



Protecting New Jersey's Natural Capital Through Land Use Planning: Opportunities and Challenges



For: NJDEP
By: PlanSmart NJ
Date: January 27, 2009

Table of Contents	Page
Acknowledgements	iv
Summary	v
Introduction	1
I. Protecting Natural Capital through Existing Municipal Approaches to Land Use	8
Land Use Legislation and Regulation Municipal Master Plans, Zoning Ordinances, Subdivision And Site Plan Review, Redevelopment Plans, Stormwater Plans, Municipal Compacts for Regional Planning	8
Financial Incentives Capital Improvement Plan – Accounting or Green Infrastructure, Transfer of Development Rights	13
Preservation and Restoration Greenway Plans, Habitat Conservation Plans, Restoration Plans, Brownfield Plans	16
Education Stormwater Education, Environmental Commissions, Awareness Day	17
II. New Municipal Approaches to Land Use to Protect and Enhance New Jersey’s Natural Capital	19
Land Use Legislation and Regulation Form-based Codes, Plant Stewardship Index, Conservation Zoning, Targets	19
Financial Incentives Ecosystem Service Districts and Trading of Credits, Property Tax Reduction	22
Preservation and Restoration Carbon Sequestration Plan	25
Education Biodiversity Education	26

Table of Contents	Page
III. State Initiatives to Protect and Enhance Natural Capital	27
A State Strategy to Secure New Jersey’s Natural Capital Priorities for Protection, Reporting – A Green State Budget	27
Legislation Municipal Land Use Law, Transfer of Development Rights, Farmland Assessment Act	28
Regulation State Access Code, Stormwater Permits, Threatened and Endangered Species Protection, Public Trust Doctrine and a Legal Shield, Forest Mitigation, Build-out, Plan Endorsement, Brownfields	30
Financial Incentives Carbon Credits, Smart Future Planning Grants, Tax Credits, Tax-Base Sharing, State Aid	32
Preservation and Restoration Grants, Wildlife Conservation Planner or Watershed Planners	33
Education Planning Board Member Training, Valuation Professions’ Declaration, Legislature and State Agencies	34
Data Priority Ecosystems for Carbon Sequestration and other Values, Monitoring	35
IV. Lessons Learned	36
Regulation Master Plans and Site Plans, Zoning and Other Ordinances, Regional Plans	36
Financial Incentives Capital Improvement Plan, Transfer of Development Rights, Carbon Credits and Ecosystem Service Districts	36

Table of Contents	Page
Preservation and Restoration Biodiversity, Restoration, Champion	37
Education Campaign for Natural Capital, Briefings, Materials	38
Data Monitoring, Designing for Protection	39
V. Next Steps	41
Potential Implementation Matrix, Possible Pilot Projects, Further Research	
VI. Implementation Matrix	43
Appendices	
A. Land Use Planning Decision Flow Charts Municipal Master Plan Redevelopment Plan Municipal Ordinances Municipal Development Review – Major Subdivision or Site Plan Capital Improvement Plan	
B. Valuing New Jersey’s Natural Capital – Map	
C. Environmentalist Roundtable Summary	
D. Land Use Planners & Academics Roundtable Summary	
E. Interview Summaries	
F. Annotated Literature Review	
G. Bibliography	

Acknowledgements

The authors, Dianne Brake and Noelle Reeve, would like to thank William Mates for his oversight of the project and for guiding the structure of this report. We would also like to thank the participants in the interviews and roundtables who took time from their busy schedules to contribute their expertise. (See Appendices C, D and E for their names and comments.) Finally, we would like to thank the Geraldine R. Dodge Foundation and the William Penn Foundation, funders of the initial research on New Jersey's natural capital, for breaking through the historical conflict between economy and the environment by identifying the value of the services and goods economies have for too long considered to be "free."

Summary

A new concept is gaining traction in the field of traditional natural resources management and its newer offspring, biodiversity planning. This new concept values nature not for its one-time extractive worth, nor for the variety of species able to be identified within a given area. Instead it values nature with a calculus that recognizes the enormous replacement cost society would face if it had to engineer the goods and services nature currently provides for free. Natural capital is the name for this new concept.

Natural capital refers to the dollar value assigned to the economic benefits that healthy ecosystems provide over an extended period of time. In other words, economists assign a natural capital value to ecosystem goods (e.g, agricultural products, minerals, fish harvests, pharmaceutical plants, drinking water, timber, game, etc.) and to ecosystem services (e.g, purification of air and water, pollination, moderation of extremes of temperature, flood and drought mitigation, soil detoxification and formation, pest control, protection from ultra-violet rays, carbon sequestration, cultural and spiritual enrichment, etc.).

Economists have developed sophisticated methods for planning for a variety of types of capital: financial capital increases through prudent investment; physical capital increases as obsolete machines are replaced; human capital increases through skills training; social capital increases as institutions grow in their ability to resist corruption and successfully enforce contracts. However, natural capital is more difficult to plan for as ecosystems have been managed through traditional land use practices subject to the fragmented goals of a variety of owners (individual land owners, corporations, non-profits, governments). Recently, however, US markets for protecting over seventy individual endangered species and US and global markets for specific services (such as carbon sequestration) have developed. These markets provide new incentives for the re-evaluation of the worth of ecosystems within the traditional land use decision-making framework of “highest and best use.”

With the publication of *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources* in 2007, New Jersey became the first state to estimate the value of its natural capital. At \$20 billion/year, New Jersey's natural capital is placed in perspective by realizing the state's total 2008 budget was \$33 billion. Even if scientists fully understood and could replicate nature's goods and services, replacing the natural capital of the state would be financially impossible.

Harnessing New Jersey's land use planning processes to protect and enhance New Jersey's natural capital is imperative for the continued economic and environmental health of New Jersey's residents. This report, *Protecting New Jersey's Natural Capital Through Land Use Planning: Opportunities and Challenges*, recommends New Jersey develop a statewide strategy to secure New Jersey's natural capital. In addition, the report suggests five land use related points of intervention: legislation/regulation; financial incentives; preservation and restoration; data; and education.

The report identifies how traditional local planning tools such as the Land Use Element of the Master Plan could be strengthened through targets to protect natural capital. Stormwater plans could also be strengthened to protect natural capital by emphasizing forest protection and restoration. The municipal Capital Improvement Plan should

provide an assessment of the replacement value for the natural capital services a municipality receives from its green infrastructure (for water filtration, flood protection, air quality improvement, etc.) and assess the impact of depletion of or investment in its natural capital.

New models for natural capital protection are also identified by the report including a preliminary zoning ordinance based on the Plant Stewardship Index for New Jersey under development by Delaware Township and Ecosystem Service Districts that would allow trading and banking of natural capital. The report argues the most significant protection of natural capital will occur through a comprehensive state Greenhouse Gas Reduction Plan that facilitates participation in the market for carbon sequestration established by the northeast states' Regional Greenhouse Gas Initiative carbon auctions.

New data will need to be gathered to monitor natural capital assets and the report recommends NJDEP, universities and the Department of Labor work together to develop and market software (similar to that developed by the University of Colorado) to allow land use planners to make the best land use decisions based on the new natural capital data available to the state of New Jersey.

Finally, municipalities, individual tax-payers and the state stand to gain financial and environmental benefits as they recognize the value of New Jersey's natural capital as a long term asset to be managed. Therefore, education of the public and municipal and state officials on the economic and environmental returns afforded by protecting and enhancing natural capital is a primary recommendation of this report.

Introduction

In April 2007, the New Jersey Department of Environmental Protection (NJDEP) released a study called *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources*. This report, for the first time, provided New Jersey with a monetary value for the goods and services provided by its ecosystems.

The total value of NJ's ecosystem goods and services is conservatively estimated in *Valuing New Jersey's Natural Capital* to be \$20 billion/year. In comparison, New Jersey's total 2008 state budget was \$33.3 billion. The cost to replace the services provided by nature with engineered services would clearly be impossible to meet without crippling New Jersey's economy.

In addition, although unquantified in DEP's report, the risk to the health of global ecosystems from the loss of habitat in New Jersey (that serves migratory species or in other ways interacts with the larger environmental systems of the planet) is even more significant.

NJDEP commissioned PlanSmart NJ to prepare this follow-up report, *Protecting New Jersey's Natural Capital through Land Use Planning: Opportunities and Challenges*. This report strives to identify how local governments could use this new way of thinking about natural resources to protect New Jersey's natural capital more effectively. It also identifies state initiatives that could be adopted to support such municipal efforts, particularly how the state could help

municipalities to work together within a region, the most appropriate scale for protecting natural capital. Finally, the report provides an implementation matrix on the policies, programs and strategies that should be accelerated and those that should be dropped or avoided.

Natural Resources, Green Infrastructure, Biodiversity and Natural Capital

The valuation of natural capital is the latest advance in a long series of approaches to managing the relationship between the built and natural environment. For centuries, the economic value of natural resources has been assessed by the monetary gain obtained from the extraction of a key resource (such as timber or water).

Within the past 150 years, the U.S. federal government introduced the concept of *natural resource management* (encouraging renewal of resources for continued extraction) and preservation of resources within an admired landscape (such as Yellowstone).

Within the past fifty years, two further concepts of natural resource management were developed. These concepts emphasize the *services_nature* provides, in addition to simply valuing its *goods*. First, the concept of *green infrastructure* recognizes that certain natural features (such as wetlands) provide services comparable to engineered grey infrastructure (such as flood control levees).

Second, the concept of *biodiversity planning* recognizes that nature is able

to perform a greater number of services when its ecosystems are intact. One measure of ecosystems is their level of biological diversity.

The most recent concept, that of *natural capital*, recognizes the benefits nature provides from *both* its goods and services and takes this recognition further by assigning a dollar value to the natural attributes of an area based on the *long-term* provision of both these benefits.

Green Infrastructure

Infrastructure is usually thought of in its “grey” form: the pipes, pumps, rails, asphalt, bridges and other man-made facilities that support water and wastewater management, transportation and development within a community. Planners, engineers and ecologists now distinguish between this kind of infrastructure that makes up the built environment and “green” infrastructure.

Green infrastructure refers to natural resources such as trees, streams, wetlands and open space. “Green infrastructure is not limited to rural landscapes, but also includes street trees, parks, waterfronts, lawns, swales, landscaped buffers, and other ‘natural’ features of urban and suburban landscapes.” (Brake, et al, p.11).

Green infrastructure provides services such as improving water quality by removing pollutants, mitigating stormwater runoff and flooding, and reducing the urban “heat island” effect.

But without a monetary value for the services provided by green

infrastructure, it has frequently been overlooked. No agencies comparable to highway departments or sewer authorities exist to promote investments in green infrastructure similar to the investments routinely made in grey infrastructure.

Biodiversity

Biodiversity, or *biological diversity* refers to the number, variety and variability of all living things. Biodiversity encompasses:

- *Genetic diversity*, meaning the genetic variation among individuals of the same species;
- *Species diversity*, meaning the number of different plants, animals, fungi and simple organisms such as bacteria and protozoa; and
- *Ecosystem diversity*, which includes the variety of ecosystems and the different ways they function. Ecosystem diversity can include both the organisms and the interactions between them and their environment e.g., fire, climate, decay, and predator-prey relationships. (B.C. Ministry of Environment, p. 1)

The health of the Earth depends upon conserving and restoring biodiversity and sustaining the viability of ecosystems. Like the goods value of natural resources, and the services value of green infrastructure, the value of biodiversity is one component generally used to calculate the natural capital of an area. This is based on the understanding that intact, rather than highly fragmented ecosystems are

related to the highest value of natural capital.

Biodiversity in New Jersey

New Jersey is often referred to as the most densely populated state in the nation. But it is also, on a square mile basis, the state with the greatest wildlife diversity, even more than the wilderness state of Alaska.

According to NJDEP's Wildlife website, Alaska hosts 687 species: 425 bird species, 102 mammal species, 10 reptile and amphibian species and 150 species of fish. New Jersey hosts 894 species: 325 bird species, 90 mammal species, 79 reptile and amphibian species and over 400 species of fish. However, when you consider Alaska is 75 times larger than New Jersey, New Jersey's wealth of wildlife is significant.

New Jersey's high level of biodiversity is the result of its geographic position where northern ecosystems reach their southern limit and where southern ecosystems reach their northern limit.

NJDEP has preliminarily recognized the biodiversity represented by the state's ecosystems through its Landscape Project mapping of five distinct ecosystems: forest, beach, grasslands, wetlands, and forested wetlands. NJDEP also has a Fish and Wildlife Division that manages individual game and non-game species.

The state does not currently have a biodiversity planning function. Again, without a monetary value attached to the benefits of biodiversity, officials and professionals involved in the land use planning process have overlooked

planning to maintain New Jersey's biodiversity.

