	Each year, 100% of all site environmental mitigation projects (wetland, forests, stream restoration, etc.) should be targeted to priority areas identified in the countywide catalog of mitigation sites. A minimum of 50% of the mitigation projects should be targeted to enhance water quality of the major watershed in which the project generating the need for mitigation is located
	Preserve, protect, enhance and restore the green infrastructure network and its ecological functions while supporting the desired development pattern of the 2000 to General Plan
	Preserve, protect and enhance surface and groundwater features and restore lost ecological functions

	Preserve existing woodland resources and replant woodland, where possible, while implementing the desired development pattern of the 2000 to General Plan
	Promote environmental stewardship is an important element to the overall success of the Green Infrastructure Plan
	Recognize the green infrastructure network as a valuable component of the counties Livable Communities Initiative
Cecil	No explicitly stated goals

The plans that contained goals linked with related county planning functions were Prince George's County (development), Anne Arundel County (recreation), Talbot County (agriculture), and Baltimore County (forestry). It is possible that focusing on these concepts when creating the goals for the specific county plans made the link between the knowledge required for the establishment of goals and the subsequent actions leading to implementation.

The Maryland Statewide Green Infrastructure Assessment was used by each of the counties as a baseline for each county plan. The information present within the statewide assessment was scientific or technical in nature consisting primarily of GIS natural features layers and was used to guide individual county plans as well as provide feedback to the MD-DNR on where broader landscape conservation efforts are and should be occurring. Interviewee MD-DNR1 from MD-DNR supports this concept of collaborative interaction between the MD-DNR and counties beginning to create their own green infrastructure plan:

> We provide technical assistance so if the county wants to do their own green infrastructure plan they typically go to our website and they look at our methodology and [ask us for assistance]. [The counties may also come to us regarding what data to use.] (Interviewee MD-DNR1).

Because of the technical focus from a statewide perspective, the statewide assessment doesn't appear to have been utilized by counties during the goal setting phase of their projects, primarily

due to issues of scale. The statewide assessment (Maryland Department of Natural Resources 2003) asserts the following:

> It should be noted that the GIS-based green infrastructure analysis utilized data that were generally available statewide and at map scales ranging from 1:24,000 to 1:100,000. Therefore, the green infrastructure depictions shown in the atlas should be considered useful for regional planning and assessment purposes only. (pg. 227)

Because of the technical aspect of the assessment it seems that the collaboration between expert knowledge communities guided the development of the assessment. As noted in Chapter 4, there was interaction with the county planners and the MD-DNR in an effort to seek feedback on the state's assessment of green infrastructure. However for the individual counties, the statewide assessment was used in the analysis phase of the planning process based on interviews with planning staff and review of planning documents. There is little evidence that the statewide assessment played a substantial role in the Plan Foundations element of the Goal Setting stage as described in (McDonald et al. 2005) but rather was more relevant in the later phases where analysis of the actual green infrastructure network has occurred.

Not all of the counties that have achieved plan adoption have included knowledge communities in the goal setting stage. In Talbot County there is no evidence supporting an integration of multiple knowledge communities at all during the goal-setting phase. Interviewee TC1 attributed their lack of involvement to a difficulty in determining stakeholders as well as identifying how they can be involved in the process:

> …we are a rural county with about 30,000 people right now so trying to figure out who the stakeholders are for a project in a rural area is a little bit difficult to interpret sometimes (Interviewee TC1).

Although this may be the sentiment for planning efforts within the county, it does not appear that it was ever an intention for the consulting agency that created the plan to seek out input from the residents of Talbot County. Based on a review of the plan it appears to be an exercise of green infrastructure analysis that would be utilized by the county who would then develop a more tangible set of goals with possibly the guidance of a steering committee who would then develop ways of integrating more knowledge communities in the later phases of the process. This does not suggest that collaboration between agencies and consultants was lacking, but rather the level of integration between differing knowledge communities was not comparable with counties that worked with either a steering committee or other agencies in developing the goals of their plans.

Analysis

Each of the plans utilized a hub/corridor approach, such as that within the statewide assessment (Maryland Department of Natural Resources 2003, 2), whereby technical experts from various resource groups, government agencies, and consulting firms worked together to design the network criteria. This process was conducted primarily by technical experts due to its dependency on GIS data as described by Interviewee PG1:

> We used it (The Statewide Green Infrastructure Assessment) as a base plan for our original network designation. Then we used it in our scenario-building. We had really good GIS data when we started. We had been mapping resources for over 10 years before the beginning of this so we were pretty advanced as most communities go. So, we used the state green infrastructure assessment to add to the resources that we had already mapped. If the state thought it was important we included it in our network (Interviewee PG1 2011).

The analysis phase of the planning process included the least amount of collaboration amongst multiple knowledge communities and relied the heaviest on expert knowledge. In terms of the statewide assessment, which was primarily a technical document, it provided the baseline for all of the networks created by the counties. Counties felt that the scale of the statewide assessment was not fine enough for effective implementation of county goals so they used more detailed GIS data to create their own networks (as stated by Interviewee PG1 from Prince George's County and Interviewee BC1 from Baltimore County). The analysis occurred by research conducted by technical experts , who were trained in a specific field rendering them capable of assessing particular aspects of the plan which used similar data sets such as water quality, location of existing environmental resources, statewide green infrastructure assessment and data presented in existing plans and programs such as the Rural Legacy Program, Program Open Space, Chesapeake Bay Critical Area Plan, (Maryland Agricultural Land Preservation Foundation) MALPF, and plans in neighboring counties and states (Pennsylvania for Baltimore County).

When the counties did their initial analysis of green infrastructure, the design criteria varied between the counties. The decision to include certain criteria was based on a collaborative discourse between planning staff, advisory committees, and/or consultants. This occurred in the counties that focused their plans around specific landscape features outside of the green infrastructure plan such as development in Prince George's County, forestry in Baltimore County and agriculture in Talbot County. In Anne Arundel County Interviewee AAC1 stated, "the design criteria focused on indicator species" (pg. 4) such as locally occurring native bird, mammal, and amphibian species and their habitat requirements were used to guide the selection of criteria. These criteria were combined with data for recreation and trail elements such as the county's Land Preservation and Recreation Plan. The five criteria that were ultimately used to

determine the network included habitat value, size, connectivity, future potential, and national and countywide trails. Although technical experts, such as staff scientists and resource managers who utilized concepts of conservation biology and landscape ecology, evaluated the selection of criteria, interviewee TCF2 described how experiential knowledge communities were included in the process:

> The future potential criterion was based on the potential to create hubs and corridors where they do not currently exist, with particular attention being paid at critical connections (Interviewee TCF2 2011).

Greenways were identified using the above criteria, which relied on scientific data. However, the process of selecting the greenways included various stakeholder groups that were not scientific experts but rather local stakeholders. This process included an analysis of different mapped information, existing studies, and aerial photographs of the county that were used to identify areas that met the criteria as well as areas where greenways could potentially occur in the future.

The process undertaken during the analysis stage of plan development by Anne Arundel and Baltimore Counties illustrates ways that multiple knowledge communities can be integrated into a process that is generally viewed as purely technical and undertaken solely by expert knowledge communities.

Each county incorporated the results from the statewide assessment into their plans. Each of the plans were also recommended as a future action or acknowledged within the county's most recent comprehensive plan.

Each planning effort appears to have started with the counties utilizing state agencies such as MD-DNR and the State Department of Planning and requesting support in the form of

technical assistance. An employee from the State Department of Planning explains the process when asked how they collaborated with individual counties:

> We work with [them]. We are the planning agency in the state as they will go to MD-DNR for certain things but they will come to us for technical assistance. We are really an agency for the certification part of the Maryland Agricultural Land Preservation Foundation (MALPF) program and the Rural Legacy Program as well because we go through a similar analysis for the Rural Legacy Program (Interviewee MDP1 2011).

During the state's creation of the green infrastructure plan, collaboration both within the agency and individual counties throughout the state occurred. The information gathered by the MD-DNR, which was responsible for creating the statewide assessment, came from multiple resources as Interviewee MD-DNR1 explained:

> Most of the data came from internal data sources and then standardized national or state data sets. We got a lot of information from different resources even from the department, which was challenging. Once maps were developed staff took the maps out to the county offices and had them review the maps throughout the state, while adhering to certain thresholds. Issues came up where counties felt they didn't have enough of their county included in the network. In those instances we did crank the thresholds down a bit in order to pull in some of the more locally significant green infrastructure features. (Interviewee MD-DNR1 2011).

Analysis of the statewide assessment does not suggest that community members were included in the goal setting stage of creating the statewide network but it does provide evidence that the individual counties were used as experiential knowledge communities who helped determine areas that were considered locally significant. Traditional planning is often described as being a

technocratic process whereby scientific knowledge is viewed as superior to experiential knowledge (Khakee, Barbanente, and Borri 2000) but in the instance of the statewide assessment it appears that experiential knowledge was used and resulted in a network that would be more representative of the ecological areas important to the counties of Maryland.

Synthesis

An amalgamation of a proposed green infrastructure network coupled with the priorities, plans goals, and relevant stakeholder input form the synthesis phase of the process. Although collaboration amongst expert knowledge communities led the analysis phase, some of the counties used the synthesis component to involve experiential knowledge communities in the process and increase collaboration between multiple knowledge communities. Counties used the synthesis phase to include stakeholders in defining the network as well as provide feedback to planning staff on the values of stakeholders. Scenario-building was one method by which planners were able to fine-tune their network to better adhere to the wants of local stakeholders without jeopardizing the integrity of the green infrastructure system. This was evident in Prince George's county where participants chose scenario five of six representing approximately 51 percent of the county to be included in the network. Had the scenario-building exercises resulted in the participants choosing some of the lower scenarios that contained less of the network, the integrity of the green infrastructure network may have been jeopardized. This process of developing scenarios is described in Berke et al. (2006) as being used to link the analytic process with the participatory component of the process (pg. 275). Research of this process has suggested that it often includes expert and experiential knowledge communities and it is both important and desirable to involve stakeholders throughout the entire scenario-building process (Mahmoud et

al. 2009). Additionally, feedback generated from each stage in the scenario-building process is also valuable during the decision-making process (Liu et al. 2008).

Prince George's County used the synthesis phase to integrate knowledge held by multiple knowledge communities. For Prince George's, the use of scenario-building exercises was used to integrate multiple knowledge communities when deciding on their network. As stated in the analysis section, this was conducted by technical experts using various overlays representing six possible scenarios for green infrastructure networks. The baseline scenario was simply the statewide assessment and each scenario added various data layers that increased the size of the potential network.

Additionally, in Prince George's County, focus groups were created and formed according to similar knowledge communities. Because each of the focus groups were arranged based on similar knowledges, the information gathered in these groups provided consistency to planning staff. Information gathered from the focus groups was used together with the information collected during the green infrastructure plan review group meeting whereby 37 participants representing multiple knowledge communities partook in a consensus building session that reviewed the six potential scenarios. The information gained from the initial group meetings, community survey, and focus groups resulted in a network similar to the fifth scenario proposed in this scenario-building meetings and the final adopted network was closely aligned with scenario number five.

The integration of multiple knowledges facilitated the creation of the network that was adopted in the final plan. This integration did occur without the presence of a committee as seen in other counties. Interviewee PG1 explained the development knowledge community was included in the process without the presence of a formal committee:

> We don't really have an active environmental group like an environmental network or citizen advisory kind of committees. The plan does recommend that there be an environmental advisory group of some kind and that was put forth in the plan… but we don't have one central organization. There are interested parties and we made sure that they had a seat at the table. The most active and vocal stakeholder was the development community. They have been quite active in both influencing implementation of the plan writing the regulations (Interviewee PG1 2011).

The planner affirmed that stakeholders involved early and often in the process, as stated in (Voinov and Gaddis 2008), was important for plan development and incorporated the knowledge and specific economic interests held by particular groups into the plan to assist in reaching consensus. The involvement of this specific knowledge community was in addition to the plan review group meetings held with other groups such as agriculture and forestry, citizens and environmental advocacy, and municipalities and large civic associations involved during the scenario-building process. During this stage, scientific knowledge formed the basis for discussion through the use of green infrastructure elements and the establishment of potential networks. But once the groups were broken out into smaller workgroups the topics of discussion during scenario-building veered away from concepts of landscape ecology and conservation biology and were based more on mapping and the regulation of green infrastructure areas. This was the point at which practical knowledge claims were intersected with the expert knowledge used to identify green infrastructure elements.

In Baltimore County there was not a plan specifically titled "green infrastructure" but the Draft Forest Sustainability Strategy served as the plan for green infrastructure in the county. The use of forest sustainability indicators framed this process and collaboration occured throughout

the synthesis stage of the process such as the mixed group carousel sessions, which were used to "guide prioritization for network identification" as described by Interviewee BC1. This type of collaboration was an interactive process whereby ideas and feedback were generated through group discussions where knowledge was shared by participants who were encouraged to share with other group members as well as the larger consortium of groups present for the meetings. The steering committee played the role of bringing the concepts and information gathered through numerous public forums, workshops, relevant state and countywide data, internal meanings as well as meetings with resource agencies into a cohesive strategy that adhered to the discourse surrounding sustainable forestry and concepts of green infrastructure throughout the county. The 5E forum, held by the steering committee in Baltimore County, set the stage for how the multiple interests present could be synthesized by achieving consensus on education, economics, easement and endicators (term created by forum to describe environmental indicators such as tools to measure the environment such as air quality and water quality). This was based on a holistic view of forestry resources that led to the creation of subcommittees that would later guide the goals of this planning effort to come to fruition. The meetings held by the steering committee utilized multiple knowledge communities internally but also incorporated an added level of integration by working collaboratively to expand the discourse with other neighboring states.

During the various meetings held by the steering committee for Baltimore County, there was an educational component present that was not evident within the other counties. There were numerous occasions where attendees at the steering committee meetings provided participants with relevant information on green infrastructure practices, the process by which previous efforts relating to sustainable forestry were conducted, and the value of partnerships and

collaboration to the process. Baltimore County utilized this process to share knowledge among stakeholders in an effort to foster better dialogue in an attempt to make better decisions.

The involvement of varying knowledge communities in planning activities was also evident in Anne Arundel County, although conducted through a different platform than Prince George's or Baltimore Counties. In Anne Arundel County the use of public workshops brought expert and experiential knowledge communities together to provide feedback for planning staff on the proposed greenways. Due to the strong environmental commitment of local citizens, planning staff noted that it was important during the design period to include the feedback from stakeholder meetings into the network. There was little evidence though of how the knowledge held by these participants was actually integrated into the planning process beyond reviewing the initial concept greenways network.

During the synthesis phase of Anne Arundel's planning process they extensively integrated their plan within existing plans such as the Rural Legacy Program and the Chesapeake Bay Critical Area Plan. The county planners and consultants responsible for creating this plan aimed to integrate the greenways network design into the larger statewide green infrastructure network and based the establishment of the 42 greenway segments on a collective integration of knowledge used to create various other plans that involved an extensive participatory component (i.e Anne Arundel County Land Preservation and Recreation Plan). Additionally, the effort to integrate their planning efforts within neighboring counties was used as a way to improve connectivity throughout the state by linking to other county green infrastructure. Based on a review of documents and interviews with planning staff, the advisory committee for Anne Arundel County led the involvement of multiple knowledge communities and was the primary means by which integration between various agencies occurred.