Natural Capital

Natural capital is a new concept that has gained traction in the field of traditional natural resources management over the past twenty years. This new concept values nature not for its one-time extractive worth, nor for the variety of species able to be identified within a given area. Instead it values nature with a calculus that recognizes the enormous replacement cost society would face if it had to engineer or otherwise recreate the goods and services nature currently provides for free.

Natural capital refers to the dollar value assigned to the economic benefits that healthy ecosystems provide over an extended period of time. In other words, economists assign a natural capital value to ecosystem goods (e.g., agricultural products, minerals, fish harvests, pharmaceutical plants, drinking water, timber, game, etc.) and to ecosystem services (e.g., purification of air and water, pollination, moderation of extremes of temperature, flood and drought mitigation, soil detoxification and formation, pest control, protection from ultra-violet rays, carbon sequestration, cultural and spiritual enrichment, etc.).

Traditionally *capital assets* (that generate a flow of economic benefits over an extended period of time) are distinguished from *operating assets* like food or gasoline (that are used up quickly). Capital assets have been associated with financial capital and

physical capital, and more recently, human capital and social capital.

Natural Capital is the term used by economists to highlight the fact that nature also provides flows of economic value over an extended period of time.

Natural Capital in New Jersey

The 2007 report, *Valuing New Jersey's Natural Capital*, identified specific "components of the natural environment that provide long term benefits to society" (NJDEP, p.1).

In the report, New Jersey's *ecosystem goods* are ranked in order of median commodity value, from highest to lowest, as follows:

- agricultural products,
- commercial fish harvest,
- mineral resources,
- water resources,
- recreational fish harvest,
- sawtimber,
- fuelwood, and
- game animals.

(NJDEP, p. 7) (The value of non-farm plants could not be estimated.)

The report also ranks *New Jersey's ecosystem services* in order of total value from highest to lowest as follows:

- nutrient cycling,
- disturbance regulation,
- water regulation,
- habitat,
- aesthetic/recreational,
- waste treatment,
- water supply,
- cultural/spiritual,
- gas/climate regulation,
- pollination,

- biological control, and
- soil formation (NJDEPa, p. 15).

The study concludes that overall, New Jersey's ecosystem services are far more valuable than its harvestable goods (NJDEPa, p. 16). Maps provided in the NJDEP report identify areas with high natural capital values for both goods and services (see Appendix B).

Land Use Planning and Natural Capital

While natural resource management has achieved some level of protection for New Jersey's plants and animals, and planning for biodiversity is likely to provide further protection in designated areas like the Meadowlands or Pinelands, something more is needed to stem the loss of habitat – and biodiversity – that continues to occur in New Jersey.

Economists have developed sophisticated methods for managing a variety of types of capital, designed to monitor improvements over time: financial capital increases through prudent investment (monitored through stock market prices); physical capital increases by replacing obsolete machines (monitored by cost/benefit analysis); human capital increases through skills training (monitored by testing); and social capital increases as institutions grow in their ability to resist corruption and successfully enforce contracts (monitored through levels of foreign investment), etc.

With no value attributed to capital goods and services in natural systems, however, it is both difficult to manage

and difficult to measure whether these assets are increasing or decreasing.

But the biggest obstacle to integrating natural capital evaluations into land use planning is the fragmentation of the system. Natural capital – like so many other regional systems – is affected by a myriad of independent decision-makers (different agencies and levels of government), and subject to the competing goals of a variety of owners and users (individual land owners, corporations, non-profits, governments).

It is well documented that patterns of land use significantly affect the level of ecosystem services and goods produced by a landscape. The *Millennium Ecosystem Assessment*, conducted by the United Nations in 2005, describes the state of the world's ecosystems and the serious implications for human well-being if the integrity of the world's ecosystems continues to decline through poor land use practices such as urban sprawl, deforestation, pollution, etc.

Natural capital protection is imperative because if poor land use decisions “eliminate species and ecosystems, we will have to do their work...and we simply do not have the knowledge or resources to fulfill their functions.” (Costanza et al.)

Fragmented ecosystems are known to be less valuable than intact ecosystems. Much research exists in the conservation literature on the relative benefits of wildlife corridors, habitat patch sizes, etc., in protecting ecosystems and their services (Chan, p. 2138).

The problem of monitoring/managing, however, may be improving. Recently, in the US, market prices have been developed for credits used in the protection of over seventy individual endangered species. Global market prices have also been developed for specific services (such as carbon sequestration).

These markets provide new incentives for the re-evaluation of the worth of ecosystems within the traditional land use decision-making framework of “highest and best use,” which has, until now, referred only to the real estate market value of the development of land.

That leaves addressing the issue of fragmented decision-making. Given the enormous value of New Jersey's natural capital relative to the state budget, harnessing New Jersey's land use decision-making process to protect and enhance New Jersey's natural capital is imperative for the continued economic and environmental health of New Jersey's residents.

This means aligning the different players who affect natural capital to improve its protection and value across the state.

In one of the best known examples of land use planning for natural capital protection in the United States, New York City recognized the natural capital value of the ecosystem at the source of its water in the Catskills. The City chose to invest \$660 million in protection of the watershed in order to avoid the \$6-8 billion cost of constructing a new filtration plant that would have been required to replace

the services provided by a healthy ecosystem.

Other cities (including Milwaukee, Seattle, Topeka, Philadelphia, Portland, etc.) have recognized the dollar savings that occur when nature's water and air filtration services are protected through land use planning.

While there is plenty of information available in New Jersey on the benefits of natural resource protection and the variety of means to protect natural resources, three main obstacles have inhibited wide use of this information:

- A separation of the applicable information from the land use application, such as:
 1. natural resource information from the local land use planning process;
 2. the work of the Environmental Commission from the Planning Board;
 3. the Natural Resource Inventory from the Master Plan or zoning;
 4. state agency data at a scale perceived as inappropriate for municipal use; etc.

- The lack of incentives to use this information in the local planning process (e.g., no monetary or time benefit given by the state; no economic benefit from the market; etc.)

- Existing disincentives in the system (e.g., threat of lawsuits if zoning is changed; cumulative negative impacts are not felt within the election cycle of towns, etc.).

Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources offers a new way of viewing natural resources – through the lens of their long-term monetary value as natural capital – rather than seeing natural resources as either having no value or only a short term, extractive-use value.

This follow up report, *Protecting New Jersey's Natural Capital Through Land Use Planning: Opportunities and Challenges*, was written after an extensive literature review and interviews/roundtables held with environmentalists, land use planners and academics. In addition, the authors drew on their professional experience and previous publications of PlanSmart NJ (*The Green Infrastructure Guide, 2001*; and *The Growth Management Handbook, 1989*).

This report identifies five land use related topics: land use regulation; financial incentives; preservation and restoration; education; and data. It also proposes five ways natural capital can be protected and enhanced by identifying:

- How natural capital can be protected through *existing* municipal approaches to land use;
- How natural capital can be protected and enhanced through *new* municipal approaches to land use;
- What new *state initiatives* are needed to protect New Jersey's natural capital;
- What lessons have been learned; and

- **What steps should be taken next, including possible pilot projects and a potential implementation matrix.**

I. Protecting Natural Capital through Existing Municipal Approaches to Land Use

Directing growth *away* from high priority ecosystems into potential centers in areas that are already developed, is key to preserving the value of the natural capital. It is referred to in planning circles as “center-based” development, or Smart Growth, and it is designed to change the suburbanized land use pattern created over the last fifty years.

As currently structured, however, the land use decision-making process continues to promote suburbanization on open land over redevelopment. Although New Jersey is running out of open land – some put build-out in as few as fifty years – regulations continue to make redevelopment costly, time-consuming and often controversial.

The idea of center-based development is not new in New Jersey. Efforts to change the land use pattern began in the 1970s, and began in earnest when New Jersey’s *State Planning Act* was signed into law in early 1986. In spite of having adopted a *State Development and Redevelopment Plan* twice, the first in 1992 and the second in 2001, both promoting center-based development, there has been little progress made that will result in changing the suburbanizing landscape. As a result, New Jersey’s natural capital continues to be lost.

The pattern of land use, which is influenced by state agency regulations, real estate markets and controlled by local governments, will determine

whether New Jersey’s natural capital increases or decreases. The more land that is retained or reclaimed as intact habitat, the greater New Jersey’s natural capital wealth will be.

New Jersey has a number of mechanisms, described below, for guiding growth and preserving habitat that could be strengthened by incorporating the information contained in the maps and analysis undertaken by the *Valuing New Jersey’s Natural Capital* report. (See Appendix A for flow charts describing these land use decision-making processes and Appendix B for a map ranking priority lands from *Valuing NJ’s Natural Capital*.)

Land Use Legislation and Regulation

The *Municipal Land Use Law*, adopted in 1975, assigns municipalities responsibility for planning for the future of their community and for the review and authorization of development projects. Municipalities carry out these responsibilities by creating a comprehensive Master Plan as a broad policy statement that guides future development within a municipality. A set of land use regulations, primarily a zoning ordinance, implements the general goals of a Master Plan by describing permitted uses in different zones. These may include special ordinances related to specific goals, such as stream corridor protection, tree protection, levels of noise permitted in a neighborhood, signage, *etc.*

Municipalities further control the use of land through Subdivision and Site

Plan review. Standards in these reviews regulate, within state-set parameters, “the improvement of raw land and the provision of major infrastructure necessary to create buildable sites” and provide the “details of utility services to buildings, landscaping and pedestrian and vehicle circulation” respectively (Zorn, p.4-5).

Clearly, how land in a municipality is used – for housing, farming, open space, or shopping and manufacturing – affects the health of the plants and animals and the processes of water, nutrient and waste cycles occurring in an ecosystem.

Similarly, how a municipality designs lots and roads within the various permitted land uses and whether the municipality allows clustering of the various uses also significantly affects the health of its ecosystems and therefore the level of goods and services they can provide.

Municipal Master Plans

While the *Municipal Land Use Law* gives New Jersey municipalities the right to protect biodiversity and habitat through a conservation element in their master plan, the land use planners that were interviewed or attended roundtables held as part of this project, all agreed that placing natural capital information in this separate, voluntary element of the Master Plan would not be the best approach to take for effective protection of natural capital. (See Appendix D for roundtable summaries and Appendix E for interview summaries).

Instead, to provide protection for a municipality’s natural capital, the planners recommended that conservation goals should be integrated within the Land Use Element designed around natural capital priority areas as identified by NJDEP’s 2007 report *Valuing New Jersey’s Natural Capital: An Assessment of the Economic Value of the State’s Natural Resources*.

To protect natural capital, Master Plans should set goals to:

- Maintain large intact habitat patches,
- Protect habitat for rare and sensitive species,
- Maintain connections through wildlife corridors, and
- Maintain ecological processes. (Theobald *et al* p. 39)

Ideally, the State could map areas that provide important regional services, such as areas that serve to provide flood control, important recharge areas, pollution control, etc., so that municipal master plans could be designed to protect them and reap the benefits.

Zoning Ordinances

A zoning ordinance “controls the type, intensity and location of development on a site.” (Zorn, pp. 4-15) Outside of special districts such as the Pinelands, New Jersey currently has no municipality with zoning ordinances for large lots that would be protective of natural capital. Such zoning can be found in other nearby states (such as Pennsylvania, Maryland and Vermont) with zoning of lots up to 50 acres for farmland or forestry protection.

Changing their current zoning is something that New Jersey municipalities are reluctant to do, out of a fear of lawsuits. However, where municipalities can demonstrate to a court that downzoning (reducing the allowable density on a tract of land) is not capricious or arbitrary, but has been undertaken to meet multiple public goals laid out in their Master Plan and is supported by the State Plan, New Jersey's courts have upheld their actions (*e.g.*, East Amwell's downzoning to one unit per ten acres).

Six to ten acre zoning, however, will not protect natural capital. The Courts have, however, indicated that protective zoning standards could be designed and upheld (up to 50 acres or more is needed and justifiable in some cases) if the background work has been done and the public benefits are clearly spelled out.

The consensus among the planners, mayors and environmentalists, who participated in this project, was that overlay zones are easier to adopt than wholesale changes to a zoning ordinance. An overlay zone is a special zone placed over an existing zoning district, part of a district, or a combination of districts. The overlay zone includes a set of regulations that is applied to property within the overlay zone as an alternative to the requirements of the underlying or base zoning district.

The overlay usually provides requirements (or incentives) intended either to protect a specific resource or to encourage development in certain areas. Overlay zones allow for increased flexibility in local zoning,

since they are more closely tailored to areas within the community which share certain characteristics. (An example of a conservation overlay zone is Princeton Township's Ridge Protection overlay zone).

Overlay zones could be adopted by a municipality to protect waterways, ridgelines, forests and/or agricultural areas from development. These overlays could increase lot size minimums in rural areas (to protect large areas of habitat or farms) and cluster or transfer any future development.

Conversely, municipalities could remove lot size minimums in their zoning ordinance to allow clustering and minimize sprawl. Municipalities could also adopt a cluster development ordinance to increase density on one portion of a tract and to preserve open space on another portion. In all these examples, however, care should be taken to specify the natural capital asset that is to be protected so that appropriate areas are conserved during the application of these zoning tools.

The New Jersey Association of Environmental Commissions, ANJEC, maintains a database of environmental ordinances from New Jersey towns. While many of the ordinances were not specifically developed to protect natural capital they should provide useful starting points. See the following topics:

- Agricultural Overlay
- Aquifer Protection
- Carbonate Bedrock
- Cluster Development

- Comprehensive Environmental Ordinance, i.e., "Performance Standards"
- Comprehensive Planning
- Conservation Design/Open Space Design/Residential Clusters/Planned Residential Development/Performance Zoning
- Dune Protection
- Erosion and Sediment Control
- Fish and Wildlife Habitat
- Floodplains
- Forested Area Protection
- Incentive Zoning
- Lot Size Averaging
- Minimum Impact Development District
- Natural Features Preservation
- Net-Out of Resources/Site Capacity Calculations
- Open Space & Recreation
- Open Space Protection
- Overlay Zoning
- Resource Management
- Ridgeline Protection
- Scenic Resources
- Steep Slope Protection
- Stormwater Management
- Stream Corridor Protection
- Transfer of Development Rights (TDR)
- Tree Preservation
- Wetlands Management.

(www.anjec.org/html/ordinances.htm)

In addition, the New Jersey League of Municipalities offers an Electronic Ordinance Library listing ordinances that have been enacted in New Jersey municipalities.

(www.njslom.org/PDF/elec_library.html).

The United States Environmental Protection Agency also offers a variety

of model ordinances on the following topics:

- Aquatic Buffers
- Erosion and Sediment Control
- Open Space
- Stormwater Operation & Maintenance
- Illicit Discharges
- Post Construction Controls
- Nonpoint Source Pollution Control
- Stormwater Utility Ordinance
- Transfer of Development Rights
- Golf Course Management Guidelines
- Wetlands Protection
- Forest Conservation.

(For details on these ordinances see: www.epa.gov/owow/nps/ordinance/).

The U.S. Department of Energy, Center of Excellence for Sustainable Development, also offers ordinances at:

www.sustainable.doe.gov/landuse/lucodtoc.shtml.

Subdivision and Site Plan Review

The planners who provided input for this report were unanimous in stating that consideration of natural capital at the Site Plan review stage of the land use planning process was too late. While municipal Site Plan ordinances are required to include provisions for protection against soil erosion, and to provide suitably sized and situated areas for public uses, etc., the preservation of existing natural

resources on the site is a discretionary provision. (Zorn, pp. 4-6, 4-8)

In addition, a site plan is in most cases too localized to provide protection for ecosystem services, unless a larger plan has already been developed and it has already been determined how the site fits into it.

For example, if a municipality had adopted a greenway plan, then the design of a site plan could contribute to the larger plan. Conversely, a single site plan that retained stream buffers or treed areas would provide little protection for ecosystem services. The fragmentation that occurs from scattered protection without connection to other areas with intact ecosystems does not protect natural capital.

The planners even thought that the subdivision stage was too late in the planning process to protect natural capital. If the subdivision plan was in conformance with the zoning ordinances that currently are in effect, little can be done to protect natural capital. One example given was the subdivision of two lots into three as allowed under the town's zoning ordinance. Despite a tree protection ordinance being in effect, the developer had the right to remove three mature trees to obtain the new lot configuration.

Unless part of a larger greenway or green infrastructure plan, natural capital is best protected at the zoning stage, rather than the subdivision/site plan stage of land use planning.

Redevelopment Plans

The *Local Redevelopment and Housing Law*, adopted in 1992, allows the governing body of a municipality to designate a redevelopment *area* and develop a redevelopment *plan*. The redevelopment plan must indicate its relevance to definite local objectives for land use as expressed in the municipality's master plan (Slachekta and Roberts, p.37). To use this tool effectively to protect natural capital, therefore, the municipality must clearly state in the master plan that such protection is an important, public interest goal of the community.

With an adopted redevelopment plan, a municipality has a strong negotiating position with developers, because the plan can specifically identify the parameters of the kind of development it would like to see occur. Municipalities could ensure these parameters include the retention of natural capital and/or the restoration of that which has been lost.

Stormwater Plans

As part of the requirements of the federal *Clean Water Act*, municipalities must prepare stormwater management plans for submission to NJDEP in order to receive stormwater permits for non-point source discharges. Retention of forested lands (including street tree corridors in urban areas) is a key strategy to manage stormwater that will also contribute to retaining the natural capital value in a municipality.

With the publication of DEP's 2007 *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources* report with its maps of New Jersey's natural

capital value, municipalities have the opportunity to consider the dollar value of the implementation of stormwater plans that promote retention of natural features such as wetlands, forests, and stream corridors. These plans, based on green infrastructure, will retain the stormwater and other ecosystem services that municipalities currently receive for free. Avoiding the cost of constructing engineered services to replace nature's services should be high on a municipality's priorities.

Municipal Compacts for Regional Planning

The best level of protecting New Jersey's natural capital would occur at a regional scale that matches the extent of the ecosystem providing the natural capital value. NJ municipalities have some experience with regional planning through compacts with their neighbors. The best example is the Ten Towns Compact, to protect the Great Swamp. Another is the five-town, three-county agreement to protect the Sourlands. Another is the agreements among towns in Somerset County around Bound Brook to mitigate losses due to flooding.

Financial Incentives

Municipalities currently have two underutilized tools available that can help them to avoid the costs of *not* protecting their natural capital: the capital improvement plan and a transfer of development rights plan. These two existing incentives could be used much more widely to protect New Jersey's natural capital.

Capital Improvement Plan – Accounting for Green Infrastructure

The *Municipal Land Use Law* assigns the local integration of private development with public capital improvement programs to municipalities. The Capital Improvement Program (CIP) is a key link between the master plan and actual development in a municipality as it guides the provision of municipal infrastructure.

The CIP is prepared by the Planning Board with a six-year time horizon and is reviewed annually. The first year of the plan is adopted as the municipality's capital budget for that fiscal year and determines what investments in infrastructure (roads, sewers, water, buildings, etc.) the municipality will make that year. (Zorn, p. 4-4)

Natural capital can be thought of as "green" rather than "grey" infrastructure and should be treated as a type of capital. Municipalities could include the maintenance of this green infrastructure in their budgets and recognize the costs avoided by not constructing grey infrastructure to do nature's work. Costs that a municipality would avoid could include, but are not limited to:

- Water purification,
- Flood damage remediation,
- Stormwater management, and
- Erosion remediation.

The Center for Neighborhood Technology in Chicago has developed a *Green Values Stormwater Calculator* that lets towns, developers and

landowners compare the difference in cost between a conventional stormwater approach for a development scenario and one using green infrastructure. (<http://greenvalues.cnt.org/calculator>)

Studies reported in the literature confirm reduced stormwater costs through green infrastructure use, e.g., “for every 10 percent increase in forest cover in the source area, treatment and chemical costs decreased approximately 20 percent; and approximately 50-55 percent of the variation in treatment costs can be explained by the percentage of forest cover in the source area.” (<http://www.miseagrant.umich.edu/claimate/workshop/images/COPING.pdf>)

Many jurisdictions, including the Milwaukee Metropolitan Sewerage District (MMSD), recognize that green infrastructure is an important component of flood prevention. MMSD has budgeted \$15 million to provide 4.7 billion gallons of flood storage from 7,065 acres to prevent the \$300 million previously invested in grey infrastructure from being overwhelmed by development over the next 20 years. The program is known as “Greenseams.” (www.urbanopenspacefoundation.org)

Milwaukee’s “stormwater rule” for 28 municipalities to reduce runoff on all properties greater than 0.5 acres allows residents to disconnect the downspouts from their homes to flow into backyard gardens. Milwaukee has sold 6,150 rain barrels for \$30, planted 50 rain gardens and demonstrated rain gardens, green roofs and wetlands at municipal sites, including the sewer district’s offices. The city has reduced

its stormwater runoff by one-third. (<http://www.gcbl.org/blog/marc-lefkowitz/green-infrastructure-making-the-city-a-sponge>)

The EPA’s 2008 *Action Strategy for Managing Wet Weather With Green Infrastructure*, the Green City Blue Lake Institute in Cleveland, and Sprawlwatch’s *Green Infrastructure Monograph* have reported on the actions of Philadelphia, Portland, Topeka, Seattle and other cities using green infrastructure to reduce stormwater management costs.

Philadelphia is working on a watershed approach to stormwater management and is reported to be introducing legislation that will allow its stormwater agency to start billing customers based on how much impervious cover is on their property.

Topeka has formed a Green Topeka Partnership and is piloting green infrastructure in the Soldier Creek watershed “in place of expensive concrete channels and underground pipes.” (www.sprawlwatch.org/green-infrastructure.pdf)

In Portland’s Green Streets program 45 streets that were determined to be unnecessarily wide will be narrowed with curb bump-outs that double as rain gardens. The project has been tested successfully on three city streets, and will be concentrated in an area of town with a lot of basement flooding (to reduce flooding).

“The initial solution was to dig up the street and put in a sewer,” Marriot says of the Siskiyou green street, which he estimates costs \$500/year to maintain. “We put in a rain garden instead, and it

takes all the stormwater on the street.”
(<http://www.gcbl.org/blog/marc-lefkowitz/green-infrastructure-making-the-city-a-sponge>)

While these cities have taken these green infrastructure actions to reduce costs, reporting on the cost reduction is sporadic. To address this lack of data, the EPA’s Robert Goo is working on a project to document comparisons between grey and green infrastructure costs.
(www.epa.gov/npdes/greeninfrastructure)

The Green Infrastructure Guide produced by West Coast Environmental Law of British Columbia, Canada, reports a number of municipalities in the Vancouver Lower Mainland have monitored the results of implementing green infrastructure plans for stormwater management. “The data collected is proving not just the ecological success of these projects, but also their economic benefits as well.” p.70
(www.wcel.org/wcelpub/2007/14255.pdf).

It is clear from the above examples, that financially prudent municipalities should develop capital improvement plans that account for the maintenance and acquisition of green infrastructure to complement existing grey infrastructure or preclude the need for future grey infrastructure investments (in water filtration, flood control, etc).

Transfer of Development Rights

On March 29, 2004, the *State Transfer of Development Rights (TDR) Act* authorized the transfer of development rights by municipalities. This bill made

New Jersey the first state in the nation to authorize TDR on a statewide level.

The Department of Community Affairs describes transfer of development rights as “a realty transfer system where development potential in a specified preservation area can be purchased by private investors for use in a targeted growth area. In exchange for a cash payment, landowners in the preservation area place a restrictive easement on the property that will maintain the resource into perpetuity. The land in the designated receiving area can then be developed at a higher density than allowed under the baseline zoning.”

TDR was developed to facilitate sound land use planning by compensating landowners for the development rights to their properties in cases where actual development of those properties would harm public goals such as protection of farmland or ecosystems.

Municipalities that develop a TDR plan can, therefore, reduce the consumption of natural capital, while still accommodating growth, and eliminate the "windfalls and wipeouts" in property values that can be associated with zoning changes.

However, less than a dozen municipalities are currently in the process of developing TDR plans, as the process is still new. It is costly to municipalities to use, requires lead time for public consultation, and is likely to be controversial. In addition, it is generally easier in New Jersey today to find areas in a municipality willing to send growth out, but fewer areas are willing to receive the growth. In spite of these concerns, Salem

County is exploring the concept of a countywide TDR plan for its municipalities to participate in.

Preservation and Restoration

Much of the research on determining the amount of habitat needed to protect species and on how corridors can be designed to effectively connect habitat hubs is also applicable to natural capital protection.

New Jersey has some useful resources that municipalities can tap to preserve natural capital. New Jersey also has considerable expertise in brownfield remediation that can be used to restore lost natural capital.

Greenway Plans

The NJ Conservation Foundation has developed the *Garden State Greenways* project to help preserve New Jersey's biodiversity by connecting important habitat areas. The project identifies *hubs* - larger areas of undeveloped land with important natural resource values - and *linear connectors* between these hubs.

Garden State Greenways provides a statewide vision and suggested goals for conservation. It also provides detailed maps of undeveloped lands and potential connectors through powerful Geographic Information System (GIS) data and planning tools.

Municipalities can use the *Greenways* data base and maps, together with the maps from DEP's 2007 *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources* to help

them prioritize their open space planning to protect natural capital.

Habitat Conservation Plans

The NJDEP *New Jersey Wildlife Action Plan* has as one of its goals the development of habitat management plans "that enhance habitat for species of conservation concern and maintain or improve the ecological integrity of the natural community." Several habitat conservation plans have been undertaken in New Jersey.