In the counties where feedback from stakeholder's review of the networks was included, there were more explicit goals (see Table 23) used to assist in the identification of priorities as described in the McDonald et al. (2005) framework. Additionally, because of the integration of knowledge from multiple knowledge communities, the resultant plans were more comprehensive and contained measurable benchmarks, which set the stage for future monitoring and evaluation of plan success. This element is an indicator of the ability of plans to be implemented and formally adopted as County policy.

As for the counties that did not include stakeholders in the synthesis process, it does not appear that this process was completely absent. Instead, the integration of plan elements was done internally by planning staff or consultants rather than through the elicitation of feedback from stakeholders or other groups who were not formally involved in the planning process. The plans that lacked a synthesis phase involving stakeholders produced plans that were more aligned with network analyses rather than an implementable plan with an identifiable relationship between the network and plan goals.

Implementation

The implementation stage of the planning process provided a framework for integrating established plan goals with priorities for conservation and tools for implementation (McDonald et al. 2005). The findings illustrated that during the implementation phase there was a large variation between the plans in terms of their role within county policy. This ranged from plans being formally adopted as county policy or functional master plans; being used as a guiding document during the development review process and; not being adopted or used by the county to date. There is not one definitive reason why certain plans have achieved relatively greater levels of implementation but there are some indicators that have facilitated continued

implementation. The counties that integrated experiential knowledge with expert knowledge and involved them early and often in the planning process (Anne Arundel, Baltimore, Prince George's) have resulted in adopted plans while counties who otherwise created their plans internally or with some assistance from an outside agency (Cecil, Talbot) have seen little to no implementation. Additionally, counties used knowledge differently during this phase and the process of linking this knowledge to action varied. The planning process does not end with plan preparation and adoption but continues with the input from stakeholders involved in implementation (Berke and Godschalk 2007). As planning staff noted throughout the various interviews (PG1, TCF2, BC1), one of the primary recommendations for each plan was to include an outreach component that would be used to gain support for the plans and involve community members in long-term plan implementation.

The progressive environmental policies present within the State of Maryland ranging from Smart Growth to the new PlanMaryland Strategy have provided opportunities for counties to coordinate their green infrastructure planning efforts with these supportive statewide strategies. The availability of implementation tools to the counties was extensive with the assistance of acquisitions, transfer of develop rights, and easements. Additionally the conservation funding available to the individual counties was similar for each county due to the reliance on federal, state, or revolving funding sources. When plans reached the implementation stage, this was the time where involving multiple knowledge communities can be a beneficial strategy for long-term implementation due to the ability of stakeholders to generate new funding sources and create unique strategies for achieving plan goals. However, attainment of implementation was not universal between the plans, and the implementation techniques used by each of the counties have resulted in plans that serve in varying capacities ranging from

extensive integration in development review processes to sitting on a shelf. To date, Prince George's County hasn't relied as heavily on market mechanisms to achieve plan goals such as in Baltimore County, but rather the Prince George's County plan has been integrated within the development review process in order to achieve specified goals.

As suggested in Voinov and Gaddis (2008), the involvement of knowledge communities throughout the implementation stages again illustrates the importance of including stakeholders throughout the process and reinforces that the plans that have reached some level of implementation have reiterated the value of integrating the knowledge held by both expert and experiential knowledge communities. The involvement of the development community within Prince George's County illustrated the importance that a plan can have on particular group and how a particular knowledge community's involvement in the process can improve the decision-making process:

> The most active and vocal stakeholder was the development community. They have been quite active in influencing implementation of the plan writing the regulations (Interviewee PG1 2011).

The role the plan has played within Prince George's has been most evident in the development review process. Interviewee PG1 described how the plan has assisted in decision-making and the impact of involving stakeholders during the process to achieve greater implementation:

> The impact [of the plan] has been huge both on the long-term planning side and on the development review side. For long range planning, it's provided us with a guidance document, a map of physical depictions of the areas that we are most interested in. It's given the developing communities some settled expectations. They know if they are developing on a property that is outside of the network that there will be more flexibility

with regard to impacts, but that if a property is within the network that we have the guidance to be looking at what resources should be protected and how that protection should go forward (Interviewee PG1 2011).

The history in Prince George's County suggests that without a formal plan, there would be a greater likelihood of potential debates during the development review process and that although the plan did incorporate landscape-scale goals for conserving the green infrastructure of the county, implementation could also occur and protect green infrastructure if the plan is used as a guide for development on smaller scales.

To explore implementation of plans it is important to understand the initial goals that are expected to be achieved through effective implementation. For Prince George's County the correlation between development and green infrastructure was defined in the plan goals by tying the expectation of maintaining percentages of forest cover for each of the individual growth tiers (Rural, Developing, and Developed). Based on the information required to establish these goals (which was based on data provided by conservation biologists and planning staff), multiple knowledge communities that included local citizens, environmental advocacy groups, engineers, and resource manager, were required to establish these goals and are likely to be important contributors to the monitoring and evaluation of the plan through the implementation phase. The incorporation of the planning goals into the broader planning context for the county presented an additional opportunity for the county to monitor plan implementation as described with the county's Biennial Growth Policy Update:

"As each Biennial Growth Policy Update is prepared, as required by the General Plan, an evaluation of the progress made on meeting these objectives will be prepared if the

> required information for updating is available". (The Maryland-National Capital Park and Planning Commission 2005, 27)

Having an adopted plan functioning as county policy can leverage attainment of plan objectives and goals by the plan being acknowledged as part of larger planning efforts.

The planning process extends beyond the implementation phase for Prince George's County with their recent creation of a Draft Environmental Legislation Package. Interviewee PG1 suggested the need for an ongoing dialogue throughout the implementation stage:

> Once [the green infrastructure plan] was adopted it really shifted to a development review focus anyway because the plan had multiple recommendations for changes to the regulations. I am proud to say it was approved July 13, 2010 (Interviewee PG1 2011).

The changes in regulations occurred between 2007 and 2010. These changes included wider stream buffers, increased requirements for environmental information early on in the development review process, and changes to how the impacts were analyzed by the county. It was also recommended that as part of this implementation strategy, the woodland conservation regulations be updated as well (Interviewee PG1 2011).

The subsequent public meetings that were held after the plan was adopted included environmental groups, citizens, and businesses that worked together to create the legislation package. It is possible that the creation of such legislation could have been created internally by planning staff but their commitment to involving various knowledge communities may be an additional attribute as to why they have faced such little resistance from community members and have garnered such support for their green infrastructure plan. Additionally, the creation of the PGAtlas as a tool for implementation has offered members of the county as well as neighboring counties a level of transparency and user integration that is not present within any of

the other counties studied. The accessibility of this tool is a positive feature allowing for anyone with Internet access to overlay various plans with parcel data to analyze green infrastructure and its relationship with other plans and information such as the Chesapeake Bay Conservation Plan, natural resources inventory, and wetlands.

The similar, Conservation Priorities Tool created by Talbot County, has not been used in the same capacity as the Prince George's tool. The reasons presented by Interviewee TC1 suggested that limitations within the county, such as their GIS capabilities, opportunities for conservation, and overarching impact of the comprehensive plan, were the primary reasons why the Conservation Priorities Tool has not been utilized rather than the tool being deficient in some capacity, suggesting, if these externalities were not present, the county would use their tool in more planning situations.

The use of the respective green infrastructure plans was fairly consistent among the counties. The planner from Anne Arundel County described how they use their greenways plan as follows:

> We use it in negotiating forest conservation provisions with developers during the development review process, in evaluating applications for agricultural and woodland preservation easements, in ranking properties under consideration for acquisition for preservation or passive park related purposes, and in partnering with local land trusts to preserve ecologically important sites (Interviewee AAC2 2011).

Within the Anne Arundel County plan there were 15 specific strategies with corresponding action items that suggested that the plan was to better involve private landowners and work to establish partnerships to provide long-term protection for the county's greenways. There were 13 individual plans that emerged from the initial Anne Arundel Greenways Plan, which each had

their own set of stakeholders (see Patuxent River Greenway Stakeholder Map) that possessed important experiential knowledge pertinent to the specific location of their greenway. In an implementation report released by the county in 2010, the decrease in unprotected greenway segments from 49 to 38 percent is likely due to the plan being used directly in the development review process as well as the collective implementation achieved by each of the 13 individual greenway plans. Further segmentation of a green infrastructure network down to a more localized level coupled with collaboration of similar local agencies may provide more achievable implementation goals for local areas to work with and may not be as cumbersome as an entire county implementation strategy.

Additional support for a more localized effort to increase implementation was evident for Baltimore County where they have utilized market mechanisms to assist in implementing their strategy for forest conservation. The findings suggested that the use of market mechanisms coupled with assessment and monitoring programs has framed the implementation phase. The continuous meeting of the steering committee to monitor implementation and create new implementation tools such as the existing Tree-Mendous Maryland Program and the Growing Home Campaign were viable methods for educating the public and including a wide breadth of stakeholders while assisting in the attainment of the goals set forth in their strategy for forest sustainability.

Similar to the strategies employed by Prince George's County, the Baltimore County example added additional evidence that this planning process is not complete with merely acquiring lands and forming easements, but rather a tangible output that involves stakeholders in the ongoing implementation and monitoring of the plans drove plan adoption and support. This stage of the process provided the most important opportunity for all of the knowledge required to

create an implementable plan to become integrated in a way that led to action. As noted by planning staff (Interviewee PG1, AAC1, AAC2, TC1) the adopted plans have gone beyond the scope of serving as the means to achieve plan objectives and have been integrated into the development review process, causing green infrastructure to become something considered comprehensively rather than just for piece-meal preservation occurrences.

The degree of implementation ranged from efforts where implementation was being monitored to a plan that has not been formally adopted to date. Based on the counties that have achieved some level of implementation, the lack of community support for the Cecil County Green Infrastructure Plan from the onset of planning activities, has led to the difficulties the county has faced in the plan being formally adopted or added as an amendment to the updated comprehensive plan. The inclusion of multiple knowledge communities occurred after the creation of the green infrastructure plan and has been occurring under a platform intended for their comprehensive plan update. The county's comprehensive plan Citizen Oversight Committee discussed the adoption of the green infrastructure plan during numerous public meetings and county stakeholder meetings that led up to the plan update in 2010. Although scenario-building teams were created, which represented various knowledge communities such as the Maryland Department of Planning, the Maryland Department of the environment, county officials, and interested citizens, these were not the direct members who were involved in creating the green infrastructure plan.

Although the county identified green infrastructure as possessing important value (Cecil County Government 2005, ES-4) in their most recent comprehensive plan update, the current work of the Citizen Oversight Committee during the updating phase, may have led to the adoption of the plan if they had been included at the onset of the planning process. Even though

the committee was able to create a set of goals, they were unable to reach consensus on basic definitions and language relative to green infrastructure, which led to the committee discussing the idea of abandoning the plan created by The Conservation Fund and redeveloping the plan along with the development of current watershed protection plans for storm water management. Had the goals and objectives and inclusion of this committee been involved from the onset of the process, these roadblocks could possibly have been avoided.

Analytic Category 2: The role of the planner

The second research question concerns the role of the planner within the green infrastructure planning process. The planning profession is constantly changing and as progression has occurred the number of planning specializations has increased (Alexander 1992). Environmental planning is just one of many planning specialties that requires a certain level of technical expertise that may not be relevant for other types of planning. Based on the findings, the planner in the case studies presented here functioned as the catalyst for linking multiple knowledge communities and subsequently held various roles throughout the planning process. Planners were involved directly with planning activities and served as technical experts for consulting agencies. In each of the cases, planners were involved in the integration of technical knowledge and the knowledge held by experiential groups. With regard to how multiple knowledge communities are integrated, this study suggests that the planner(s) involved in the planning process were the key to bringing various knowledge communities together and ultimately determined how knowledge was used to guide the planning process.

For each county, the planner worked in various capacities throughout the planning process but the integration of knowledge from the various groups was consistent throughout the counties. The following comment from Interviewee PG1 from Prince George's County

illustrated the groups that planners commonly worked with throughout the green infrastructure planning process:

> Of course there was a team effort and we got a lot of different professionals involved. We had landscape architects, engineers, planners, and transportation planners chimed in with regard to trails elements to make sure that we weren't in conflict with any other policies and regulations. So, while I had a project manager, I was the supervisor of the project working directly with the stakeholders (Interviewee PG1 2011).

The collaborative focus that was apparent in Prince George's County was also present in others such as Anne Arundel where the principal planner described some of the collaborative groups that were brought in during the process:

> Members were brought in from the Maryland Department of Natural Resources, Maryland Greenways Commission, the National Park Service, county GIS folks, and various consulting agencies (Interviewee AAC1 2011.

In both of these examples the planner(s) identified relevant knowledge communities that possessed technical information that helped facilitate planning processes and worked with these groups to lead to a more informed decision-making process. The collaborative demands on the planner throughout the planning process, was further supported during the interviews. In Baltimore County there was a strong collaborative nature that appeared to drive the principal planner working on the county's forest sustainability strategy. The relationship between this planner and state agencies was present from the onset of the planning process due to Baltimore County's role as a test county for conducting a green infrastructure assessment by the state. In this situation, the planner held a technical role whereby he facilitated the laying out of a framework that was used to establish a methodology going forward for the state. The role of

Baltimore County's planner was unique in this regard due to the other county green infrastructure plans occurring subsequent to the state's methodology being established. However, the relationship of this planner with technical experts was not unique.

Rydin (2007, 53) suggests that the planner assumes the role of an expert due to their grasp of specialist knowledge. The practicing planner is also a user of knowledge and can use various types of knowledge to guide decision-making in a professional setting. This study suggests that within green infrastructure planning, the planner is primarily responsible for the integration of multiple knowledge communities, which is an extension of Rydin's assertion that "the purpose of planning is to handle multiple knowledges"(pg. 55). The examples of Baltimore County, where the planner worked with the steering committee and various resource agencies, and Prince George's County who had various knowledge communities involved in providing feedback on the network and implementation strategies support this claim. The responsibility of managing multiple knowledge communities is also relevant for county planners accountable for overseeing a green infrastructure planning strategy as the scope of their position varies widely as described by Interviewee PG1 from Prince George's County who stated the following regarding her role in the process:

> I was a cheerleader, a cattle prodder, schmoozer, and motivator; there was no mandate to get this done. It was certainly a recommendation in the general plan but it didn't say in the next five years get this plan passed. It's certainly a passion of mine and protection of the environment takes a really long time you can't just jump in and say we should have wider stream buffers. You need a process that leads to everybody understanding that wider stream buffers are better, and so if we didn't have this plan in place I think making

> the changes to the environmental legislation would have been very difficult to get implemented (Interviewee PG1 2011).

Interviewee BC1 from Baltimore County described his role in the process as follows:

> My role is to help make it happen and move forward. Within the broader context (National Sustainable Forestry initiatives) I represent local government and communities and I am really the only county person there. Mostly the national level people don't understand the counties and they wonder why the counties don't do anything. So what we have done, as a county, has blown their socks off a little bit. You can have all of the these fancy names for processes but really what it's about, as managers, we want to make the best decisions on behalf of the resources and our citizens and hopefully we were informed by good science and discussions so that people buy into what's being done and support it because you need the public's support to do anything (Interviewee BC1 2011).

The interviews with these planners illustrated the extensive role that planning professionals have in the planning process. There is a certain rigor in the level of integration that must take place on behalf of these individuals. This integration of multiple knowledge communities was evident based on the various planning entities often involved in green infrastructure plans as well as large constituencies of stakeholders that were included in plans created by counties internally rather than the plans created by outside agencies. For the plans that were created by the counties (Anne Arundel, Baltimore, Prince George's) there was a greater level of integration of multiple knowledge communities required of the planners overseeing these plans, due to their direct contact with constituants.

Alexander (1992) discussed various roles that may be assumed by a practicing planner and illustrated that these roles can change and be held concurrently with other roles as described

by Interviewee PG1 from Prince George's County. In the plans that lacked contributions from multiple knowledge communities throughout the planning process, it is likely that there would be fewer knowledge claims presented to planners and would result in their roles aligning with more technical/administrative characteristics rather than a mediator or mobilizer role. The planners interviewed that were in their positions from the beginning of plan creation have been actively involved in several aspects of the planning process and have developed relationships with key stakeholders, resource agencies, local, state, and federal government agencies and worked to inform people about green infrastructure planning and its benefits (Baltimore County and Prince George's County).

Each planner, when discussing their roles, specifically noted the importance of their relationships with other agencies, NGO's, state and local stakeholder groups, and citizens. These relationships emerged from technical expertise provided for network creation to experiential knowledge of market mechanisms used for implementation. Although there was little evidence regarding the specific timeframe of involvement for non-technical groups in the process, all of the counties noted a continued ongoing relationship with technical experts such as ecologists, geologists, water specialists, and GIS technicians, which has been maintained directly by the planner. These groups helped determine the scientific underpinnings for network creation and the planner served as the intermediary between these expert groups and the experiential and practical stakeholder groups that were also involved in the process.

Planners in Maryland have benefited from the extensive technical resources available at a statewide scale. Not only are the data more robust than what may be available in other states, but the overall embrace of green infrastructure planning from state agencies such as the Department of Natural Resources and the State Department of Planning; the programs set up by state

agencies (Smart Growth, PlanMaryland) have set the stage in affording planners an environment conducive to carrying out a green infrastructure plan assessment.

CHAPTER 6 – CONCLUSIONS AND RECOMMENDATIONS

A small body of literature exists regarding the green infrastructure planning process with little guidance on how knowledge should be used given the many participants who contribute to the process. The purpose of this study was to explore this planning process with a sample of counties that have created green infrastructure plans and examine how knowledge was used in these examples. Counties were chosen within the State of Maryland based on the state's embrace of green infrastructure as a strategy for conservation, and the availability of several county plans that could illustrate the process more uniformly. Green infrastructure has become an important strategy for preserving valuable ecological resources such as many of the coastal resources associated with the Chesapeake Bay. A review of relevant literature revealed that, although there is a general planning process for green infrastructure planning, there is much to be discovered concerning how different knowledge communities ranging from expert to experiential are included in this process. The conclusions from this research correspond directly to the research questions and subsequent findings and address the following areas: (a) importance of including multiple knowledges; (b) how the linkage between knowledge and action is achieved; and (c) planner's role in the planning process and committee influence. The following chapter is a discussion of the major findings and the conclusions that were drawn from conducting this study. Following the conclusions are recommendations for future practice and research as well as a final reflection on the research.

The analysis within this study compared current green infrastructure practices with a general green infrastructure planning process (McDonald et. al 2005), finding that this process was used in the same general capacity by each of the counties in the study but, the knowledge communities that informed decision-making processes differed. The findings of this study are

common to the overall process of green infrastructure planning and the role of knowledge, which have implications for planning activities and green infrastructure planning more broadly.

Importance of Including Multiple Knowledge Communities

The first major finding of this study is that successful green infrastructure planning process is based upon the integration of knowledge claims held by expert and experiential knowledge communities. A conclusion that can be drawn from this finding is that managers or agencies that are tasked with creating a green infrastructure plan should involve both experts and experiential groups and that technical or scientific data used alone is not enough to create implementable plans. Green infrastructure as a planning process is highly complex requiring the inclusion of multiple knowledge communities. There was a great deal of technical data required to create a green infrastructure plan but there was also a high degree of non-technical insight required to be incorporated in the process to ultimately lead to more comprehensive goal setting and implementation. The data that were used by each of the counties were based upon similar statewide data. This illustrates that having a statewide assessment was a critical element of data for the counties in Maryland that decided to go beyond the statewide assessment and create their own plans. This does not indicate that a statewide assessment is a requirement for green infrastructure planning to take place but that having a similar methodology used at a larger scale can provide valuable direction for a county creating its county-scale green infrastructure plan.

The generation of knowledge used to guide decision-making was based on the integration of knowledge claims suggested by different experts and experiential groups within each county. Although the groups were related, they were unique throughout the counties. The expert groups included resource managers, scientists, engineers, consultants, research institutions, and government agencies. Experiential groups involved included, citizens, environmental advocacy

groups, tourism, development community, and corporate organizations. The various group dynamics, coupled with the lack of a uniform approach for how various knowledge communities were involved in the process, does little more than affirm their presence and suggest they played a role in decision-making. The analysis of how knowledge was generated and which knowledge was included in creating the plan illustrates the role that the comprehensive planning process plays in green infrastructure planning. Additionally, the ways in which knowledge was acquired through collaboration with different knowledge communities during this process demonstrates the importance of differentiating information and understanding the value that non-technical data can provide to the process. Through determining the knowledge communities that are integral to creating implementable plans, future efforts can lead to more informed decision-making and secure that the appropriate groups are actively involved in planning activities.

In all of the counties but Cecil, the inclusion and integration of multiple knowledges was evident at all stages of the planning process. While the McDonald et al. framework proved to be consistent with the processes followed by the counties and holds promise for providing a general procedure by which green infrastructure planning can occur, I believe that this framework trivializes the importance of including expert and experiential knowledge communities in stages beyond goal setting and therefore is inadequate for informing planners how to both include and integrate the knowledge held by the numerous groups/individuals involved in the process. The examples where integration of experiential knowledge communities is occurring in Maryland (in Prince George County the use of scenario-building and focus groups, and in Baltimore County the presence of a steering committee and use of forums) should be included in the framework and the importance of experiential groups being included to render an implementable plan should become a focus of a green infrastructure planning framework.

The case studies illustrate that not only do experiential and non-technical knowledge communities participate in all four stages (goal setting, analysis, synthesis, and implementation) of the green infrastructure planning process, but they help to develop and guide the process through their continued involvement. When the green infrastructure planning process is approached based solely on technical data, there is little chance that it will ever become an implementable plan due to the lack of involvement from experiential knowledge communities. Additionally, a planning effort using only technical information provides little opportunity for these experiential knowledge communities to become involved and they are essentially forced out of the discussion. By integrating groups early and often in the process they are afforded the prospect of becoming active participants in planning activities and can provide valuable information often missed in pure technical analyses.

The Linkage Between Knowledge and Action

The second finding was that there are discrepancies in planning practice and theoretical constructs regarding how green infrastructure is defined. The variations found in defining green infrastructure are valid within a specific context and there are distinctive ways that green infrastructure can be addressed and studied. Issues of scale play a large part in this phenomenon whereby green infrastructure can be analyzed at the site/parcel, county, state, regional, and landscape scale. Ultimately the knowledge and participants involved at these various scales are likely to vary.

The counties in this study that used knowledge generated from related county planning initiatives (development, agriculture, sustainable forestry, and parks and recreation) as a framework for their county planning processes have resulted in more implementable plans (See Table 22). Linking of plans with goals developed in other planning efforts has been a path that

some of the counties have taken leading to more attainable planning outcomes. There is a conclusion that can be drawn from the case studies that using the knowledge provided within a statewide assessment is only part of the equation to producing implementable plans. The integration of goals and concepts of plans or initiatives, which are congruent with current county policy, are helpful to provide the context under which green infrastructure can be approached. Additionally, the state planning initiatives in place in Maryland ranging from PlanMaryland, Smart Growth, Program Open Space, Rural Legacy, and the Maryland Agricultural Land Preservation Foundation, have provided numerous opportunities for the counties aiming to create green infrastructure initiatives to incorporate the direction of these other efforts into their goals and plan strategies. The various types of expert and experiential knowledge that are often present to facilitate the continued functioning of these programs and endeavors form the basis for and relevance of continued inclusion of multiple knowledge communities in green infrastructure planning.

Planner's Role in Green Infrastructure Planning

Central to the green infrastructure planning process and the integration and inclusion of multiple knowledges is the planner. The third finding of this study was that the planner was the catalyst for identifying multiple knowledge claims and their role changes throughout the planning process as well as between different counties. Although there were variations regarding their role in the process, the collaborative nature of their position was evident in all of the plans studied. They were key to identifying knowledge communities that possessed pertinent technical data and worked collaboratively with these groups to facilitate the integration of technical data with other facets of the planning process. The integration of multiple knowledge communities is an activity that is carried out primarily by the planner and supporting a collaborative setting

helps to assist planning processes. The planners involved in this process are more than just facilitators of plan creation and implementation; they are experts on the multifaceted environment surrounding this type of planning process and are critical players in every stage of the planning process.

A fourth finding of this study was that much of the dialogue between various knowledge communities took place within steering committees or advisory committees and these groups played a critical role in acquiring knowledge and using this knowledge to guide decision-making. The presence of a recognized guiding committee, such as a steering committee, played a role in whether and how multiple knowledge communities were included in the process. Based on the study it can be concluded that steering committees increase the discourse between expert and experiential groups, and further, the timing of their involvement impacts plan adoption. The establishment of a committee elicits input from a greater variety of knowledge communities, and, with the assistance of the planner a committee can provide the opportunity for local community members to become involved in the process and ultimately increase awareness of this concept in the public domain and garner support when promoting plan implementation.

Study Limitations

There were limiting conditions within this study, which are associated with the research methodology and general limitations inherent within the research design. It was intended within the research design to account for limitations and ultimately minimize their impact.

A primary concern for this study, similar to other qualitative studies, is the potential for researcher bias. Due to the subjective nature of qualitative research this is a key limitation and the researcher took appropriate measures to minimize effects. A semi-structured interview process was used when interviewing respondents. To limit bias, respondents were asked

identical questions although the order of the questioning varied. Respondents may also be influenced by the interviewer because of body language or tone of voice, which may subtly influence the answer given by the respondent. To minimize this limitation, all respondents were provided with the questions prior to the interview and were asked to formulate initial responses before the formal interview occurs. There was another potential limitation to this research, which was present within the interview process. It is important that all respondents be asked questions on similar topics and that the general wording of these questions is comparable. While deviation from the interview questions can result in key issues being missed, by disallowing deviation, new and interesting results may not be discovered.

Another limitation of this qualitative method is that the findings cannot be extended to wider populations with the same degree of certainty that quantitative approaches can. Due to the relatively small number of cases, statistical analyses were not practical for this study. Unlike quantitative research, qualitative studies contain no formulas for determining the significance of findings or for subsequent interpretation, and there is no way to exactly replicate the analytical thinking of the researcher (Bloomberg and Volpe 2008). Quantitative studies commonly rely on statistical tests to measure significance of the findings where in qualitative studies, the findings are measured by their substantive significance (Patton 2002). As stated previously, rather than seeking to achieve external/internal validity (generalizability), the research designs aims to ensure credibility, dependability, confirmability, and transferability.

Time was also a limiting factor throughout this study. Because many of these processes occurred over ten years ago, some of the informants were unable to be contacted or had little memory of the specifics of the process. Also, there were meetings held by the counties that were not recorded and meeting minutes were not available.

Recommendations for Planning Practice

Given the demonstrated importance of both expert and experiential knowledge, future planning efforts should recognize the value and importance of including multiple knowledge communities in the planning process. This is particularly important when setting goals and determining what attributes will be included in the final network. There is a difference that exists between an analysis of green infrastructure and developing a green infrastructure plan. If a county were simply partaking in a technical study trying to identify the most important natural resources, based on ecological value, there is little need to acquire knowledge outside of the technical data that are commonly used in network analysis. The differentiation occurs when counties attempt to create meaningful, implementable plans with comprehensive goals that encourage the long-term support for maintaining the integrity of the identified green infrastructure network.

Counties attempting to create a green infrastructure plan should utilize any available and relevant state planning initiatives available at a statewide scale. Once goals are established and linked with either the county comprehensive plan or related county planning functions, there should be open dialogue between the county and the state regarding the data necessary to create the plan and counties can leverage state data when available. Future counties creating a green infrastructure plan should:

1. Establish a guiding committee before goal setting takes place and establish goals within the committee based on recommendations within their county's comprehensive plan. This committee should be comprised of expert and experiential participants from a wide range of professions and represent local interests. The goals should align with

other related planning functions important to the county such as recreation, agriculture, sustainable forestry, and development.

2. Include expert and experiential knowledge communities early and often in the process to foster support and establish achievable goals leading to more implementable plans. Some of these knowledge communities include but are not limited to, resource managers, scientists, engineers, consultants, research institutions, government agencies, citizens, environmental advocacy groups, tourism agencies, developers, and corporate organizations.
3. Rely on the principles of conservation biology and landscape ecology to guide network identification coupled with inclusion of experiential groups in the discovery phase and feedback from local citizens. This will help to create a theoretically and scientifically sound plan and gain community support, while not jeopardizing the integrity of the green infrastructure network.
4. Collaborate with state agencies and other entities or groups when necessary to attain the appropriate technical data required to create a network that is representative of the most important ecological areas both to the county and to a larger statewide or regional network if applicable.
5. Become knowledgeable about the green infrastructure planning process as a whole so that more useful integration of knowledge can be maintained and ultimately lead to better decision-making.

The practice of integrating these multiple knowledges is based upon an understanding of the scientific data required to identify green infrastructure networks coupled with policy implications of implementing plan recommendations. These concepts are associated with the knowledge held

by science and policy experts but can only be linked to action when the stakeholders helping to implement that often represent experiential knowledge communities are included in the process and are supportive of the plan.

Recommendation for Future Research

This study illustrates that there is much to be learned about green infrastructure planning and the process of creating a green infrastructure plan. A similar study which looks at the planning process for plans created outside of Maryland or states that have not made green infrastructure a state initiative, would be useful to compare and contrast the processes and identify how other states are including similar forms of knowledge in their planning processes. Additional studies on effective knowledge integration and its linkage with long-term plan goals within a green infrastructure planning context would also be a valuable research endeavor.

Within the State of Maryland, as more counties create individual green infrastructure plans, there will be more research opportunities to examine these planning processes. Future efforts could explore the relationship between plan quality and implementation and could be used to ultimately examine the effectiveness of planning efforts to protect, restore, and enhance green infrastructure. The constraints associated with realizing changes in ecological features would require a long temporal scale and extensive GIS capabilities.

Concluding Thoughts

Green infrastructure intends to provide many social, economic, and environmental benefits to our society. Not only does green infrastructure help to maintain a healthy ecosystem, but it is also vital for quality of life. Green Infrastructure planning is a complex process of strategically managing the integrity of ecologically significant natural areas and intensively used landscapes. It is a process that can vary from one plan to another but is based on the same

guiding principles that help to identify a network made up of various natural elements and create a strategy of implementation to achieve plan goals. Although there isn't one "correct" way to create a green infrastructure plan, there are important lessons for how we approach this process and the groups that are involved throughout the various stages. As a practice, green infrastructure planning provides promise as a means to achieve goals pertaining to the integrity of our nation's ecosystems. The knowledge used to guide this practice is comprehensive in the purest sense providing a holistic perspective of the importance of the interaction between a community and its environment.