The Sourland Mountain Plan

Initial data gathering for the five township (West Amwell, East Amwell, Hopewell, Hillsborough and Montgomery), three county (Mercer, Somerset, Hunterdon) Sourlands region was completed in 2006 with an initial grant from the Office of Smart Growth. A visioning process was undertaken in the fall of 2007 with additional funding from OSG. Work is ongoing to create a management plan for the region.

Raritan Piedmont Grassland Conservation Plan

The Raritan Piedmont Wildlife Habitat Partnership, made up of 15 towns in Somerset and Hunterdon Counties, is another example of habitat planning. NJ Audubon Society wrote the conservation plan for the project and is currently working with a broad coalition of partners that includes the New Jersey Conservation Foundation, Conservation Resources, D & R Greenway, Duke Farms, and the New Jersey Endangered and Nongame Species Program to implement the conservation plan.

Municipalities in other parts of the state can draw on these experiences to develop plans for their regions to enhance the preservation of natural capital.

Restoration Plans

The City of Davis, California and the US Army Corps of Engineers recently undertook a Wetlands Restoration Project that created 400 acres of wetlands to receive the city's stormwater and treated wastewater before discharging it into the Sacramento river. (Beatley, p. 15).

New Jersey's capital, the City of Trenton, is also currently working with the Army Corps of Engineers to restore a greenway along the Assunpink River, which was first designed by Frederick Law Olmstead over 100 years ago. The greenway plan will remediate channeling along the river and "daylight" it within the city's downtown, as well as creating a new park in an area of the city with limited open space.

Brownfield Plans

Brownfield plans are developed to mitigate contaminated sites and return them to productive use. Brownfield remediation can provide the opportunity to restore lost natural capital either through re-introducing native species as part of the landscaping for a brownfield mitigation redevelopment project or by returning the brownfield entirely to a greenfield.

The Brownfields to Greenfields position paper published by NY/NJ

Baykeeper provides municipalities with suggestions for pursuing this option. The report cites "the iPort 12 in Carteret as an extraordinary possibility for good greenfields redevelopment. This old industrial complex - covering 250 acres - is now a feeding ground for yellow crown and black crown night herons. And it has potential to be a breeding ground for these endangered species as well."

Many municipalities have worked with NJDEP to remediate single sites or through the NJDEP's Brownfields Development Area (BDA) program, have received assistance in designing and implementing remediation and reuse plans for multiple properties simultaneously. New Jersey still has many brownfield sites requiring remediation and consideration of natural capital restoration should be included in relevant areas.

Education

Municipalities undertake a wide variety of education and outreach activities for their residents. Many of these programs could be expanded or modified to highlight natural capital values in the municipality and grants available to land owners for protection of the natural resources that generate the natural capital values.

Stormwater Education

Municipalities are currently required by law as part of their NJPDES stormwater permits to undertake public education about ways to protect stormwater quality. This education largely takes the form of fliers or one

day events as well as identifying storm drains that flow to rivers.

Information from the *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources* report on the value of the natural capital in a municipality, specifically its wetlands and forests for stormwater management, could be incorporated into the current municipal stormwater education program. For example, municipalities could identify the water purification benefits that wetlands and forests provide, such as water filtration and flood reduction.

Environmental Commissions

Most towns in New Jersey have Environmental Commissions that advise Planning Boards on natural resource protection issues. The Association of Environmental Commissions (ANJEC) sometimes has foundation funding that allows them to give out small grants to municipalities with Environmental Commissions to support their documentation of their natural resources in a Natural Resource Inventory or otherwise undertake projects to protect natural resources.

The natural capital maps and information available from NJDEP should be included in the information provided by a Natural Resource Inventory. Understanding the value of a municipality's natural capital is important so that the Planning Board can make appropriate and fiscally responsible decisions about how its natural capital should be retained to avoid the costs associated with replacing its services in the future.

In addition, municipalities could seek funding from ANJEC to determine *how* their natural capital can be protected.

Some counties (such as Hunterdon, Monmouth, etc.) have brought municipal Environmental Commissions and other environmental organizations together to form "Greentables," where environmental issues that cross municipal boundaries are discussed. These forums would be useful venues for presenting information on natural capital.

Awareness Day

Natural capital is a new concept and will need promoting for the public to become aware of it and appreciate its importance to their tax base and their quality of life. Municipalities could pass a resolution designating an Awareness Day on natural capital where they could host a presentation on natural capital or make literature on the topic available to the public (from NJDEP or organizations such as the Ecological Society of America).

Municipalities can also contact any of the non-profit groups that can be found in NJ that promote natural resource conservation, preservation and environmental planning. All of these groups are willing to work with towns to raise awareness and protect their environments.

NJ Environmental Lobby maintains a list of such environmental organizations. (See <http://www.njenvironment.org/environmentallinksall>).

II. New Municipal Approaches to Protect and Enhance New Jersey's Natural Capital

Although natural capital is a new concept in New Jersey, innovative approaches to protecting natural capital have been developed in other parts of the United States. Ecosystem Service Districts and carbon sequestration plans directly address the value of various types of natural capital while other innovations in land use planning such as form-based codes could be adapted to protect natural capital.

Land Use Legislation and Regulation

The suggestions below arose from the roundtables held for this project. Most of the suggestions could be implemented under existing legislation and regulation. Some represent new institutional approaches beyond the land use practices that are currently undertaken by municipalities in New Jersey.

Form-Based Codes

While New Jersey's municipal Master Plans are required to be updated every six years, in practice the update can be extended with a simple resolution. The planners who participated in the roundtables for this project, therefore, expressed concern that inclusion in the Land Use Element of a municipal Master Plan may not be the quickest or most effective way to implement the protection of natural capital.

They suggested investigating the possibility of using form-based codes to protect natural capital value. While these codes have been used elsewhere in the U.S. to replace traditional zoning, they are new to New Jersey.

Form-based codes re-examine the underlying zoning principle of separating uses. Rather than focusing on delineating permitted uses on individual lots, form-based codes specifically address the context (or form) that buildings and the environment create.

The Form-Based Codes Institute describes these codes as primarily addressing the relationship of buildings to the streetscape and the buildings while addressing land uses secondarily.

The Congress for New Urbanism (CNU) promotes form-based codes. They state that a well-written form-based code can insure the agreed upon community vision is what actually gets built. The terms core, center, general, and edge are used to describe the form of development and natural landscape areas to be designed.

The term Smart Code is also used in connection with form-based codes. According to its inventors, Duany Plater-Zyberk and Company (DPZ), as a form-based code, the Smart Code was designed to keep towns compact and rural lands open, while reforming the destructive sprawl-producing patterns of separated-use zoning. DPZ's Smart Code is based on a "transect" concept that moves from T1 – natural lands to T6 - highly built-up, mixed-use cores.

Within the Smart Code, Regional Scale Plans are first developed from combinations of seven sector types (such as Reserved Open Sector, Controlled Growth Sector, etc.). Community Scale Plans for the Growth Sectors are then selected from new or infill community Unit Types (such as CLD – Clustered Land Development, TND – Traditional Neighborhood Development, etc.) to define the streetscape. Building Scale Plans are then selected describing building disposition, configuration, parking location, etc. (DPZ, p. SC3, SC9) The resulting code is described with detailed graphics as well as text and requires little review of new development applications as long as they conform to the code.

The CNU has a New Jersey chapter (www.cnu.org/newjersey) as well as chapters in Philadelphia and New York City. Towns interested in learning more about form-based codes can contact the CNU or the chapter nearest to them. Although the *Municipal Land Use Law* does not mention form-based codes, some planners believe form-based codes can be undertaken in New Jersey without changing the *Municipal Land Use Law* to include a specific provision for form-based codes. The Township of Brick is reportedly working on a form-based code.

Plant Stewardship Index

The Plant Stewardship Index (PSI) is a standardized assessment tool currently used by the D & R Greenway and others to establish priorities for preservation. The tool allows users to survey and assess the status of the native plant populations on a site. Adapted from the 25 year-old Floristic

Quality Assessment Index developed in Michigan, the PSI assigns relative values to every plant within an area and calculates an overall PSI value for each area.

Delaware Township in Hunterdon County is developing a Woodlands Protection Ordinance using the PSI as its basis. Under the ordinance, Priority Woodlands would be designated as critical and/or sensitive natural areas that should be managed for maintaining indigenous biodiversity in the Township and would be protected by easement.

The easement on Priority Woodlands would prohibit removing any native vegetation except where safety is an issue. The ordinance criteria are based on total area of forest clearance per application rather than a fixed percentage per lot. Under no circumstances would total forest clearance be allowed to exceed more than one acre per lot, including roads and utilities.

Forest quality would be determined on a site-by-site basis using the Plant Stewardship Index for New Jersey that ranks landscapes by their level of naturalness and the extent to which they support species more sensitive to disturbance. Other criteria for Priority Woodlands include steep slopes and riparian forests, designated viewsheds and NJ Landscape Project rankings of 3 or over. (Delaware Township, n.p.).

The Bowman's Hill Wildflower Preserve maintains a database of plants for New Jersey and the Piedmont Region of Pennsylvania available to the public. The participants in this project's

Environmental Roundtable recommended that municipalities make the Plant Stewardship Index a mandatory requirement of the site plan checklist. In turn, the information gathered as part of the site plan approval process would be downloaded to the PSI database to increase information about the biodiversity and natural capital of New Jersey.

Conservation Zoning

Conservation zoning is used in a number of states to prevent or mitigate impacts on specific resources. Examples of resources to be protected include: large tracts of forest, blocks of contiguous farmland, areas characterized by fragile environmental features, etc.

Randall Arendt, landscape planner and former University of Massachusetts professor of Landscape Architecture and Regional Planning, is currently a Senior Advisor to the National Lands Trust located in Media, Pennsylvania.

According to the website, <http://www.greenerprospects.com/bio.html>, "His conservation subdivisions built in twenty one states are considered "twice green because they succeed both economically and environmentally. In Tennessee, his re-design saved one developer approximately \$212,000 in street construction costs, while at the same time introducing significantly more quality open space into the layout. By respecting natural terrain and designing around existing site features on an 80-lot development in Texas, he recently cut grading costs by 83%, or one quarter-million dollars (from \$300,000 to \$50,000). Another

design is credited by an Indiana developer as having added \$20,000 to \$25,000 of value to each of his 40 lots (an added value of \$800,000 to \$1m), while still providing for full development density."

Arendt has promoted conservation zoning since the mid-1990s successfully in Pennsylvania, New England, Virginia and Washington state. He advocates strong incentives such as those used in Clallam County, Washington. "The County revised its zoning from a density of one unit per five acres (which was creating non-functional "farmettes") to a minimum of thirty acres. However, the original one unit per five acres density remains available if the houselots are downsized and clustered so as not to consume more than fifteen to twenty percent of the parcel." (Arendt, p.1)

While some towns in NJ have densities as low as one unit per ten acres, towns outside of the Pinelands have not yet implemented true conservation zoning as has been implemented in nearby states.

In Vermont, "Resource Conservation Districts in Vermont include forest districts and agricultural districts which only allow residential development at densities of one unit per 25-50 acres." (www.smartgrowthvermont.org)

Closer to New Jersey, in Lancaster County, Pennsylvania, thirty nine of forty one townships have adopted various forms of agricultural zoning ordinances to keep development away from areas best suited for agricultural uses. At this time, approximately 320,000 acres are zoned for

agriculture and roughly 276,000 are considered to be “effective agricultural zoning”, allowing less than or equal to 1 housing unit per 20 acres. (County of Lancaster, p. 1).

Members of the environmental roundtable convened for this project recommended that New Jersey municipalities adopt conservation zoning, allowed under the *Municipal Land Use Law*, to protect natural capital, where the basis for the downzoning is not arbitrary or capricious and some value is left to the landowner. Other tools such as Transfer of Development Rights, farmland preservation, etc., can be used with this approach.

Targets

Master Plans traditionally have goal statements that “balance land uses”. To more effectively protect natural capital, however, master plans could establish specific targets in the Land Use Element to spell out protection for natural capital. One of the goals in the Comprehensive Plan for Albermarle County, Virginia, for example, is to “sustain the ecological integrity required for important ecological services.” (Bowler and Hirschmann, p. 13)

The Albermarle County Master Plan divides the county into designated development areas (5% of the county or 35 square miles) and rural areas (95% of the county or 695 square miles) and requires a Biodiversity Assessment and Action Plan as part of the Master Plan.

The Biodiversity Action Plan will “sustain the landscape states and

ecological integrity required for important ecological services and healthy populations of native plants and animals.” (www.albermarle.org)

Specific ecosystem service targets proposed by the Albermarle County Department of Engineering and Public Works include: miles of streams with buffers, percent forest canopy, and percent effective impervious cover. (Bowler and Hirschmann, p. 13)

Financial Incentives

Federal and state policies have created opportunities for compensation for those who protect natural capital.