As the pressures and demands on our nation's landscapes increase, a systematic approach that aims to protect and preserve the integrity of valuable natural resources is valuable. Green infrastructure, as a method for strategic conservation, shows promise and continued support of this approach will provide valuable assistance for identifying the areas of environmental importance that sustain the support system for the functional of our nation's ecosystems. The embrace of green infrastructure planning in Maryland, as a proactive approach to conservation planning, can provide many ecological, economic, and quality of life benefits for its residents. As green infrastructure planning is used to protect and restore landscapes and the Chesapeake Bay, it is imperative that the role of multiple knowledge communities and active participation of experiential knowledge groups be recognized as an essential component to the green infrastructure planning process.

APPENDIX A. IRB APPROVAL FORM

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
1L-09 Brody Medical Sciences Building• 600 Moye Boulevard • Greenville, NC 27834
Office **252-744-2914** • Fax **252-744-2284** • **www.ecu.edu/irb**

TO: Lauren Jordan, 775 Redwood Dr., Southampton, PA, 18966

FROM: UMCIRB KK

DATE: November 22, 2010

RE: Expedited Category Research Study

TITLE: "An Epistemological Inquiry of Green Infrastructure Planning in Coastal Maryland"

UMCIRB #10-0679

This research study has undergone review and approval using expedited review on 11.19.10. This research study is eligible for review under an expedited category number 6 & 7. The Chairperson (or designee) deemed this **unfunded** study **no more than minimal risk** requiring a continuing review in **12 months**. Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The investigator must adhere to all reporting requirements for this study.

The above referenced research study has been given approval for the period of **11.19.10** to **11.18.11**. The approval includes the following items:

- Internal Processing Form
- Appendix A: Requesting Participation Letter
- Appendix B: Interview Protocol Based on Research Questions
- Dissertation

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies under the Food and Drug Administration regulation. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.

**********IMPORTANT INFORMATION**********

Continuing Review/Closure Obligation

As a investigator you are required to submit a continuing review/closure form to the UMCIRB office in order to have your study renewed or closed before the date of expiration as noted on your approval letter. This information is required to outline the research activities since it was last approved. You must submit this research form even if you there has been no activity, no participant s enrolled, or you do not wish to continue the activity any longer. The regulations do not permit any research activity outside of the IRB approval period. Additionally, the regulations do not permit the UMCIRB to provide a retrospective approval during a period of lapse. Research studies that are allowed to be expired will be reported to the Vice Chancellor for Research and Graduate Studies, along with relevant other administration within the institution. The continuing review/closure form is located on our website at www.ecu.edu/irb under forms and documents. The meeting dates and submission deadlines are also posted on our web site under meeting information. Please contact the UMCIRB office at 252-744-2914 if you have any questions regarding your role or requirements with continuing review.
http://www.hhs.gov/ohrp/humansubjects/guidance/contrev0107.htm

Required Approval for Any Changes to the IRB Approved Research

As a research investigator you are required to obtain IRB approval prior to making any changes in your research study. Changes may not be initiated without IRB review and approval, except when necessary to eliminate an immediate apparent hazard to the participant. In the case when changes must be immediately undertaken to prevent a hazard to the participant and there was no opportunity to obtain prior IRB approval, the IRB must be informed of the change as soon as possible via a protocol deviation form.
http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm#46.103

Reporting of Unanticipated Problems to Participants or Others

As a research investigator you are required to report unanticipated problems to participants or others involving your research as soon as possible. Serious adverse events as defined by the FDA regulations may be a subset of unanticipated problems. The reporting times as specified within the research protocol, applicable regulations and policies should be followed.
http://www.hhs.gov/ohrp/policy/AdvEvntGuid.htm

APPENDIX B. REQUESTING PARTICIPATION LETTER

Dear Participant,

My name is Lauren Jordan and I am a doctoral student at East Carolina University in the Coastal Resources Management Ph.D. Program. I am writing to ask you to be part of a qualitative research study on green infrastructure planning in Maryland. This is part of the requirements for a doctoral degree in Coastal Resources Management. I hope you will agree to participate.

I am interested in environmental planning efforts occurring in Maryland. I will be examining the role of knowledge as well as the role of the planner within a green infrastructure planning approach. In particular, I am interested in the planning process and how planning outputs are ultimately determined. My goals are to explore the intricacies of green infrastructure planning and present and gain a better understanding of the planner's role. I intend to generate publishable reports for both scholarly and professional audiences, with the aim of helping other counties planning efforts. I can provide a detailed list of research questions and topics that I am researching prior to meeting.

Participating in this study will include:

An interview conversation that should last approximately 60 minutes, and will be conducted at a time and location convenient for you, either in person or over the phone. Prior to this conversation, I will submit the interview questions to you and request you review the questions in advance. This conversation will be recorded by a tape recorder, and I will also be taking written notes. If needed, a follow up meeting may occur which will allow me to check for accuracy of my notes and to ask any follow up questions I have after reviewing the transcripts from our initial meeting.

Participation in this study is completely voluntary and there is no penalty for not participating. If you agree to participate in this study, your identity will be kept strictly confidential. Your name and position will not appear in the study. Your stories will be referenced by a pseudo name. All transcripts will be kept on a CD-ROM in a secured office in my home.

Please contact me by replying by email to JORDANL07@students.ecu.edu or by phone at (267) 744-4312.

Thank you for your time and I hope that you are able to participate in my study.

Best regards,
Lauren Jordan
Ph.D. Candidate
East Carolina University

APPENDIX C. INTERVIEW PROTOCOL BASED ON RESEARCH QUESTIONS

Name:_____
Agency:_____
Job Title:_____
Years with Organization:_____

A. Preliminary Questions
   1. Describe the agency's mission and goals
   2. Briefly describe the county
      a. What are some of the environmental issues faced by the county/state?
   3. How did the county become involved in green infrastructure?

B. Research Question (1)
   1. Describe how your county uses state data.
   2. How did your county initially use the statewide green infrastructure assessment (GIA)?
      a. Has the role of the GIA changed county planning efforts? If so how?
   3. How does your county generally interact with state agencies/organizations?

C. Research Question (2)
   1. Describe the environmental planning process for your county.
      a. What is the role of stakeholder involvement throughout your planning process?
      b. Describe the methods by which stakeholders are included in the planning process.
      c. Briefly describe any collaborative efforts within the county. (Between agencies)

D. Research Question (3)
   1. Describe your role within this process.
   2. How has your role changed throughout the various stages of the planning process?
   3. How has your specific role influenced the process?
   4. What has been your experience when interacting with stakeholders?
      a. How have you integrated the knowledge from various groups into the planning process?
   5. What problems have you faced?

E. Research Question (4)
   1. Describe the role of your plan within the broader context of statewide planning.
   2. How did/does statewide efforts influence your county planning efforts?

F. Research Question (5)
   1. Describe the impact your plan has had on existing planning efforts.

G. Research Question (6)
   1. What have been the outputs produced by your plan?
   2. Describe how plan outputs are measured.

a. Does your county have quantifiable goals and timelines for achieving these goals? If so, please describe how this is related to various stages of the planning process.

H. Final Question

1. Is there anything else you would like to add or anything else you think I should know?

APPENDIX D. TEMPLATE FOR DOCUMENT SUMMARY FORM

{Adapted from (Miles and Huberman 1994, 54-55)}

Name or Type of Document: _____

Document Number: _____

Date Received: _____

Date of Document: _____

Event or Contact with which Document is Associated:

_____

☐ Descriptive

☐ Evaluative

☐ Other _____

Page #	Key Words/Concepts	Comments: Relationship to research questions

Brief Summary of Contents:

_____

Significance or Purpose of Document:

_____

Is There Anything Contradictory About the Document?

☐ Yes

☐ No

Salient Questions/Issues to Consider:

_____

Additional Comments/Reflections/Issues:

_____

APPENDIX E. PRESENCE OF KNOWLEDGE COMMUNITIES

GOAL SETTING

KNOWLEDGE COMMUNITES

	Expert						Experiential				
COUNTIES	*Resource Managers*	*Scientific Experts*	*Engineers*	*Consultants*	*Research Institutions*	*Government*	*Citizens*	*Environmental Advocacy*	*Tourism*	*Development*	*Corporate*
Anne Arundel	✔	✔	✔	✔	✔	✔	✔	✔		✔	
Baltimore	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Cecil	✔	✔	✔	✔		✔					
Prince George's	✔	✔	✔			✔	✔	✔		✔	✔
Talbot	✔	✔	✔	✔		✔					

ANALYSIS

KNOWLEDGE COMMUNITES

	Expert						Experiential				
COUNTIES	*Resource Managers*	*Scientific Experts*	*Engineers*	*Consultants*	*Research Institutions*	*Government*	*Citizens*	*Environmental Advocacy*	*Tourism*	*Development*	*Corporate*
Anne Arundel	✔	✔	✔	✔	✔	✔		✔			
Baltimore	✔	✔	✔	✔	✔	✔	✔	✔		✔	
Cecil	✔	✔	✔	✔							
Prince George's	✔	✔	✔			✔	✔	✔	✔	✔	✔
Talbot	✔	✔	✔	✔		✔					

SYNTHESIS

KNOWLEDGE COMMUNITES

	Expert						Experiential				
COUNTIES	*Resource Managers*	*Scientific Experts*	*Engineers*	*Consultants*	*Research Institutions*	*Government*	*Citizens*	*Environmental Advocacy*	*Tourism*	*Development*	*Corporate*
Anne Arundel	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Baltimore	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Cecil	✔	✔	✔	✔		✔					
Prince George's	✔	✔	✔			✔	✔	✔	✔	✔	✔
Talbot	✔	✔	✔	✔		✔					

IMPLEMENTATION

KNOWLEDGE COMMUNITES

	Expert						Experiential				
COUNTIES	*Resource Managers*	*Scientific Experts*	*Engineers*	*Consultants*	*Research Institutions*	*Government*	*Citizens*	*Environmental Advocacy*	*Tourism*	*Development*	*Corporate*
Anne Arundel	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Baltimore	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Cecil		✔		✔			✔	✔		✔	✔
Prince George's	✔	✔	✔			✔	✔	✔	✔	✔	✔
Talbot	✔	✔	✔	✔		✔		✔	✔		

APPENDIX F. CODING SCHEME

Categories	*Sub-Categories*
(GS) Goal Setting	(pf) Plan Foundations (si) Stakeholder Involvement (cv) Conservation Vision
(A) Analysis	(nd) Network Design (nsa) Network Suitability Analysis
(S) Synthesis	(ndme) Network Design Model Enhancements (ip) Identification of Priorities (rpg) Relationship to Plan Goals
(I) Implementation	(dsp) Decision Support Tools (it) Implementation Tools (cf) Conservation Funding (cs) Conservation Strategies (ddo) Defining Development Opportunities
(PR) Planners Roles	(pr1) Champion (pr2) Administrator (pr3) Mobilizer (pr4) Mediator (pr5) Entrepreneur (pr6) Technical Expert (pr7) Advocate
Issues of Scale	(ios1) Landscape Scale (ios2) Site Scale
Participatory Involvement of Knowledge Communities	(pikc1) Extensive (pikc2) Moderate (pikc3) Low (pikc4) None

Anne Arundel County

Categories	*Rating*	*Sub-Categories*	*Rating*
(GS) Goal Setting	✓+	(pf) Plan Foundations	✓+
		(si) Stakeholder Involvement	✓+
		(cv) Conservation Vision	✓
(A) Analysis	✓+	(nd) Network Design	✓
		(nsa) Network Suitability Analysis	✓
(S) Synthesis	✓+	(ndme) Network Design Model Enhancements	✓
		(ip) Identification of Priorities	✓+
		(rpg) Relationship to Plan Goals	✓+
(I) Implementation	✓	(dsp) Decision Support Tools	0
		(it) Implementation Tools	✓
		(cf) Conservation Funding	✓
		(cs) Conservation Strategies	✓
		(ddo) Defining Development Opportunities	✓
(PR) Planners Roles	✓+	(pr1) Champion	✓+
		(pr2) Administrator	✓
		(pr3) Mobilizer	0
		(pr4) Mediator	✓
		(pr5) Entrepreneur	0
		(pr6) Technical Expert	✓
		(pr7) Advocate	0
Issues of Scale	✓+	(ios1) Landscape Scale	✓
		(ios2) Site Scale	✓+
Participatory Involvement of Knowledge Communities	✓+	(pikc1) Extensive	✓+
		(pikc2) Moderate	0
		(pikc3) Low	0
		(pikc4) None	0

Baltimore County

Categories	*Rating*	*Sub-Categories*	*Rating*
(GS) Goal Setting	✓+	(pf) Plan Foundations	✓+
		(si) Stakeholder Involvement	✓+
		(cv) Conservation Vision	✓+
(A) Analysis	✓	(nd) Network Design	✓
		(nsa) Network Suitability Analysis	✓
(S) Synthesis	✓+	(ndme) Network Design Model Enhancements	✓+
		(ip) Identification of Priorities	✓+
		(rpg) Relationship to Plan Goals	✓+
(I) Implementation	✓	(dsp) Decision Support Tools	0
		(it) Implementation Tools	✓+
		(cf) Conservation Funding	✓+
		(cs) Conservation Strategies	✓+
		(ddo) Defining Development Opportunities	✓+
(PR) Planners Roles	✓+	(pr1) Champion	✓+
		(pr2) Administrator	✓+
		(pr3) Mobilizer	✓+
		(pr4) Mediator	✓+
		(pr5) Entrepreneur	0
		(pr6) Technical Expert	✓+
		(pr7) Advocate	✓+
Issues of Scale	✓+	(ios1) Landscape Scale	✓+
		(ios2) Site Scale	✓+
Participatory Involvement of Knowledge Communities	✓+	(pikc1) Extensive	✓+
		(pikc2) Moderate	0
		(pikc3) Low	0
		(pikc4) None	0

Cecil County

Categories	*Rating*	*Sub-Categories*	*Rating*
(GS) Goal Setting	0	(pf) Plan Foundations	0
		(si) Stakeholder Involvement	0
		(cv) Conservation Vision	✓
(A) Analysis	✓+	(nd) Network Design	✓+
		(nsa) Network Suitability Analysis	✓+
(S) Synthesis	✓	(ndme) Network Design Model Enhancements	✓
		(ip) Identification of Priorities	✓+
		(rpg) Relationship to Plan Goals	0
(I) Implementation	✓	(dsp) Decision Support Tools	0
		(it) Implementation Tools	✓+
		(cf) Conservation Funding	✓+
		(cs) Conservation Strategies	✓+
		(ddo) Defining Development Opportunities	✓
(PR) Planners Roles	✓	(pr1) Champion	0
		(pr2) Administrator	✓
		(pr3) Mobilizer	0
		(pr4) Mediator	0
		(pr5) Entrepreneur	0
		(pr6) Technical Expert	✓+
		(pr7) Advocate	0
Issues of Scale	✓	(ios1) Landscape Scale	✓+
		(ios2) Site Scale	✓
Participatory Involvement of Knowledge Communities	0	(pikc1) Extensive	0
		(pikc2) Moderate	0
		(pikc3) Low	✓
		(pikc4) None	0

Prince George's County

Categories	*Rating*	*Sub-Categories*	*Rating*
(GS) Goal Setting	✓+	(pf) Plan Foundations	✓+
		(si) Stakeholder Involvement	✓+
		(cv) Conservation Vision	✓+
(A) Analysis	✓+	(nd) Network Design	✓+
		(nsa) Network Suitability Analysis	✓+
(S) Synthesis	✓+	(ndme) Network Design Model Enhancements	✓
		(ip) Identification of Priorities	✓+
		(rpg) Relationship to Plan Goals	✓+
(I) Implementation	✓+	(dsp) Decision Support Tools	✓+
		(it) Implementation Tools	✓+
		(cf) Conservation Funding	✓
		(cs) Conservation Strategies	✓+
		(ddo) Defining Development Opportunities	✓+
(PR) Planners Roles	✓+	(pr1) Champion	✓+
		(pr2) Administrator	✓+
		(pr3) Mobilizer	✓+
		(pr4) Mediator	✓+
		(pr5) Entrepreneur	✓+
		(pr6) Technical Expert	✓+
		(pr7) Advocate	✓+
Issues of Scale	✓+	(ios1) Landscape Scale	✓
		(ios2) Site Scale	✓+
Participatory Involvement of Knowledge Communities	✓+	(pikc1) Extensive	✓+
		(pikc2) Moderate	0
		(pikc3) Low	0
		(pikc4) None	0

Talbot County

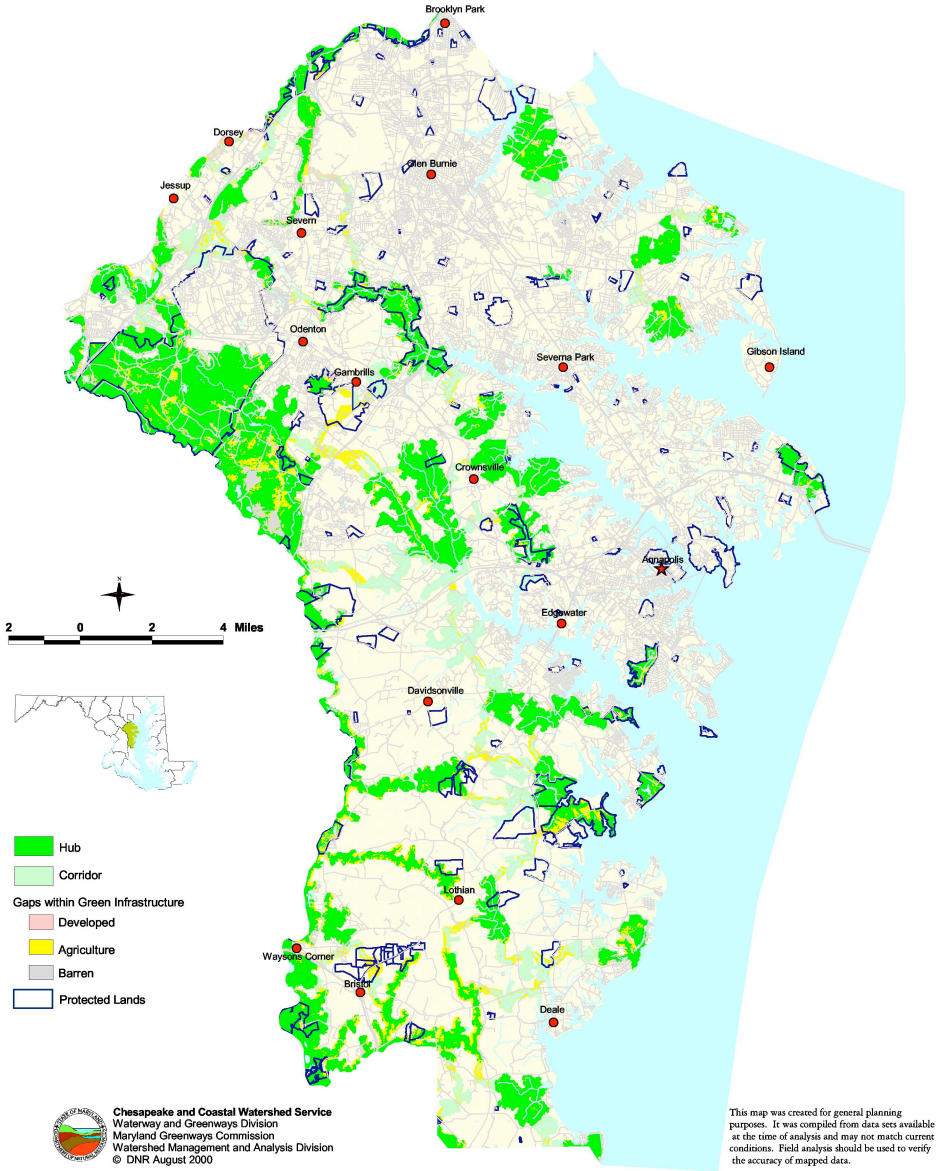
Categories	*Rating*	*Sub-Categories*	*Rating*
(GS) Goal Setting	✓	(pf) Plan Foundations	✓
		(si) Stakeholder Involvement	0
		(cv) Conservation Vision	✓+
(A) Analysis	✓+	(nd) Network Design	✓+
		(nsa) Network Suitability Analysis	✓+
(S) Synthesis	✓	(ndme) Network Design Model Enhancements	✓
		(ip) Identification of Priorities	✓+
		(rpg) Relationship to Plan Goals	✓
(I) Implementation	✓	(dsp) Decision Support Tools	✓+
		(it) Implementation Tools	✓+
		(cf) Conservation Funding	✓
		(cs) Conservation Strategies	✓
		(ddo) Defining Development Opportunities	✓
(PR) Planners Roles	✓	(pr1) Champion	0
		(pr2) Administrator	✓
		(pr3) Mobilizer	✓
		(pr4) Mediator	✓
		(pr5) Entrepreneur	0
		(pr6) Technical Expert	✓+
		(pr7) Advocate	0
Issues of Scale	✓+	(ios1) Landscape Scale	✓+
		(ios2) Site Scale	✓+
Participatory Involvement of Knowledge Communities	0	(pikc1) Extensive	0
		(pikc2) Moderate	0
		(pikc3) Low	✓
		(pikc4) None	0

APPENDIX G. MARYLAND GREENPRINT MAPS

Maryland's GreenPrint Program: Targeted Funding for Key Ecological Lands

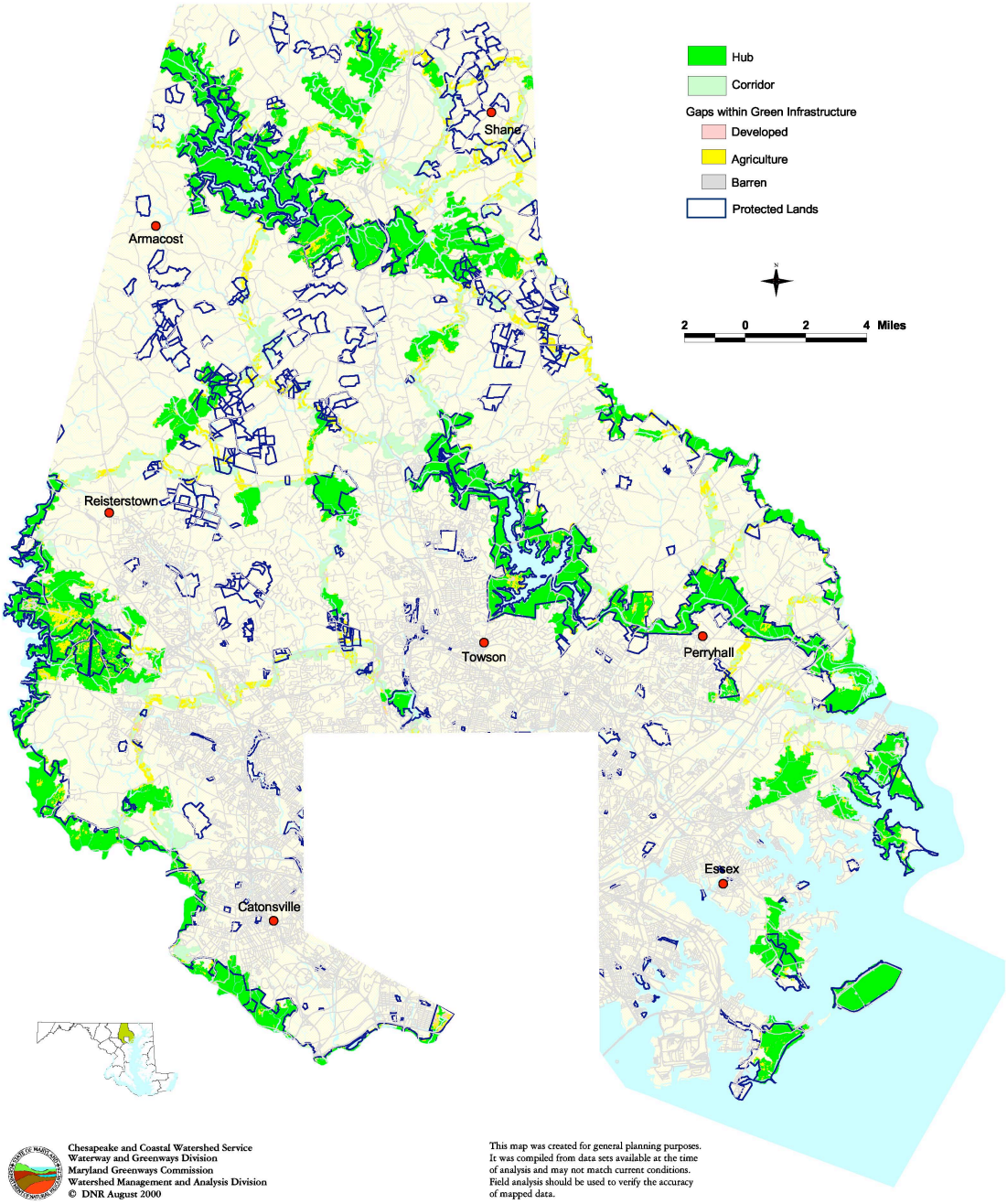
Anne Arundel County

Green Infrastructure



Baltimore County

Green Infrastructure



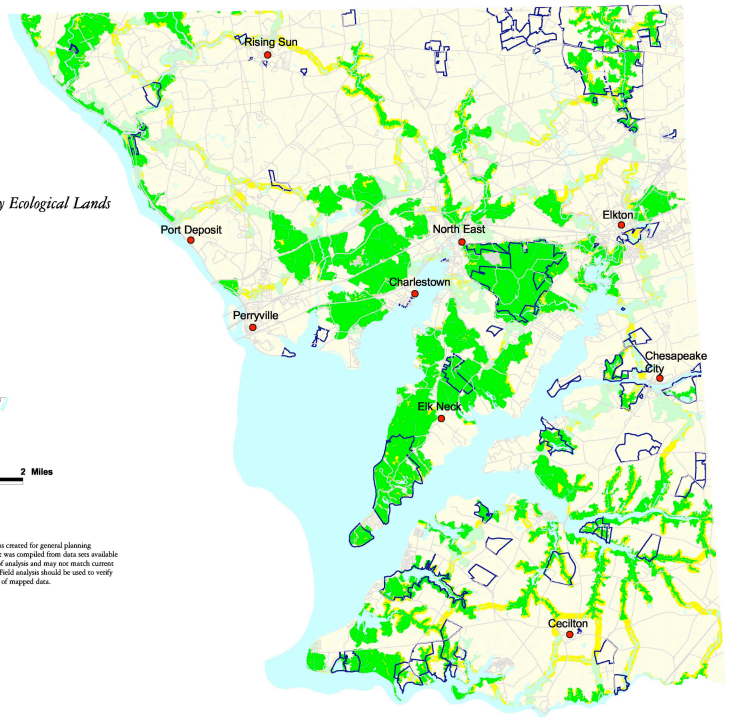
Chesapeake and Coastal Watershed Service
Waterway and Greenways Division
Maryland Greenways Commission
Watershed Management and Analysis Division

This map was created for general planning purposes. It was compiled from data sets available at the time of analysis and may not match current conditions. Field analysis should be used to verify the accuracy of mapped data.

Maryland's GreenPrint Program: Targeted Funding for Key Ecological Lands

Cecil County

Green Infrastructure



Hub
Corridor
Gaps within Green Infrastructure
Developed
Agriculture
Barren
Protected Lands

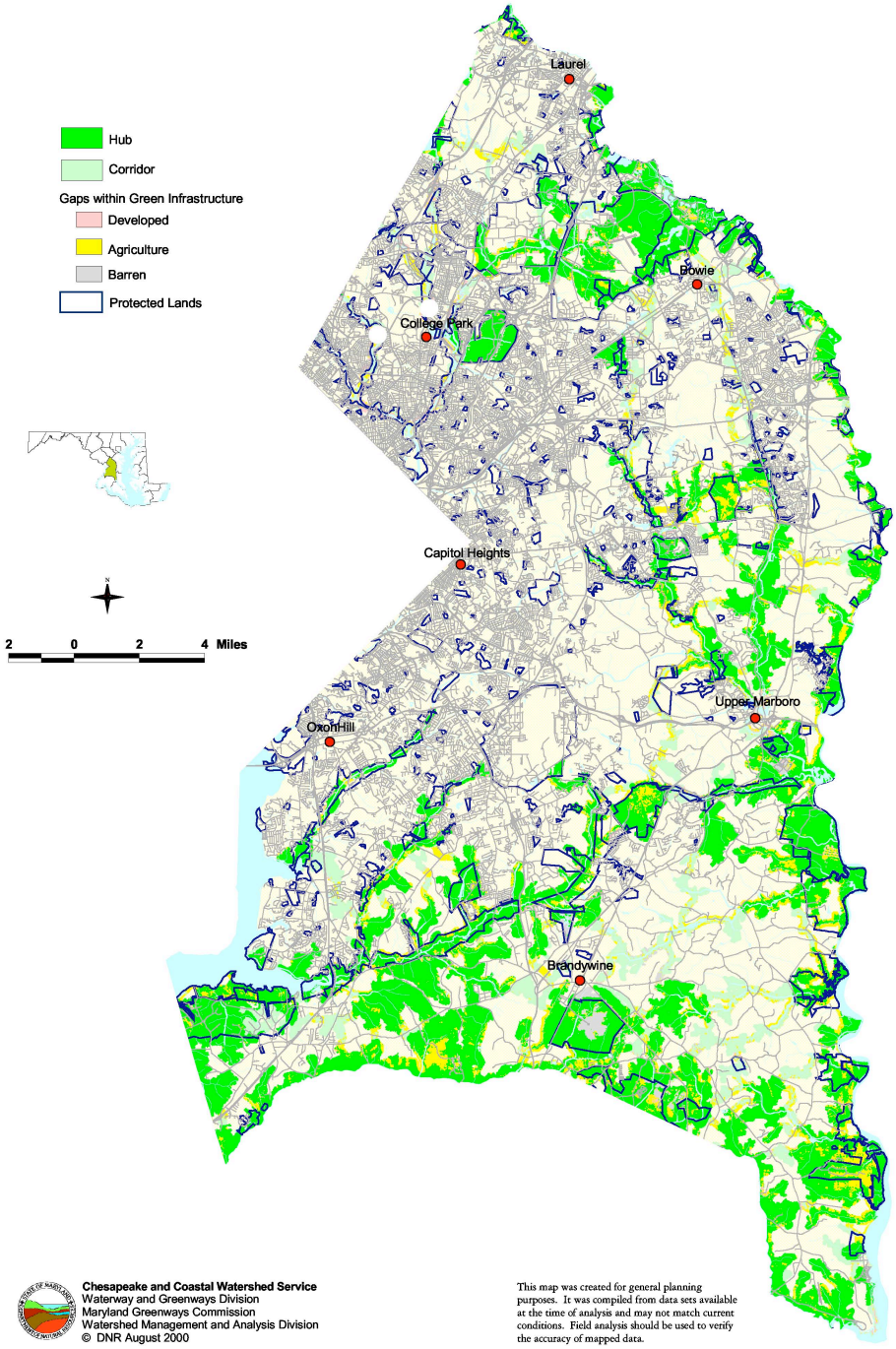
2 0 2 Miles

Chesapeake and Coastal Watershed Service
Waterway and Greenways Division
Maryland Greenways Commission
Watershed Management and Analysis Division
© DNR August 2000

This map was created for general planning purposes. It was compiled from data sets available at the time of analysis and may not match current conditions. Field analysis should be used to verify the accuracy of mapped data.