Ecosystem Service Districts and Trading of Credits

The existence of the services provided by ecosystems is often taken for granted. However, as the list below demonstrates, these services are the foundation of all life and wealth on the planet. Ecosystem services include:

- water supply,
- purification of air and water,
- food production,
- mitigation of floods and droughts,
- detoxification and decomposition of wastes,
- generation of soil,
- nutrient cycling for fertility,
- pollination of crops and natural vegetation,
- control of the vast majority of potential agricultural pests,
- dispersal of seeds and translocation of nutrients,

- genetic resources of crop varieties, medicines,
- habitat for resident and transient populations
- sources of raw materials for industrial enterprise,
- protection from the sun's harmful ultraviolet rays,
- partial stabilization of climate,
- moderation of temperature extremes and the force of wind and waves,
- support of diverse human cultures,
- erosion control,
- provision of aesthetic beauty and intellectual stimulation that lift the human spirit,
- recreation opportunities, and
- sequestration of atmospheric carbon.

(Costanza *et al*, p. 254,
www.albermarlecounty.org)

However, the loss of many natural areas has led to widespread reductions in ecosystem services, as is documented in *The Millennium Ecosystem Assessment* (MA). This assessment began in 2001 and was conducted under the auspices of the United Nations. The MA found that human activities have caused declines in twenty of twenty-four services examined. In addition, degradation of ecosystems services could grow significantly worse during the first half of this century.

Until very recently there were few financial incentives for municipal or private landowners to maintain forests or other kinds of natural capital on their property. Instead, developing those properties in ways that damage

or eliminate ecosystem services can produce large financial returns (for example by over-harvesting trees or fish).

However, new markets are developing for ecosystem services and have given rise to Ecosystem Service Districts to supply these new markets. Ecosystem Service Districts are a mechanism for delineating geographic locations of certain types of tradable natural capital.

Trading of credits is a market-based program that provides incentives for entities to create credits by going beyond statutory or regulatory goals. The credits then can be traded to others to help them meet their obligations.

In Colton, San Bernardino County, California, habitat for the endangered Delhi Sands Flower-loving fly was determined to be worth \$150,000 an acre. If fly habitat was destroyed, an off-set was required to protect habitat for the fly elsewhere. Following this determination, a company acquired a large portion of fly habitat and sold credits to developers based on the amount of habitat preserved. As well as the Delhi Sand Fly, over seventy species specific conservation banks exist in the US that have turned what was perceived as a potential liability into an asset. (Bayon, pgs. 2, 3) Municipalities in New Jersey could undertake similar projects if the municipalities contain endangered species or other natural capital attributes for which markets have been established.

While no Ecosystem Service Districts have been established in New Jersey yet, New Jersey is participating in two

“cap and trade” programs – a phosphorus trading program and a carbon trading program.

Municipalities that undertake sound land use planning to maintain and enhance the ecosystem services provided by their natural capital, may then be able to obtain revenue from their natural capital if desired as they will have ecosystem capacity to trade (for a fee) to those who do not have the capacity they desire.

For example, most of the 19 sewage treatment plants in the non-tidal Passaic River watershed will need to invest heavily in upgraded equipment to comply with a new phosphorus standard. A trading project was proposed as a cost effective alternative to meeting the phosphorus effluent standard.

The EPA funded development of the trading program running from 2005 through 2008. The NJ League of Municipalities was a stakeholder in this project. A symposium was held in July 2008 summarizing the trading framework developed by the project. More information on the program is available from Rutgers University: www.water.rutgers.edu/Projects/trading/Passaic.htm.

In Ohio, the Miami Conservancy District (MCD) implements the Great Miami River water quality trading program. A research project is underway to determine if the MCD can develop into an Ecosystem Service District. The focus will be on MCD’s role in a water quality trading program and how the involvement of MCD in this trading program transforms the organization’s work, particularly in the

areas of natural flow restoration and protection.

Lessons learned from the MCD may be useful for determining if and how the Passaic trading project could evolve into an Ecosystem Services District.

In Pennsylvania, Red Barn Trading Co. has executed the first nutrient credit sale established to clean up the state’s rivers and streams and help Pennsylvania meet its federal obligations to improve water quality in the Chesapeake Bay.

In September 2007, the PA Department of Environmental Protection introduced a nutrient and sediment trading policy that offers farmers, communities and industries another tool to help them meet, or exceed, state and federal water quality goals.

Red Barn works with its agricultural client base to identify farm improvements that generate credits, and then pools credits for buyers. Red Barn holds the majority of available PA DEP-certified credits and has applications for more than 100,000 more credits pending before the department. (Environmental Trading Network).

As state and federal governments develop cap and trade policies, municipalities should begin to see the benefit of creating Ecosystem Service Districts within their communities.

Property Tax Reduction

It would be worth exploring to determine if municipalities could give abatements to tax payers for preserving

natural capital on their properties. The abatement would reflect the contribution of the green infrastructure role of natural capital in managing stormwater, etc. that the municipality would otherwise have to pay for through the construction of grey infrastructure.

Preservation and Restoration

Most municipalities in New Jersey have developed open space plans and many have developed agricultural protection plans. One resource that has not specifically been planned for is forest protection. With the state's development of a Greenhouse Gas Reduction Plan, municipalities should take a new look at their existing land protection plans to determine how they can be augmented to contribute to greenhouse gas reductions. Forest retention and afforestation will play an important role in reducing greenhouse gases through carbon sequestration and meeting the state's draft goal of increasing carbon sequestration by one percent.

Carbon Sequestration Plan

Concerns about the impacts of global warming have prompted New Jersey mayors to take steps to mitigate greenhouse gas emissions. Mayors have joined the Cool Cities campaign, formed a Mayors' Green Committee of the League of Municipalities, pursued Green Building ordinances, etc.

One untapped area of action for municipalities to pursue is identifying those ecosystems in a community that provide the greatest opportunity for carbon sequestration.

According to the US Department of Energy, carbon sequestration is one of the most promising ways for reducing the buildup of greenhouse gases in the atmosphere. Even under the most optimistic scenarios for energy efficiency gains and the greater use of low- or no-carbon fuels, sequestration will likely be essential to stabilize atmospheric concentrations of greenhouse gases at acceptable levels.

Carbon sequestration removes atmospheric carbon and stores it in plants, their roots and in soil:

- “Forest land sequestration includes below-ground carbon and long-term management and utilization of standing stocks, understory, ground cover, and litter.
- Agricultural land sequestration includes crop lands, grasslands, and range lands, with emphasis on increasing long-lived soil carbon.
- Biomass cropland sequestration is a complement to ongoing efforts related to biofuels, with the focus on long-term increases in soil carbon and value-added organic products.”
(www.fossil.energy.gov/programs/sequestration/terrestrial/)

Enhancing the natural processes that remove carbon dioxide from the atmosphere is thought to be one of the most cost-effective means of reducing atmospheric levels of carbon dioxide.

Municipalities may be able to realize monetary value for undertaking land use planning that promotes carbon

sequestration. For example, New Jersey's Regional Greenhouse Gas Initiative (RGGI) Auction rule targets electric generating stations greater than 25 megawatts. It has established a framework for New Jersey companies to participate in a cap and trade program for carbon dioxide emission allowances with other northeast states, thus providing a potential market for New Jersey carbon sequestration activities.

In addition, the Chicago Climate Exchange (CCX), launched in 2003, is the world's first and North America's oldest active voluntary, legally binding integrated trading system to reduce emissions of all six major greenhouse gases (GHGs), with offset projects worldwide.

The commodity traded at CCX is the CFI contract, each of which represents 100 metric tons of CO₂ equivalent. CFI contracts are comprised of Exchange Allowances and Exchange Offsets. Exchange Allowances are issued to emitting members in accordance with their emission baseline and the CCX Emission Reduction Schedule. Exchange Offsets are generated by qualifying offset projects.

www.chicagoclimatex.com/content.jsf?id=821).

Offset projects for carbon sequestration such as forest planting, forest retention, agricultural land retention, etc. would be worth investigating by municipalities in order to accrue carbon credits that could be traded for revenue through the RGGI or Chicago Exchange or other trading programs.

Soil Conservation District officers offer the ability to assist municipalities in developing agricultural/soil based carbon sequestration plans.

Education

Biodiversity Heritage

To develop an understanding of the value of natural capital, towns could initiate celebrations of biodiversity and their natural capital heritage in conjunction with other types of existing heritage day celebrations.

Information about federal Safe Harbor Agreements for protecting endangered species could be made available at these events to encourage landowners to consider protecting the habitat required for any endangered species in the area. Under the Safe Harbor Agreements, land owners are shielded from prosecution under the federal *Endangered Species Act* and may be compensated for providing conservation easements on their properties.

A "thermometer" similar to the United Way fundraising thermometer could be displayed at the Municipal Hall representing the value of the town's natural capital as determined yearly by the amount of development that destroyed natural capital and/or the amount of restoration that re-created natural capital. This could be a monitoring tool to let residents know whether their natural capital is increasing or decreasing.

III. State Initiatives to Protect and Enhance Natural Capital

As natural capital is a recently developed concept, the existing regulatory and policy framework of the state of New Jersey was not designed with protection of natural capital value as a focus. Therefore, a strategy needs to be developed to coordinate the state's actions. While a number of current programs can be used to facilitate natural capital protection, others will need to be amended to remove barriers to natural capital protection and new programs will need to be developed to support the state's new Greenhouse Gas initiatives, Water Supply plan, etc.

A State Strategy to Secure New Jersey's Natural Capital

A statewide strategy is necessary to ensure New Jersey's natural capital remains available to the state and is not lost to degradation, fragmentation or unsustainable activities. The strategy should include:

- establishing priorities for natural capital protection,
- incentives or mandates for local governments and landowners to maintain natural capital, and
- new data gathering to monitor the quantity and quality of the state's natural capital.

Priorities for Protection

New Jersey currently has legislation that provides limits to wetland development and water quality degradation. However, forested land

lacks a comparable level of protection. Forested land has been dramatically affected by conversion to urban land in New Jersey with 285,069 acres lost between 1972 and 2001.

(<http://www.nj.gov/dep/dsr/landuse/landuse00-01.pdf>). Wetlands and water quality have also continued to be affected by development despite current legislation.

Therefore, to secure New Jersey's natural capital, the state must revisit its current approach to managing land use. Just as the New Jersey Department of Transportation outlines a ten year transportation infrastructure capital plan, the state should outline a natural capital infrastructure plan to ensure New Jersey's natural capital is available to meet the state's intentions: to grow its carbon sequestration capacity to 8% from 7%; to make its waterways fishable, swimmable and drinkable; and to meet federal air pollution standards.

Forestry protection through land use planning and tradable permits has been undertaken successfully in Oregon and other states and should be a priority for New Jersey's natural capital protection strategy. Strong incentives and disincentives limiting where residential development can occur will need to be created to secure New Jersey's capital.

Reporting – A Green State Budget

The calculation of a Green Gross Domestic Product (GDP), or integrated environmental and economic accounting, has been undertaken by the United Nations, International Monetary Fund, World Bank and countries ranging from Norway to

China to the Philippines. In the United States in 1999, the US National Academy of Science released *Nature's Numbers: Expanding the National Economic Accounts to Include the Environment*. That report recommended adding environmental accounting as a "satellite report" to the existing system of national accounts.

The United Nation's Green Accounting Virtual Resource Center (http://www.unep.ch/etb/areas/VRC_index.php) provides a wide range of manuals, handbooks and technical reports on green accounting activities around the world including in the United States.

According to a *Resources for the Future* article, green accounting ranges from: natural resource accounts covering stocks of natural resources; to emissions accounting; the disaggregation of conventional national accounts; to implementing a Green GDP where natural resource depletion costs and environmental degradation costs are subtracted from economic development output. (www.rff.org/rff/Documents/RFF-Resources-135-enviroaccount.pdf)

Two recent reports call for Canada to go beyond its current efforts in green accounting. Statistics Canada currently tracks some natural capital stocks as well as pollution impacts but the Green Budget Coalition's *Meeting the Challenge: Recommendations for Budget 2009 Climate Water Nature* and The Nature Conservancy/Ducks Unlimited's *The Value of Natural Capital in Settled Areas of Canada* call on the government to implement ecological fiscal reform reflected in a Green GDP.

An accounting of New Jersey's natural capital in the State Budget would send a strong message that natural capital is an important asset. Just as New Jersey's "green" pension fund investments are assessed on their performance, and the state's grey infrastructure is assessed on its fitness or obsolescence, the state of New Jersey's "green infrastructure" or natural capital should be monitored and managed for highest returns on investment.

Legislation

Municipal Land Use Law

The planners who were interviewed for this project as well as those that participated in the roundtables were unanimous in their assertion that natural capital would not be protected if left to the Subdivision and Site Plan stage of land use planning as currently delineated under the *Municipal Land Use Law (MLUL)*.

The *MLUL* was described as defining conditions under which development could occur without providing a corresponding promotion of conditions under which conservation could occur. In essence, conventional zoning is a blueprint for development alone.

Zoning separates incompatible uses and establishes standards (such as minimum setbacks, pavement thickness, culvert diameters, etc.), but does not set standards for the quantity, quality and configuration of open space to be preserved.

Conventional zoning assigns a development designation to every acre of land, generally residential, commercial, or industrial. The only lands not designated for development are wetlands, some floodplains or steep slopes. Each development parcel is converted to front yards, back yards, streets, sidewalks, or driveways.

The *MLUL* does not provide for compulsory open space zoning - a technique used by a number of municipalities in New England and the Mid-Atlantic states and elsewhere. Open space zoning allows the same overall amount of development that is already permitted but new construction can only be located on a portion -- typically half -- of the parcel. The remaining open space is permanently protected under a conservation easement co-signed by a local conservation commission or land trust, and recorded in the registry of deeds.

Under the *MLUL* the development process is very strictly defined with review and approval based on specific criteria being met. If proposals meet the specified criteria (such as building envelope, set backs, parking spaces, etc.) and receive permit approvals (from NJDEP) the Planning Board cannot deny approval of a proposal.

One example given referred to a tree protection ordinance and the subdivision of two lots into three. The Planning Board could not refuse the subdivision application even though there were a number of very old, large trees on the site and the municipality had a tree protection ordinance.

The planners suggested that changes to the *MLUL* to define conditions that would permit both development and conservation be pursued, specifically around zoning changes.

Transfer of Development Rights Act

Changes are currently being proposed to the state's Transfer of Development Rights program by the State Agriculture and Development Committee (SADC). NJDEP should ensure that these changes do not restrict and are sufficient to promote TDR for natural capital protection.

Additional effort is needed to increase the ease of pursuing TDR in New Jersey. In other jurisdictions, "such as the successful TDR program in Montgomery County, Maryland, the development rights can be bought and sold through the existing real estate system, where realtors earn commissions on the transactions and thus have an incentive for publicizing the program." The Maryland program has strong land use controls that stimulate demand. Another alternative to stimulate demand, is for "governments to consider mandating that large developers acquire a minimal number of permits for all projects. This would be similar to the EPA's initial requirement that all large firms participate at a minimal level in the SO₂ marketable permit program." (<http://ag.udel.edu/frec/faculty/Research%20-%20Messer/TDR%20Programs%20-%20An%20Economic%20Framework%20for%20Success,%20JCP%20Messer%202007.pdf>)

Farmland Assessment Act

To protect natural capital, the state should consider extending the roll back of the tax abatement on farmland for greater than three years if it is sold for development. A ten year roll back was suggested.

Soil Conservation District officers also have suggestions for changing farmland assessment to be decoupled from agricultural production alone to include implementation of natural capital protection Best Management Practices.

Regulation

State Access Code

The State Access Code governs the location and number of access points to state highways. The Access Code is currently being revised and could be a powerful tool for limiting development in areas with high natural capital as development cannot occur without road access.

Stormwater Permits

Both the Environmental and the Planners' roundtables suggested that the state should develop a mechanism within the stormwater permits to recognize a municipality's work to retain forests as a Best Management Practice.

Threatened and Endangered Species Protection

The Environment Roundtable suggested that targets be set for natural capital e.g., "x% of ecosystem services of high value must be preserved" and that municipalities would then be

encouraged to meet this goal through incentives or penalties that are likely to be developed as part of new Threatened and Endangered Species regulations.

Public Trust Doctrine and a Legal Shield

The Public Trust Doctrine holds that certain resources are so valuable to humanity that they must be held "in trust" for the common good and not be allowed to be privately owned. Drinking water is one such resource that the United Nations is seeking to ratify as something that should not be sold between countries. Development in the Mono Lakes in California was recently defeated on the basis of the Public Trust doctrine.

The Roundtables for this project suggested that the State should consider the threshold at which natural capital has Public Trust value. The roundtables both agreed that a large intact forest provides more value than any one landowner's two acres of forest.

In keeping with the idea that natural capital value is a Public Trust, it was suggested that the state provide a legal shield to a municipality that wanted to protect its natural capital value in accordance with State standards.

Forest Mitigation

While forest protection and mitigation plans have been proposed for the Highlands, roundtable participants suggested New Jersey should develop mitigation requirements for forests that are as strict as those that exist for wetlands. In Maryland, the *Forest*

Conservation Act of 1991 requires retention, reforestation, or afforestation of specified amounts of forested land onsite or, if necessary, offsite when land is developed. The *Chesapeake Bay Critical Area Act* (COMAR 27.01.02.04) requires mitigation of up to 3:1 for trees cleared without conformance.

Build-out

The Roundtables for this project also suggested the state agree on a uniform formula for build-out so that the build-out requirements now in stormwater, wastewater, affordable housing and transportation regulations and programs, etc., could be aligned and used to find better ways to preserve natural capital more effectively.

A consistent understanding of the amount and type of growth the state would face if land were to be built as zoned is necessary to assess whether zoning will produce desired state and regional goals. If not, the State can then make changes to achieve the desired outcome before opportunities are lost.

Plan Endorsement

In addition, it was suggested that the State Plan Endorsement process require towns to agree within a region to create plans to protect their natural capital as part of their application to the Office of Smart Growth.

New Jersey will run out of open, developable land sooner than any other state in the country – as soon as 50 years, according to some analyses.

New planning tools and strategies are

being developed that could be used in the Endorsement process to change the current system that encourages building primarily on greenfields to building primarily where there is already development – in both urban, suburban and rural locations. While center-based development has always been the goal of the State Plan, it has not been successful in its implementation.

Instead, using natural capital as an example, State agencies could set performance measures and monitoring standards for regional systems, allowing these to become the parameters to measure local planning initiatives to meet Endorsement.

Since conditions across the state vary, however, statewide targets should not be applied uniformly to each region. A means to describe the differences in a Land Use Score - a geographic assessment of conditions on the ground – could be produced (see www.plansmartnj.org 2008 *Land Use Reform: Improving Conditions on the Ground.*)

The process by which towns could come to regional agreements has been proposed in NJDOT's Central Jersey Transportation Forum as a Regional Action Planning Process, or a RAP. It was designed to integrate the various decisions and coordinate the actions of many players, to reach the shared, statewide goals and regional targets.

When the public meetings take place, the focus is on whether or not the issues have been effectively identified, whether the targets are appropriate and what actions each municipality will take that – together – may meet the

targets. The RAP process includes an assessment of whether the agreements are likely to meet the targets or not before a final Regional Action Plan (RAP) can be approved.

Brownfields

Finally, the state should review the obstacles to brownfields to greenfields development identified by the NY/NJ Baykeeper report, *Brownfields to Greenfields*, and determine how the obstacles can be addressed to encourage the restoration of natural capital value on appropriate sites.

Financial Incentives

New Jersey has demonstrated its ability for innovative financial incentives for energy efficiency and greenhouse gas mitigation with its renewable energy credits and its “green” pension fund investments. This innovative posture could be extended to protection of natural capital value as well through credits and tax base sharing.

Carbon Credits

The state has developed a framework for carbon trading as part of the northeast US Regional Greenhouse Gas Initiative (RGGI). Carbon credits could be very useful in protecting New Jersey’s natural capital. However, care should be taken to ensure that retaining existing natural capital is rewarded as well as the creation of new natural capital assets. There are reports in the literature that forests have been cut down and new trees planted when incentives for *tree planting* were implemented, but

incentives for *retention of trees* were not implemented. Clearly cutting down forests would be counter-productive to natural capital protection.

Smart Future Planning Grants

It was also suggested that funding by the Department of Community Affairs’ could be tailored to encourage towns to include the value of natural capital in Master Plan revisions or to develop natural capital audits. These audits would go beyond Natural Resource Inventories by assessing the monetary value the town receives from nature’s services, as outlined in NJDEP’s 2007 report. This monetary value would reflect the cost that is currently being avoided by the town by not having to construct detention basins, water filtration plants, or to repair flood damage, etc.

Tax Credits

In Vermont, landowners pay reduced property taxes for maintaining natural resources on their properties. However, the Vermont tax credit is not paid out in cash but is placed in a trust. When sufficient funds are accumulated, a preservation easement can then be purchased either for farmland or woodland protection.

While New Jersey currently provides a tax credit for woodland management, harvesting of timber *must* occur to receive the credit. This requirement should be amended to retain capital, not destroy it.

Tax-Base Sharing

In the New Jersey Meadowlands Plan, the State already has a model for tax-base sharing designed to protect natural capital (in this case, wetlands). The fourteen municipalities that make up the Meadowlands share the revenue generated by development in the municipalities where development is permitted, compensating the municipalities that do not develop their lands in order to protect the wetlands present.

Tax-base sharing can end the destructive, sprawl-inducing process of ratable chasing (luring commercial or industrial development to a municipality to obtain the taxes while preventing workforce housing from being built). Significant research on and promotion of tax-base sharing statewide has been undertaken by the New Jersey Regional Coalition showing that a majority of New Jersey residents would benefit as would the natural environment.
(www.njregionalequity.org/)

The NJDEP and Office of Smart Growth should build on this work to pilot additional tax-base sharing areas beyond the Meadowlands, based on natural capital protection priorities.

State Aid

The State could prioritize all its municipal grants (DOT Municipal Aid, Historic Preservation, etc.) based on whether towns had developed natural capital action plans that were being implemented.

Preservation and Restoration

Grants

The Roundtables for this project recommended that the two NJDEP funded programs that exist specifically to protect habitat be continued and expanded if possible. The Landowner Incentive Program (LIP) is designed to “implement important and creative management activities on private property on a cost share basis for the benefit of endangered or threatened species”.

The Wildlife Habitat Incentives Program (WHIP) is “a voluntary program that provides technical and financial assistance to landowners to create, enhance or maintain wildlife habitat on their lands”.

The roundtables also suggested that NJDEP Green Acres funding criteria should be modified to reflect natural capital priorities within a clear multi-year acquisition plan that does not respond reactively to development pressures.

NJDEP currently has a grant and loan page for environmental protection at (<http://www.state.nj.us/dep/grantandloanprograms/>) which could link to other sources of funding for environmental protection such as NJ’s Smart Growth Gateway. The Gateway identifies federal, state and private funding sources for smart Growth and Environmental plans at:
<http://www.smartgrowthgateway.org/fiancing.shtml>.

Wildlife Conservation Planner or Watershed Planners

Attachment D of the NJDEP *Wildlife Action Plan 1/23/08* contains a goal to,

“create a staff internally to provide technical support to NJ counties and municipalities to develop wildlife conservation planning... within the next ten years...”

This type of champion who can assist municipalities will be crucial in achieving natural capital protection and should be accelerated to be created as soon as possible. The Planners’ roundtable and interviewees were united in their belief that municipal planners have no spare capacity and can barely keep up with day to day work and would therefore be in a poor position to internalize and effectively achieve natural capital protection on their own.

NJDEP could also look at its watershed function and determine if natural capital outreach could be incorporated into watershed staff’s delivery of services.

With the Greenhouse Gas Plan objectives likely to overlap with the objectives of the two programs listed above, perhaps some restructuring of the work these groups do could be organized around the single activity of natural capital protection that would ultimately achieve each of their given goals.

Education

Planning Board Member Training

Currently, Planning Board members are required to receive training on land use planning in order to serve in their positions. Information on the importance of natural capital protection and how to incorporate it

into land use planning should be included in this Department of Community Affairs supervised training.

Valuation Professions’ Declaration

In March 2007 an international conference of appraisers, investors and developers was held in Vancouver, Canada to examine the interrelationship of sustainability and value. The outcome of the summit was the Vancouver Valuation Accord, the valuation professions’ declaration to commit “to promote competency in the appropriate methods of addressing sustainability in valuations and appraisals.”

(http://www.vancouveraccord.org/pdf/VVS_Vancouver_Accord.pdf).

The State could encourage a similar conference to be held in New Jersey to raise awareness and expertise in the state’s appraisal and development community.

Legislature and State Agencies

Previously held in Europe, the first North American *Congress on Social and Environmental Accounting Research* was held in 2008 in Montreal and brought US and international academics together to explore expanding the current accounting systems to include natural capital and other considerations.

(http://johnmolson.concordia.ca/csear_na_2008/en/index.php?lang=en).

A key participant from this conference could be invited to brief key Legislative committees and the ACE team (via videoconferencing or in person) on the

possibilities for green accounting in New Jersey.

Data

Priority Ecosystems for Carbon Sequestration and Other Values

A major benefit NJDEP could provide to municipalities would be the provision of data at a scale municipalities can use. For example, it would be useful to know which species of trees and arrangement of trees are the most important for carbon sequestration.