Prince George's County

Green Infrastructure

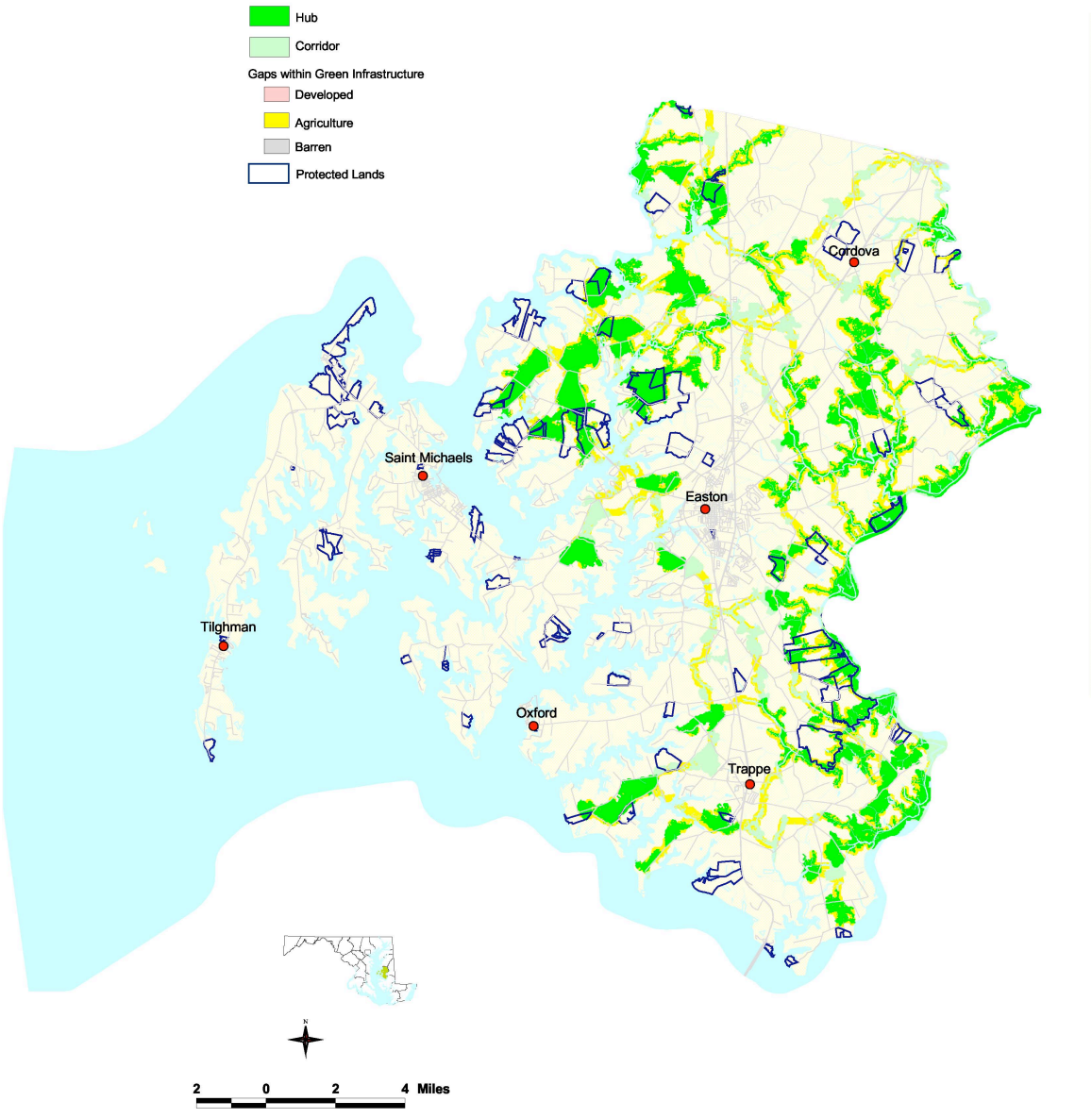


Chesapeake and Coastal Watershed Service
Waterway and Greenways Division
Maryland Greenways Commission
Watershed Management and Analysis Division
© DNR August 2000

This map was created for general planning purposes. It was compiled from data sets available at the time of analysis and may not match current conditions. Field analysis should be used to verify the accuracy of mapped data.

Talbot County

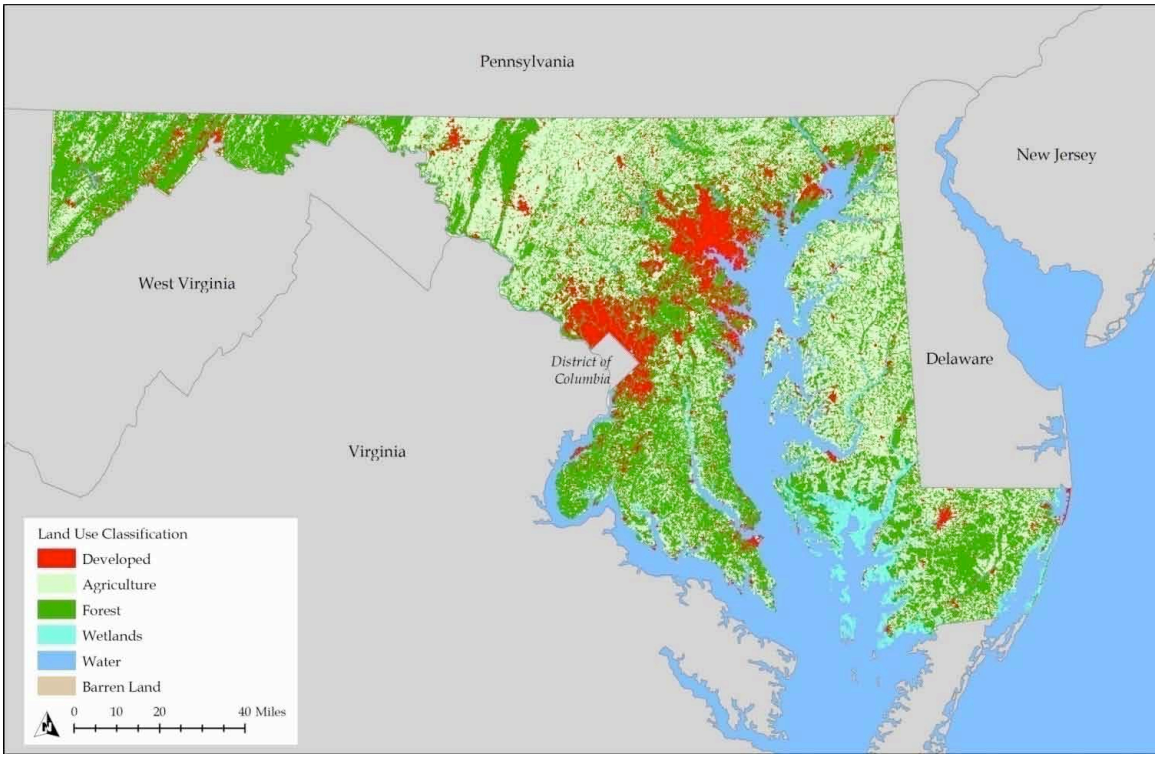
Green Infrastructure



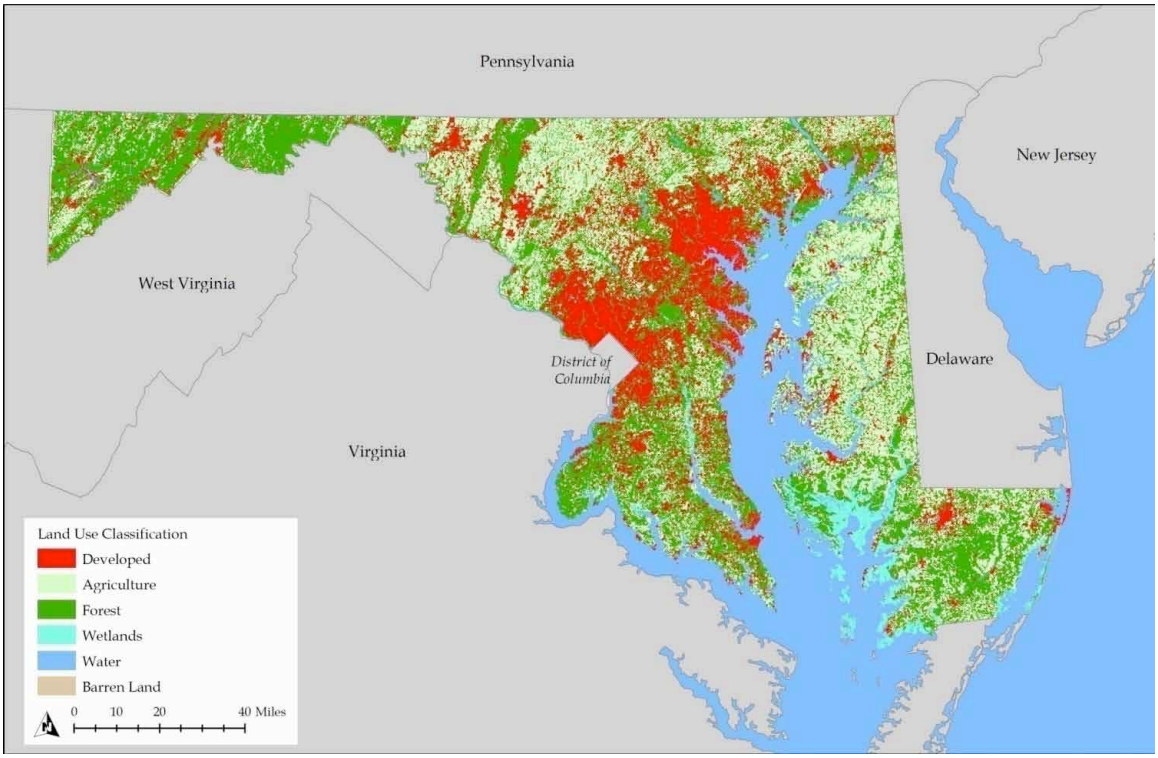
This map was created for general planning purposes.
It was compiled from data sets available at the time of analysis and may not match current conditions.
Field analysis should be used to verify the accuracy of mapped data.

Chesapeake and Coastal Watershed Service
Waterway and Greenways Division
Maryland Greenways Commission
Watershed Management and Analysis Division

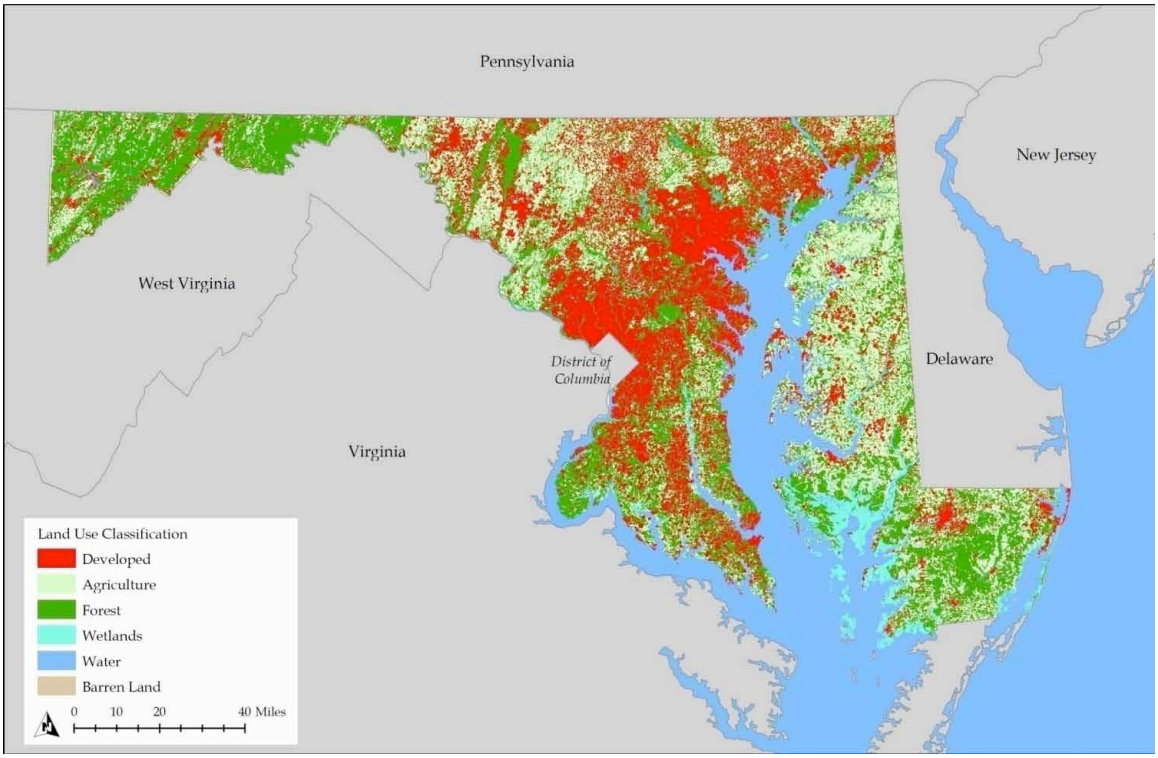
APPENDIX H: PLAN MARYLAND LAND USE/LAND COVER MAPS



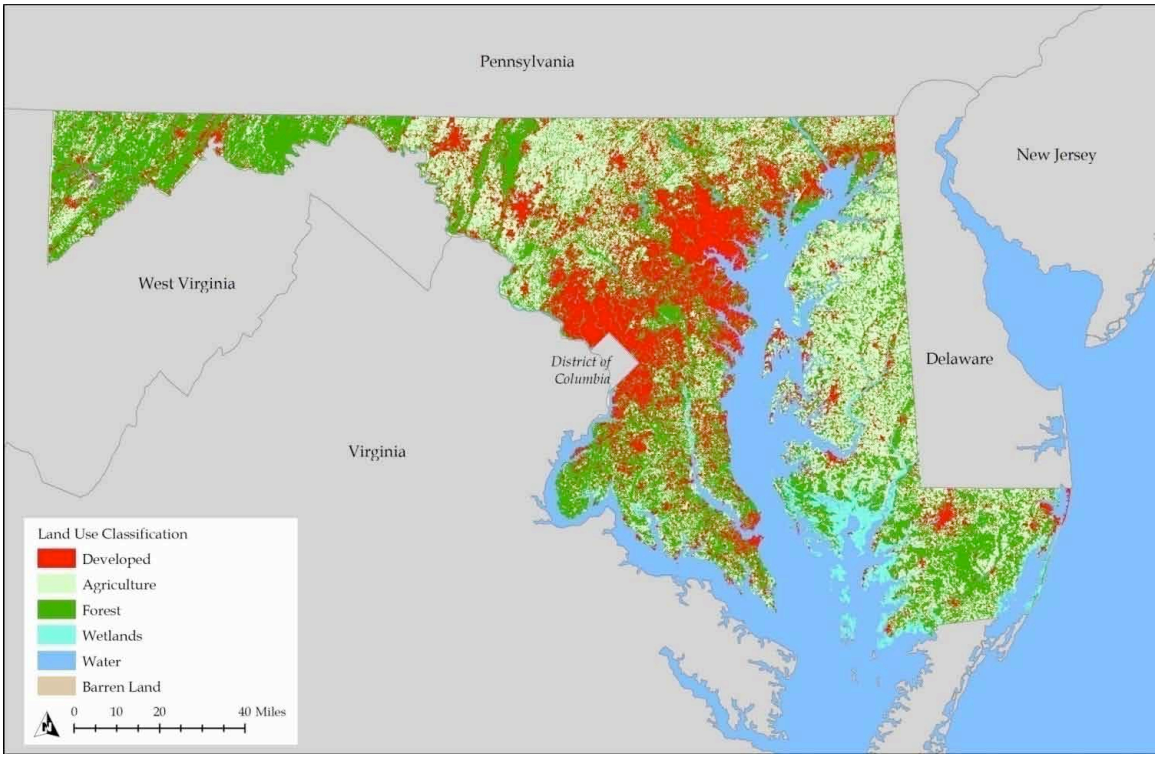
Plan Maryland 1973 Land Use/Land Cover



2002 Land Use/Land Cover



2030 Land Use/Land Cover Based on Current Trends



2030 Land Use/Land Cover Smart Growth Policies

APPENDIX I. PLANMARYLAND FORUMS

Forum	What is working?	What is not working?	Solutions
Small Group Table Discussions at the College of Southern Maryland Public Forum, April 8, 2010 (Maryland Department of Planning 2010a)	• Maryland is one of the leaders in environmental planning in the U.S. but more needs to be done • Maryland is a leader in forest conversation, and other environmental protection problems • Land preservation is working • Conservation laws TDR – working in Talbot County – high percentage of land	• Protected lands, trails, ecosystems, and cultural offerings - all need to be increased • Long way to go to protect wetland and aquifer areas. This needs to be a priority • Natural resources are not worth anything to planners unless they can be exploited • One unit per 3 or 5 acres in the agricultural conservation zone is not working • Lack of Plan Implementation	• Development is done at the expense of the environment. Need a paradigm shift. Look at water and other resources first before development • Protect forest and wetlands. Too valuable to lose • Protect farm land even if just fields – open space
Small Group Table Discussions at the Community College of Baltimore County, Essex Public Forum, April 14, 2010 (Maryland Department of Planning 2010b)	• Protecting the Bay is the most prevalent vision and environmental protection initiative pursued by State agencies • The State Park System is working. The Patapsco State Park has doubled in area since 1980 and is doing a better job protecting the water quality of this river environment. Program Open Space	• State and County coordination of environmental protection needs to be stronger and more streamlined • The Preservation element for the State has gotten worse • The concept of building without completely destroying a site needs to become the expected practice. Even our public agencies have not	• The State should control how land is utilized in so far as protecting lands purchased through the Program Open Space Program. Urban growth areas should have both recreation and parks. We need more preservation, not just soccer fields • Refocus environmental protection by not developing new areas, promote

	was working well • Baltimore County's urban-rural demarcation line (URDL) works. It provides resource protection around the reservoirs	lived up to their responsibility	redevelopment, avoid the clear cutting of trees, and build sustainably
Small Group Table Discussions at the Cecil College Public Forum, May 26, 2010(Maryland Department of Planning 2010c)	• There's a good sense of place in Cecil County. Protected resources are important	• The State has put a value on development in this county, and there needs to be more focus on green infrastructure • There is no strategic plan at the County level	None
Small Group Table Discussions at the Washington College Public Forum, June 16, 2010 (Maryland Department of Planning 2010d)	• Public participation is critical to the success of getting environmental projects adopted. Education is also important to getting support for environmental protection • Our "green infrastructure" is really good • For the Eastern Shore, resource conservation and community design are tightly linked	• There is a need for more cooperation, consider changing the review approach from site-based to watershed-based • State has to stop buying land and use those dollars to preserve it by putting easements on land. • I'm sick of making plans that are not implemented. If you put it in a plan do it	None

APPENDIX J. SUMMARY OF INFORMATION SOURCES FOR SELECTION OF GREENWAYS

- Maryland's green infrastructure, including Baltimore City, Baltimore, Calvert, Howard, and Prince George's Counties.

- Anne Arundel County Land Preservation and Recreation Plan

- Anne Arundel County Small Area Plans

- Maryland Greenways Atlas - State land

- Federal land - City of Annapolis-owned land (in the County)

- County land – parks, schools, government sites - Development activity (subdivisions, site plans)

- County zoning district boundaries, with particular attention to the Open Space Zoning District

- Roads, rail lines

- Streams and floodplains - Chesapeake Bay Critical Area

- Forest patches over 50 acres in size, with particular attention to patches not included in the state's green infrastructure

- Bogs and proposed bog protection areas

- State sensitive species review areas - Lands protected by easements, agricultural easements, Maryland Environmental Trust Easements, other easements such as those held by land trusts or conservancies

- Anadromous streams - Existing and proposed recreational trails

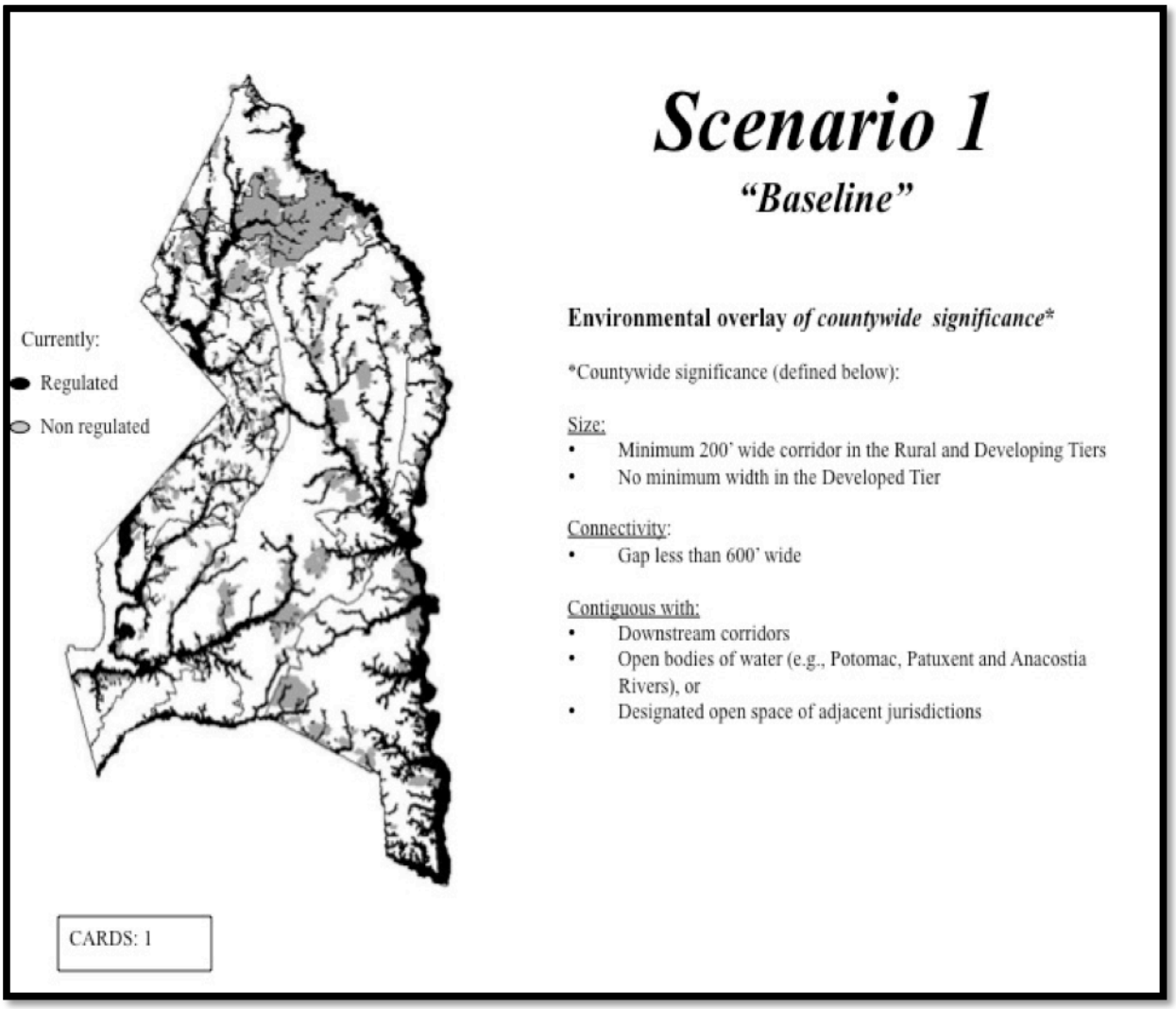
- Privately owned conservation lands - Annapolis, Londontown, South County Heritage Area boundary

- Rural Legacy program boundary - Historic sites from the Maryland Historical Trust inventory

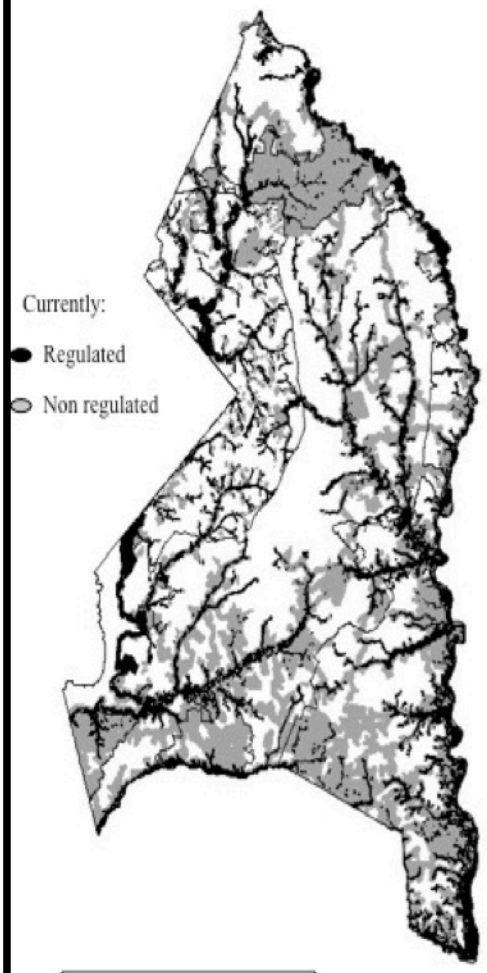
- Public water access points

Adapted from: (Anne Arundel County Office of Planning and Zoning 2002, 21)

APPENDIX K. SCENARIO'S PRINCE GEORGE'S COUNTY



Scenario 2



CARDS: 1, 2

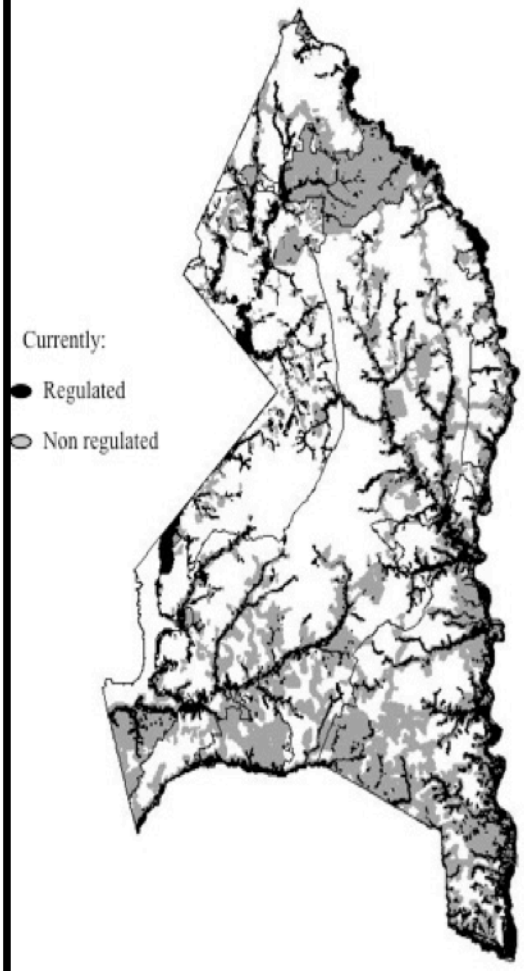
Environmental overlay of countywide significance
[Scenario 1] *plus State green infrastructure*

This map includes all of Scenario 1 and the outermost limits of the State green infrastructure assessment area. The State green infrastructure assessment area is 1100 feet wide or greater and includes:

- Large blocks of contiguous forests
- Large contiguous wetland complexes
- Unique wetland habitats
- Steep Slopes
- Colonial Waterbird Nesting locations
- Habitat Protection Areas
- Rare, threatened and endangered species sites
- Existing protected lands
- Natural Heritage Areas
- Waterfowl Concentration and Staging Areas
- Riparian Areas

Note: Final Scenario modified for countywide significance:

Size:
Minimum 200' wide in the Rural and Developing Tiers
No minimum width in the Developed Tier
Connectivity:
Gap less than 600' wide
Contiguous with:
Downstream corridors
Open bodies of water (e.g., Potomac, Patuxent and Anacostia Rivers), or
Designated open space of adjacent jurisdictions



Scenario 3

Environmental overlay of countywide significance plus State green infrastructure [Scenario 2], *which has been modified for existing development and approved subdivisions*

This scenario subtracts out:

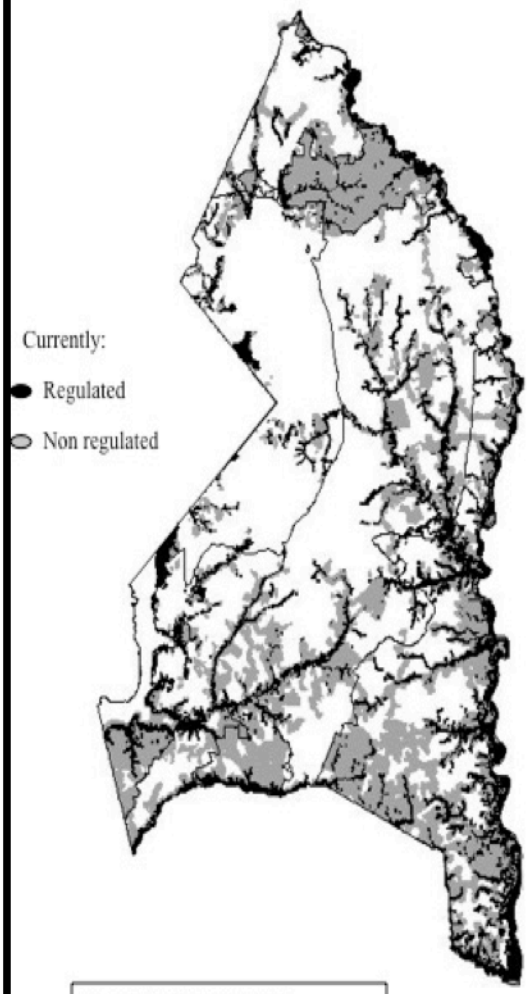
- Final platted subdivisions as of 3/31/04 with lots less than 4 acres in size
- Existing development