The *Valuing New Jersey's Natural Capital* report provides some information on land use practices to protect Natural Capital but more of this information should be extracted from the background research that is not in the report and made available to municipal planners. For example, the report states that stands of forest along rivers can protect water quality better than thin ribbons of streambank cover.

Municipal planners have stated that the Landscape Project data is useful at a general level but they would like similar data at the site or subdivision level. This desire should be taken into consideration when considering the type of data that would be useful for municipalities. However, PlanSmart NJ and both the roundtables we convened for this project felt strongly that municipalities must understand their role in the region and that site data should not be used in isolation from corridor, hub, and ecosystem level data.

In Colorado, the Ecology Lab of the State University in Fort Collins and the Habitat Research Section of the Colorado Division of Fish and Wildlife collaborated to develop a System for Conservation Planning GIS application that allows the user to click on a site and determine if there are “concerns if developed” related to that site. (Theobald et al p. 41) These “concerns if developed” were associated with regional targets and reflected the role of the site in a regional plan. This GIS product could be evaluated for application to New Jersey.

Further work on quantifying the cost avoidance a municipality’s natural capital provides (through water filtration, flood prevention, air quality improvement, etc.) would be very useful as an incentive for municipalities to preserve that natural capital as a way of controlling budget costs.

Monitoring

Monitoring data on Natural Capital gains and losses would also be useful for the state to provide to municipalities. NJDEP and CRSSA already monitor land use changes through air photo analysis. Natural capital analysis could be reported from this data set also. As part of its Wildlife Action Strategy, NJDEP could undertake a program to teach municipalities how to do natural capital audits.

IV. Lessons Learned

New Jersey has a strong base to build on to protect natural capital. It has strong land use legislation and environmental protection legislation. It has innovative mapping and data capacity. However, protection of natural capital will require accelerating some existing programs and reconfiguring others.

Regulation

Master Plans and Site Plans

The planners who were interviewed for this project as well as those that participated in the roundtables were unanimous in recommending that natural capital should be used in the Land Use Element of the Master Plan as the basis for designing a Master Plan. Pilot projects with some towns whose master plans were due for renewal should be undertaken.

They were also unanimous in asserting that natural capital would not be protected if left to the Subdivision or Site Plan stage of land use planning. They felt integrating the protection of natural capital within the Master Plan, and then creating regulations that supported it, would be a better approach.

Zoning and Other Ordinances

Planners were united on the need for revisions to zoning in New Jersey to allow for conservation density zoning (at densities of 1 unit to 20 – 50 acres as are used in other states). Form-based Codes were also proposed as an

opportunity to be pursued for protecting natural capital.

However, while environmentalists felt protective ordinances (such as stream corridor or tree ordinances) could do a lot of good, planners felt these ordinances frequently were superseded by the requirements of the *Municipal Land Use Law (MLUL)* for subdivision approval or stormwater drainage requirements. The planners suggested the *MLUL* should be revisited to remove its development-only bias and provide the authorization for open space zoning.

Regional Plans

Both roundtables were supportive of the need to plan for natural capital on a regional basis first, and to implement protection at the municipal level. Both Roundtables supported including natural capital within a revised Plan Endorsement process based on statewide targets.

Regional planning agencies (Highlands Council, Meadowlands Commission, Pinelands Commission) were also urged to consider rewarding planning for natural capital with expedited permit review as the Meadowlands Commission does for Green Buildings.

Counties can coordinate their roles in open space planning and preservation with their roles in stormwater and wastewater management to prioritize protection for green infrastructure for water treatment and carbon reduction.

Financial Incentives

Capital Improvement Plan

The municipal Capital Improvement Plan could be expanded to provide an assessment of the replacement value for the natural capital services a municipality receives and the impact of depletion of its natural capital.

Transfer of Development Rights

Although Transfer of Development Rights is permitted statewide, only a limited number of programs have been successfully implemented due to the costs involved in the planning, the difficulty of identifying receiving areas and complexities of determining the valuation of the credits.

It is essential that the state look for ways to make the program easier to use if natural capital is to be preserved.

Carbon Credits and Ecosystem Service Districts

The most significant protection of natural capital will occur through a comprehensive state Greenhouse Gas Reduction Plan that establishes a market for carbon sequestration similar to New Jersey's Solar Renewable Energy Credits or by the state actively facilitating participation in existing carbon credit exchanges. In addition, Ecosystem Service Districts that allow trading and banking of natural capital would also provide significant incentives for its preservation.

Preservation and Restoration

The state should reach out to universities and colleges to encourage

them to work on biodiversity and natural capital audits for their regions. Academics could also be encouraged to:

- Track & measure changes in New Jersey's natural capital;
- Better quantify the costs of not protecting natural capital in order to implement the Capital Improvement Plan action recommended on p. 35;
- Ascertain the value of green infrastructure; and
- Develop approaches to institutionalize the concept and integrate it into land use decision-making.

The economic value of natural capital can be brought home to decision-makers through an analysis of the value of the natural capital coupled with an analysis of its replacement cost. The replacement cost of natural capital should be assessed to assist in:

- setting priorities for acquisition,
- determining the value of tax credits,
- assessing the level of impact fees, or
- determining the value of transfer of development rights credits.

Municipalities that have lost natural capital should be encouraged to restore it with federal funding. For example, the City of Trenton is working with the Army Corps of Engineers to restore significant sections of the Assunpink River and create a Greenway. The key to this effort has been the appointment

of a paid “champion” tasked with brownfield reclamation.

This concept of a champion for natural capital protection should be implemented in NJDEP’s Wildlife or Watershed Divisions as many goals can be achieved when natural capital is preserved – watershed protection, habitat protection, etc. Sacramento, California, has achieved its first real Smart Growth successes following the appointment of a champion to broker agreements.

Education

Natural capital preservation must be redefined and communicated as self-preservation. A change of consciousness is needed at the municipal and all levels of government to understand what the *Seattle Times* put well:

“We know that what is bad for wild salmon is bad for us. Polluted waters, eroding land, wetlands which protect communities from flooding being dredged and filled, farmland being eaten up by runaway sprawl and the last nearby woods being cut and cleared for a strip mall – this is not what we want for our children, and we know, both in our guts and from the work of scientists, that it’s hurting not only the salmon but the health of our whole region.” (Beatley, p. 8)

Municipalities, individual taxpayers and the State stand to gain financial and health benefits from the recognition of the value of New Jersey’s natural capital as a long-term asset to be managed. Therefore, education of the public and state and

municipal officials on the returns afforded by protecting and enhancing natural capital should be accelerated.

Campaign for Natural Capital

There have been very successful marketing campaigns to change societal behavior – anti-drinking and driving, anti-smoking, pro-recycling, etc. It would be worth using some of the RGGI funds to develop an advertising campaign that would support the land use changes needed at the municipal level to protect natural capital. Education on the benefits of natural capital protection could discourage NIMBY groups from forming in response to good plans for Transit Oriented Development or Centers that reduce impacts on natural capital.

Briefings

Briefings for reporters and professional associations should be set up on natural capital and its importance to New Jersey.

The NJ chapter of the American Planning Association has its annual meeting in early November of each year. Applications for panel submissions are usually due in June. NJDEP could put together a panel of staff and towns that are leading in the area of natural capital protection. Planners are required to obtain certification maintenance credits now so attendance at the APA is higher than ever.

There is also a NJ chapter of the Congress of New Urbanism. NJDEP could work with the NJ chapter to coordinate outreach to planners about

natural capital and the role of the New Urbanist Transect in its protection.

A New Jersey chapter of the Smart Growth Alliance has recently been established and is working on a checklist for rating proposed projects on their Smart Growth contribution. Natural capital values could be incorporated into that checklist.

The League of Municipalities' Green Mayors Committee and the League's annual conference would also be good places to do education on natural capital values and highlight good examples of natural capital protection. For example, a speaker from the Atlantic City Utilities Authority could describe their work to capture value (energy) from wind and the value of wetlands to help the municipal bottom line.

A presentation to the State Chamber's Cornerstone CEO group by the NJ Pension Fund managers who have developed a portfolio of green investments could also be beneficial in opening a discussion of the value of natural capital.

Materials

NJDEP could better publicize the promotional material it has already developed that encourages an appreciation of the ecosystems that provide natural capital. For example, NJDEP staff has developed power points on the value of natural capital.

Also, NJDEP has material on the richness of New Jersey's wildlife and the uniqueness of its habitats that the public may not be aware of. Its two-day, self-guided interpretive 'Wildlife

Diversity Tours' in the Wildlife Viewing Guide could be used to encourage an understanding of the eco-tourism value of wildlife habitat.

In this guide, selected wildlife viewing sites that reflect the dominant ecosystem in the region and the relationships of wildlife and man to those systems have been linked together to form a self-guided tour using interpretive text in the guide and at the sites. These tours have been designed to encourage overnight excursions to keep tourists and tourism dollars in an area for longer periods of time.

The Ecological Society of America also has a number of fact sheets that could be distributed by NJDEP.

Data

Monitoring

Monitoring data on natural capital gains and losses would also be useful for the state to provide to municipalities. NJDEP and CRSSA already monitor land use changes through air photo analysis. Natural capital analysis could be reported from this data set also.

Designing for Protection

More explicit information needs to be available to municipalities on the value of different configurations of natural capital. For example, *The Value of New Jersey's Ecosystem Services and Natural Capital*, (NJDEPb) provides some information on how spatial land use patterns significantly affect

ecosystem but more information is needed.

The report states, “Small river buffers have only a minor impact on water quality and need to be fairly large to be of use, whereas small, dispersed forest patches do more to enhance water quality than larger forest clusters.” Land use planners will need guidance on an optimal landscape approach incorporating all natural capital considerations such as the need for large forest clusters for carbon sequestration or bird habitat.

NJDEP, universities and the Department of Labor should work together to develop and market software (similar to that developed by the University of Colorado) to allow land use planners to make the best land use decisions based on the new natural capital data available to the state of New Jersey.

V. Next Steps

Potential Implementation Matrix

This report has identified a number of ways in which municipalities and the state can address natural capital protection. The Implementation Matrix that follows summarizes actions municipalities and the state can take to implement natural capital protection and indicates which actions could be taken more easily and more quickly than others, as well as providing the significance of the action for the protection of natural capital.

Actions in regular font can be done as a part of ongoing activities. Activities in italics will require a new approach.

Possible Pilot Projects

This report recommends that NJDEP select towns as potential pilots for protection of natural capital by selecting ecosystem services that currently resonate with the public (in order to gain the greatest support for this new concept) *e.g.*, water quality and supply or carbon sequestration services.

NJDEP could use the maps in the *Valuing New Jersey's Natural Capital* report to identify priority areas for the selected ecosystem services. NJDEP could then work with the NJAPA and the NJ League of Municipalities' Green Mayors Committee, ANJEC, Audubon, and the Sierra Club's Cool Cities campaign to identify communities that would be good candidates for:

- Master Plan revisions based on natural capital, or
- developing a Capital Improvement Plan that reflects natural capital values based on a Green Infrastructure assessment, or developing a Community Facilities Plan to protect natural capital, or introducing a zoning ordinance based on the Plant Stewardship Index for New Jersey similar to the one under development by Delaware Township, or developing Ecosystem Service Districts that would allow trading and banking of natural capital.

Further Research

A number of questions were raised by the research and in the discussions held as part of this project that were beyond the scope of this report. The questions focus on how to allocate the statewide values of natural capital reported in NJDEP's 2007 *Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources*.

One question related to how to allocate natural capital values and incentives below the municipal scale to individual landowners to encourage them to protect natural capital while recognizing that there also exists an expectation that clean water and air belong to society not individuals.

Another question related to how to allocate natural capital benefits between municipalities (*e.g.*, should a downstream municipality pay an upstream municipality for the flood

protection it receives, or should the State pay for this benefit as a public good)?

Another question related to how to allocate the benefits of protecting biodiversity versus protecting natural capital.

For example, one article in the literature states that in planning for conservation of the natural capital of six ecosystem services in California (carbon storage, flood control, forage production, outdoor recreation, crop pollination, and water provision), biodiversity protection was reduced by 44% compared to planning for biodiversity protection alone. However, when forage production and pollination services were dropped as priorities, biodiversity protection was almost as great as planning for biodiversity protection alone and valuable synergies were identified. (Chan, p. 2138)

The report, *Valuing New Jersey's Natural Capital*, itself contains information that makes clear the need to distinguish between planning for natural capital and for biodiversity. According to the report, farmland and marine ecosystems generated the highest value goods in terms of total value, however, barren land ranked first in value per acre due to the presence of quarries. (NJDEP, p. 7) Barren land, however, holds little biodiversity value.