(NOTE: removing final platted subdivisions captured most substantial existing development. This was verified by looking at overlays of building footprints, water and sewer lines and aerial photography)

Note: Final Scenario modified for countywide significance:

Size:
Minimum 200' wide in the Rural and Developing Tiers
No minimum width in the Developed Tier
Connectivity:
Gap less than 600' wide
Contiguous with:
Downstream corridors
Open bodies of water (e.g., Potomac, Patuxent and Anacostia Rivers), or
Designated open space of adjacent jurisdictions

CARDS: 1, 2, 14, 16



CARDS: 1, 2, 14, 16, 17

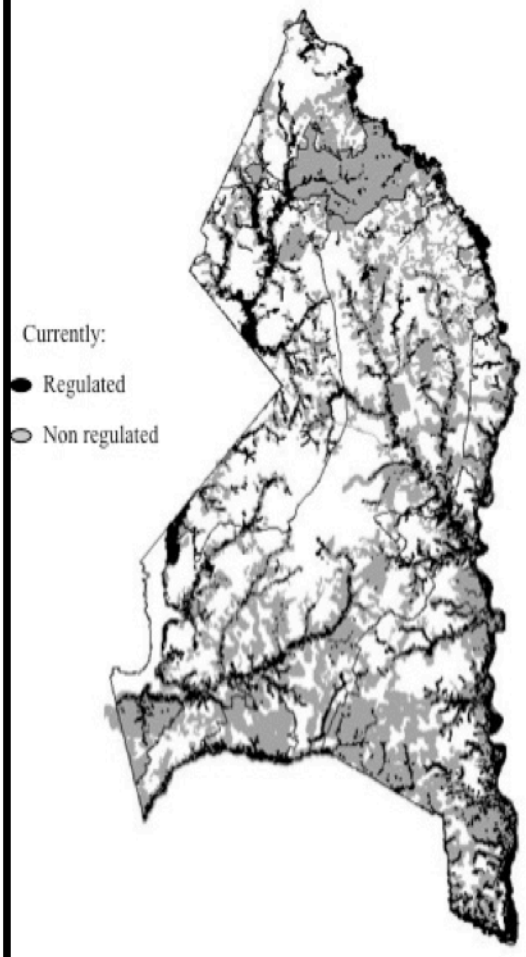
Scenario 4

Environmental overlay of countywide significance and State green infrastructure [Scenario 2], which has been modified for existing development and, approved subdivisions [Scenario 3], *with further modification to subtract areas which fall within development centers and corridors approved in the General Plan.*

This scenario contains the same subtractions for existing development and approved subdivisions as was done in Scenario 3 and also removes areas within approved corridors and centers from the General Plan.

Note: Final Scenario modified for countywide significance:

Size:
Minimum 200' wide in the Rural and Developing Tiers
No minimum width in the Developed Tier
Connectivity:
Gap less than 600' wide
Contiguous with:
Downstream corridors
Open bodies of water (e.g., Potomac, Patuxent and Anacostia Rivers), or
Designated open space of adjacent jurisdictions



CARDS: 1, 2, 3, 4, 5, 14, 16

Scenario 5

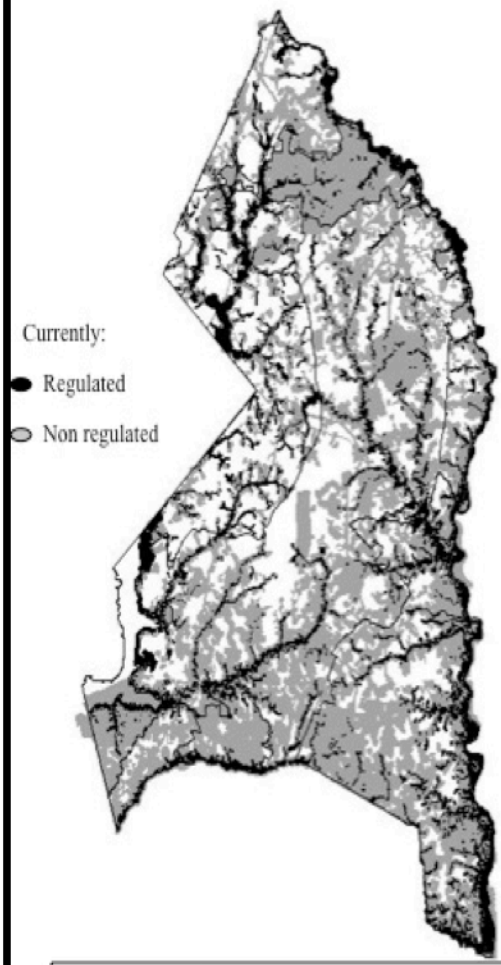
Environmental overlay of countywide significance and State green infrastructure [Scenario 2], which has been modified for existing development and approved subdivisions [Scenario 3] ***with protected land and priority areas added back in.***

This scenario includes the same subtractions for existing development and approved subdivisions as contained in Scenario 3 with the following added back in:

1. Protected lands including:
   a. Easements
   b. Woodland mitigation banks
2. Priority areas requested by:
   a. Municipalities
   b. Adjoining jurisdictions
   c. Focus groups
3. Stream valley park systems adopted in Subregion Master Plans

Note: Final Scenario modified for countywide significance:

Size:
Minimum 200' wide in the Rural and Developing Tiers
No minimum width in the Developed Tier
Connectivity:
Gap less than 600' wide
Contiguous with:
Downstream corridors
Open bodies of water (e.g., Potomac, Patuxent and Anacostia Rivers), or
Designated open space of adjacent jurisdictions



CARDS: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 18

Scenario 6

Environmental overlay of countywide significance and State green infrastructure [Scenario 2] with all environmentally important areas, protected lands, stream valley park systems and requested priority areas added back in – not modified for existing, approved, or planned development

This scenario contains the outermost boundary of all of the following:

- Existing regulated framework of countywide significance
- State green infrastructure
- Protected lands including:
  - Easements
  - Woodland mitigation banks
- Priority areas requested by:
  - Municipalities
  - Adjoining jurisdictions
  - Focus groups
- Stream valley parks adopted in Subregion Master Plans
- Rare, threatened and endangered species evaluation areas
- Interior forests potentially supporting interior dwelling bird species (including all areas to the outer edge of the forest)
- Mature forests (more than 68 years old)
- Colonial waterbird nesting sites and bald eagle nest sites
- Unique or unusual habitats such as granite outcrops which have been identified in master plans, or through the development review process
- Railroad corridors
- High voltage power transmission lines

Note: Final Scenario modified for countywide significance: Size:
Minimum 200' wide in the Rural and Developing Tiers
No minimum width in the Developed Tier: Connectivity:
Gap less than 600' wide: Contiguous with: Downstream corridors
Open bodies of water (e.g., Potomac, Patuxent and Anacostia Rivers), or
Designated open space of adjacent jurisdictions

APPENDIX L. PRINCE GEORGE'S COUNTY EXAMPLE POLICY WITH CORRESPONDING STRATEGY FOR EFFECTIVE IMPLEMENTATION

Policy 2

Preserve, protect and enhance surface and ground water features and restore lost ecological functions.

Strategies

2.1. Help address compliance with total maximum daily load (TMDL) caps established by the state under the federal Clean Water Act for waterbodies in the county where water quality standards have not been met.

a. Target mitigation to identified point and nonpoint pollution sources in a watershed with a TMDL.

b. Ensure that all mitigation and/or retrofit projects in the county are appropriately credited toward meeting existing and/or future TMDL requirements.

2.2 Establish and/or maintain adequate buffers to protect and/or restore water quality.

a. Revise the regulations to increase the minimum regulated stream buffer width to 75 feet, except in the Developed Tier and in growth centers and corridors.

b. In the Developed Tier and growth centers and corridors, maintain the current minimum regulated stream buffer width of 50 feet.

2.3 Manage and treat stormwater to minimize impacts to water quality and ecological systems.

a. Revise applicable ordinances to allow, and where appropriate require, the use of systems and processes for managing and treating stormwater runoff that preserve and/or reestablish natural resources and systems such as reducing natural vegetation removal, reducing impervious surfaces and increasing infiltration.

b. Evaluate current regulations that result in the construction of required impervious surfaces. Encourage the use of innovative designs that reduce the amount of impervious surfaces.

c. Manage and treat stormwater on-site to the fullest extent possible to maximize infiltration, restore the natural hydrologic system, improve water quality, and minimize run-off.

d. Coordinate watershed protection policies and programs with adjoining jurisdictions.

2.4 Prepare and implement major watershed management plans to address the preservation and restoration of ecological functions within watersheds.

a. Implement the recommendations contained in completed Watershed Restoration Action Strategy plans.

b. Include in each area/sector plan a comprehensive watershed management section for the area that provides guidance for preservation, enhancement, and/or protection of water-related resources.

c. Implement the recommendations of the State's Tributary Strategy Teams and the Patuxent River Policy Plan that are applicable to the county.

2.5 Regularly assess water quality ratings.

a. Evaluate the most recent data from the Assessment of Streams and Watersheds of Prince George's County water quality monitoring project conducted by the Prince George's County Department of Environmental Resources and make appropriate recommendations to improve water quality.

b. Periodically employ a water-quality model that evaluates how existing land uses impact water quality and use the results to determine where additional efforts and/or program changes are needed to improve water quality.

Adapted from: (The Maryland-National Capital Park and Planning Commission 2005, 38-39)

APPENDIX M. PRINCE GEORGE'S COUNTY GREEN INFRASTRUCTURE PLAN OBJECTIVES

1. By the year 2025, ensure that 75 percent of the green infrastructure network acreage meets the definition of countywide significance.

2. Ninety percent of the land acreage purchased for environmental preservation using public funds should be located within the green infrastructure network. If a portion of a property purchased is in the green infrastructure network and a portion is outside of the network, for the purpose of this calculation, the entire acreage purchased will be counted toward meeting this objective.

3. In new subdivisions in the Rural Tier and outside of approved growth centers and corridors in the Developing Tier, ensure that 100 percent of impacts to regulated areas are limited to unavoidable impacts, such as those for road and utility crossings.
4. By the year 2025, less than 25 percent of countywide net losses of woodland cover should occur within the green infrastructure network.

5. By the year 2025, improve the water quality in each major watershed to elevate the Benthic Index of Biological Integrity (IBI) rating of the watershed by at least one category using as a baseline the 1999–2003 biological assessment of the streams and watersheds of Prince George's County completed by the Department of Environmental Resources (DER).

6. By the year 2025, improve the stream habitat in each major watershed to elevate the habitat rating of the watershed by at least one category using as a baseline the 1999–2003 biological assessment of the streams and watersheds of Prince George's County completed by DER.

7. Each year, strategically target 100 percent of off-site forest mitigation acreage into the green infrastructure network and/or adjacent to streams outside of the green infrastructure network. Fifty percent of the forest mitigation acreage should be targeted to improving water quality by establishing, enhancing, and/or restoring riparian forest buffers.

8. Each year, 100 percent of off-site environmental mitigation projects (wetland, forests, stream restoration, etc.) should be targeted to priority areas identified in the countywide catalog of mitigation sites. A minimum of 50 percent of the mitigation projects should be targeted to enhance the water quality of the major watershed in which the project generating the need for mitigation is located.

9. The update of the environmental regulations implements many of the strategies needed to meet these objectives. The technical manual assists in the implementation of the Green Infrastructure Plan by providing guidance on the structural elements needed to meet the requirements of the updated regulations.

Adapted from: (Maryland-National Capital Parks and Planning Commission and Prince George's County Planning Department 2010, I-5).

APPENDIX N. INFORMATION SOURCES FOR CREATION OF PRINCE GEORGE'S GREEN INFRASTRUCTURE PLAN

I. Water Quality

A. U.S. Environmental Protection Agency

- Chesapeake Bay Program Watershed Profiles
- Chesapeake Bay Program River Basin Summaries for the Middle Potomac and Patuxent

B. Maryland Department of the Environment

- List of Impaired Surface Waters [303(d) List] and Integrated Assessment of Water Quality in Maryland
- Maryland Clean Water Action Plan
- Source Water Assessment for Community Water System in Prince George's County, MD

C. Prince George's County Department of Environmental Resources

- Biological Assessment of the Streams and Watersheds of Prince George's County (1999, 2000, 2001, 2002 and 2003)
- Comparison of Hydrological Responses from Low Impact Development with Conventional Development

D. Maryland Department of Natural Resources

- Maryland Biological Stream Surveys
- Western Branch Stream Corridor Assessment Study

E. Prince George's County Health Department

- Historic water quality sampling data for Western Branch
- Historic water quality sampling data for Anacostia

F. Metropolitan Washington Council of Governments (MWCOG)

- Historic water quality sampling data

G. City of Bowie

- Wellhead Protection Program (1993)

H. U.S. Fish and Wildlife Service

- Tumor prevalence in Anacostia fish

II. Forest Buffers

A. USDA Forest Service/Chesapeake Bay Program

- Riparian forest buffer widths

B. Adjacent Jurisdictions

- Current buffer requirement widths

III. Health Issues

A. American Cancer Society

- Surveillance Research

B. American Lung Association

- State of the Air 2002 Report

IV. Environmentally Sensitive Areas

A. Maryland Department of Natural Resources

- Maryland's Green Infrastructure Assessment: A Comprehensive Strategy for Land Conservation and Restoration
- Forest and Green Infrastructure Loss in Maryland 1997-2000, and Implications for the Future

B. The Maryland-National Capital Park and Planning Commission

- Geographic Information System
- Management Strategies For Critical Areas Suitland Bog

V. Agricultural Issues

- Prince George's County Soil Conservation District
- U.S. Department of Agriculture, National Agricultural Statistics Service: 2002 Census of Agriculture County Data

VI. Coordination Meetings

- Adjacent jurisdictions including:
  - Anne Arundel County
  - Calvert County
  - Charles County
  - Howard County
  - Montgomery County
  - District of Columbia
- Patuxent River Commission
- Middle Potomac Tributary Team
- Municipalities
  - Bowie
  - Cheverly

College Park
Greenbelt
Laurel

• Port Towns

• Prince George's County Municipal Association (PGCMA) representing all municipalities in the county

VII. Existing Plans and Documents

• 2002 Approved General Plan

• Maryland's Green Infrastructure Assessment: A Comprehensive Strategy for Land Conservation and Restoration Adopted Master and Sector Plans

• Commission 2000 Final Report

• Countywide Green Infrastructure Plan Public Forum Information Brochure

• Preliminary General Plan Technical Summary: Environmental Infrastructure, Transportation and Public Facilities

• Draft Master Plan of Transportation

• Mattawoman Creek Watershed Management Plan

• Patuxent River Policy Plan

• Approved master, area and sector plans

Adapted from: (The Maryland-National Capital Park and Planning Commission 2005, 49-51)

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