MUNICIPAL | Regulation –

GOAL 1 – Include Natural Capital Information in the Appropriate Local Plans and Ordinances

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
1.1	Master Plans	<ul style="list-style-type: none"> ❖ In the Land Use Element of the Master Plan ensure Natural Capital priority areas are identified and protected by designating growth areas away from these areas. ❖ In the Land Use Element, ensure land use patterns support Smart Growth. Encourage a greater mix of uses in residential and commercial districts supportive of transit service in centers and away from large tracts with high natural capital value. ❖ <i>Go beyond traditional goal statements that “balance land uses” and establish goals and targets in the Land Use Element to protect natural capital</i> <ul style="list-style-type: none"> ➤ e.g., the following goal from Albermarle County, Virginia: <i>sustain the landscape states and ecological integrity required for important ecological services and healthy populations of native plants and animals. Targets include: miles of streams with buffers, percent forest canopy, percent effective impervious cover.</i> ❖ Recognize Natural Capital in the Community Facilities element to be planned for as a 	<p>Medium</p> <p>Medium</p> <p>High</p> <p>High</p>	<p>Low, municipality would instruct planners on direction to include in plan.</p> <p>Potential funding priority with OSG Smart Future grants.</p> <p>Medium, municipal</p>	<p>Medium, plans require update every six years but can be deferred for an additional six.</p> <p>Medium, plans require update</p>

1.2	Redevelopment Plans	<p>necessary resource like schools and soccer fields.</p> <p>❖ Negotiate natural capital preservation in the preparation of a redevelopment plan.</p>	Medium to High depending on size of the plan	<p>engineer, Manager or a consultant would need to insert a replacement cost estimate into the plan.</p> <p>Low, municipality can set this as a parameter of the plan.</p>	<p>every six years but can be deferred for an additional six.</p> <p>Short</p>
-----	---------------------	---	--	--	--

MUNICIPAL | Regulation

GOAL 1 - Include Natural Capital Information in the Appropriate Local Plans and Ordinances

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
1.3	Stormwater Plans	<ul style="list-style-type: none"> ❖ Ensure protection of forested areas and stream buffers is contained in the stormwater protection plan. ❖ Develop a plan to retain and construct wetlands throughout the municipality e.g., the Staten Island Bluebelt Plan. 	High	High, municipalities would need to plan more regionally for stormwater protection and NJDEP would need to review the plans in greater detail	Short - Medium, if RGGI money was made available
1.4	Zoning Ordinances	<ul style="list-style-type: none"> ❖ Adopt overlay zones that protect waterways, forests, or agricultural areas from development either by increasing lot size minimums in rural areas (to protect large contiguous areas of habitat or farms) or by removing lot size minimums to prevent sprawl. ❖ Adopt a cluster development ordinance (to increase density on one portion of a tract and preserve open space on another portion). ❖ Adopt flexible parking requirements (to reduce impervious cover). ❖ <i>Conservation Zoning at low enough density to preserve natural capital should be allowed by</i> 	<p>High</p> <p>High</p> <p>Low</p> <p>High</p>	<p>Medium, adopting overlay zones is easier than amending each use in the zoning ordinance</p> <p>Medium</p> <p>Medium</p> <p>High, while downzoning is</p>	<p>Short</p> <p>Short</p> <p>Short</p> <p>Medium to Long</p>

		<p><i>right in the zoning so no special approvals are required.</i></p> <ul style="list-style-type: none"> ❖ <i>Form-based Codes that focus on shaping the form of the built environment and open space or Conservation Design Districts could be adopted.</i> ❖ <i>Adopt an ordinance to protect Natural Capital based on the Plant Stewardship Index for New Jersey (that ranks landscapes by their level of naturalness and the extent to which they support more sensitive species) similar to the Woodlands Protection Ordinance developed by Delaware Township, Hunterdon County.</i> 	<p>High, Form-based Codes are new to New Jersey with one adopted in Brick Twp.</p> <p>High</p>	<p>permitted if not arbitrary and capricious, it can be politically difficult.</p> <p>Potential priority for Smart Future funding.</p> <p>Medium</p>	<p>Medium</p> <p>Short</p>
--	--	---	--	--	----------------------------

MUNICIPAL | Financial Incentives

GOAL - 2 : Include Natural Capital Information in Financial Incentives

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
2.1	Transfer of Development Rights	❖ Apply to the State TDR board for a matching grant to develop a TDR plan to focus development in development zones and compensate property owners for restricting development in preserved areas.	High	High, requires pre-planning work to identify initial feasibility	Medium to Long
2.2	Open Space Conversion Fee	❖ The SLERP Commission recommended developers of new construction in greenfields in PA3, 4, and 5 that would not create a Village or Center should pay a fee. This fee could be scaled per the significance of habitat being displaced.	Medium	Low	Short
2.3	Capital Improvement Plan	❖ Provide an assessment of the replacement value for the natural capital services the municipality currently receives e.g, water supply, water quality, energy savings from forest cover, etc. and the impact of depletion of natural capital.	High	Medium, municipal engineer, Manager or a consultant would need to insert a replacement cost estimate into the plan.	Short, if focused on water quality and supply and had RGGI funds
2.4	<i>Ecosystem Service Districts</i>	❖ <i>Identify potential high value tradable natural capital resources and seek payments from industry or state government to protect them e.g., Akron, Ohio and NYC, New York have created ecosystem service districts to protect water quality. In Colton, California a mitigation</i>	High	High as this is a new concept and economic development staff would need training to	Short – Medium if the state creates a trading mechanism similar to NJ's

2.5	Property Tax Reduction	<p><i>bank has been created to meet the Endangered Species Act requirement to protect the Dehli Sands Flower-Loving fly.</i></p> <p>❖ <i>For sustaining Natural Capital value on their property, municipalities could assess property owners lower property taxes.</i></p>	High	<p>implement this.</p> <p>Medium</p>	<p>Solar Renewable Energy Credits.</p> <p>Short</p>
-----	------------------------	--	------	--------------------------------------	---

Municipal | Preservation and Restoration

GOAL - 3 : Include Natural Capital Information in Preservation and Restoration Efforts

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
3.1	Open Space Plans	❖ Prioritize protection of Natural Capital in Open Space Plans.	Medium	Low, Green Acres funding	Short
		❖ Implement the Garden State Greenways Plan by requiring greenway provisions where possible in new development projects.	Medium	Low	Short
3.2	Habitat Conservation Plans	❖ Use the model of the Raritan Piedmont Wildlife Habitat Partnership's Grassland Conservation Plan to develop other local habitat conservation plans.	High	Medium, requires liaison with NJDEP Fish & Wildlife & funding for Audubon or other group	Short
3.3	Brownfield Plans	❖ <i>Restore lost natural capital where possible through brownfield redevelopment.</i>	Medium	Low, municipality can include as a parameter of the plan.	Short
3.4	Carbon Sequestration Plan	❖ <i>Develop a carbon sequestration plan based on natural capital data.</i>	High	High as it is a new activity for NJ	Short if RGGI funds are available
3.5	Audits	❖ <i>Use the Plant Species Index (developed 25 years ago in Minnesota) in ranking land for acquisition.</i>	Medium	Medium as it is already used by D& R Greenway	Short

Municipal | Education

GOAL - 4 : Provide Education about the Value of Natural Capital

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
4.1	Stormwater Education	❖ Include Natural Capital information in the printed material or events that promote good stormwater management practices. For example, NYC preserving the Catskills watershed saved \$8.5 billion in avoiding construction of a filtration plant.	Medium	Low for municipalities if NJDEP can make such information available in a flyer.	Short
4.2	Environmental Commissions	❖ Include Natural Capital information in Natural Resource Inventories or other educational material prepared by Environmental Commissions.	Medium	Low as GIS layers already exist for this information.	Short
4.3	Historic or Heritage days	❖ <i>Recognize Natural Capital as a type of heritage to be celebrated and protected.</i>	Medium	Low for municipalities if NJDEP can make such information available in a flyer.	Short

State | Legislation

GOAL-1 : Include Natural Capital Information in Appropriate Land Use, Transportation, and Environmental Legislation

Strategy		Tactics	Impact	Agency Impact/ Funding or Planning Assistance	Time Frame
1.1	Transfer of Development Rights Act	❖ Ensure changes currently being proposed to the SADC TDR program are sufficient to promote TDR for Natural Capital protection.	High	Medium, NJDEP liaise w/ SADC.	Short
1.2	Farmland Assessment Act	❖ State tax credit for woodlot management should not require harvesting but should encourage management for Natural Capital enhancement.	High	Low, NJDEP and Agriculture liaison.	Short
1.3	Municipal Land Use Law	❖ Rewrite to change emphasis from regulation of development to regulation of land uses including conservation as an as of right use. Determine if changes are required to the MLUL in order to facilitate Form-based Codes for natural resource protection.	Medium-High	High, NJDEP liaise with OLS and NJAPA.	Medium-Long

State | Regulation

GOAL-2 : Include Natural Capital Information in the Appropriate State Plan, Land Use, Transportation and Environmental Regulations

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
2.1	NJ State Development and Redevelopment Plan	❖ Require an assessment of Natural Capital in the Endorsement process.	Medium - High	Low for OSG as towns will provide it.	Short
	Stormwater	❖ Stormwater regulations should include a target for preserving a percentage of forests to act as stormwater management mechanisms.	Medium - High	Medium, for NJDEP to determine a valid target	Medium
	Forestry Mitigation beyond the Highlands	❖ While Forest protection and mitigation plans have been proposed for the Highlands, NJ should develop mitigation requirements for forests as strict as for wetlands e.g., in Maryland, the Forest Conservation Act of 1991 requires retention reforestation, or afforestation of specified amounts of forested land onsite or, if necessary, offsite when land is developed. The Chesapeake Bay Critical Area Act (COMAR 27.01.02.04) requires mitigation of up to 3:1 for trees cleared without conformance.	High	Low to develop if Highlands' model is used, but High for NJDEP to introduce new rules unless introduced as part of a Greenhouse Gas Reduction Plan.	Short if part of a Greenhouse Gas Reduction Plan.
	Access Code	❖ Include Natural Capital information in Access Code considerations. Limiting street size and access points would protect areas with high Natural Capital value from disturbance.	High	Medium, NJDEP to liaise with NJDOT. Mercer Cty draft Access Code could be used as a model.	Medium

State | Financial Incentives

GOAL - 3 : Include Natural Capital Information in Financial Incentives

Strategy		Tactics	Impact	Agency Impact/ Funding or Planning Assistance	Time Frame
3.1	Carbon Credits	❖ Create a market for carbon credits in the way the State created a market for Solar Renewable Energy Credits.	High	NJDEP liaise with BPU to create market.	Short-Medium
3.2	Green Component to State Budget	❖ Add an accounting of the natural capital assets to the state's report on assets and indicate whether the natural capital assets have increased or decreased year to year.	Medium to High	High, would require a new activity in Treasury	Medium-Long
3.3	Prioritize state funding to towns developing a Natural Capital Management Plan	❖ Towns with an assessment in their Capital Improvement Plan or Community Facilities Element of their Master Plan would receive points in their applications for state funding.	High	Low, simply add a line to an application review check list.	Short

State | Preservation and Restoration

GOAL - 4 : Include Natural Capital Information in Preservation and Restoration Efforts

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
4.1	Smart Future Grants	❖ Smart Future Grants priorities could include a category for creating local natural capital preservation plans including a natural capital audit.	High	Low, OSG could prepare its grant descriptions going forward with this as a category	Short
4.2	Green Acre funding	❖ Green Acres funding should be guided by Natural Capital priorities.	High	Low, NJDEP could prepare its grant descriptions going forward with this as a category	Short
4.3	Wildlife Action Plan current update	❖ Natural Capital information should be included in the Wildlife Action Plan.	Medium	Low, as the information already is mapped.	Short

State | Education

GOAL-5 : Provide Education about the Value of Natural Capital

Strategy		Tactics	Impact	Agency Impact/Funding or Planning Assistance	Time Frame
5.1	Wildlife Diversity Tours	❖ Publicize more widely the self-guided natural assets tour developed by NJDEP at the League of Municipalities annual meeting, NJAPA annual meeting, and on their websites.	Medium	Low, NJDEP prepare powerpoints or booths	Short
5.2	Wildlife Action Plan	❖ Develop sessions on the Natural Capital Report, Wildlife Action Plan and Landscape Project for the NJAPA annual conference (now mandatory for planners to obtain Certification Maintenance Credits).	Medium	Low, NJDEP prepare powerpoints or booths	Short
5.3	Planning Board Training	❖ Require natural capital information be included as a module in the mandatory Planning Board training.	Medium	Low, NJDEP give this report to the Center for Government Services.	Short
5.4	Municipal Implementation of State Greenhouse Gas Reduction Target	❖ Reinforce the role of specific types of natural capital in Greenhouse Gas Mitigation Plans	High	Low, if already prepared for GHG Plan.	Short if RGGI funds available.
5.5	Champions	❖ Broker agreements to protect rather than destroy natural capital.	High	High, NJDEP and EDA liaise to provide staff to promote economic value of Natural Capital	Short-medium if RGGI funds available.

State | Data and Monitoring

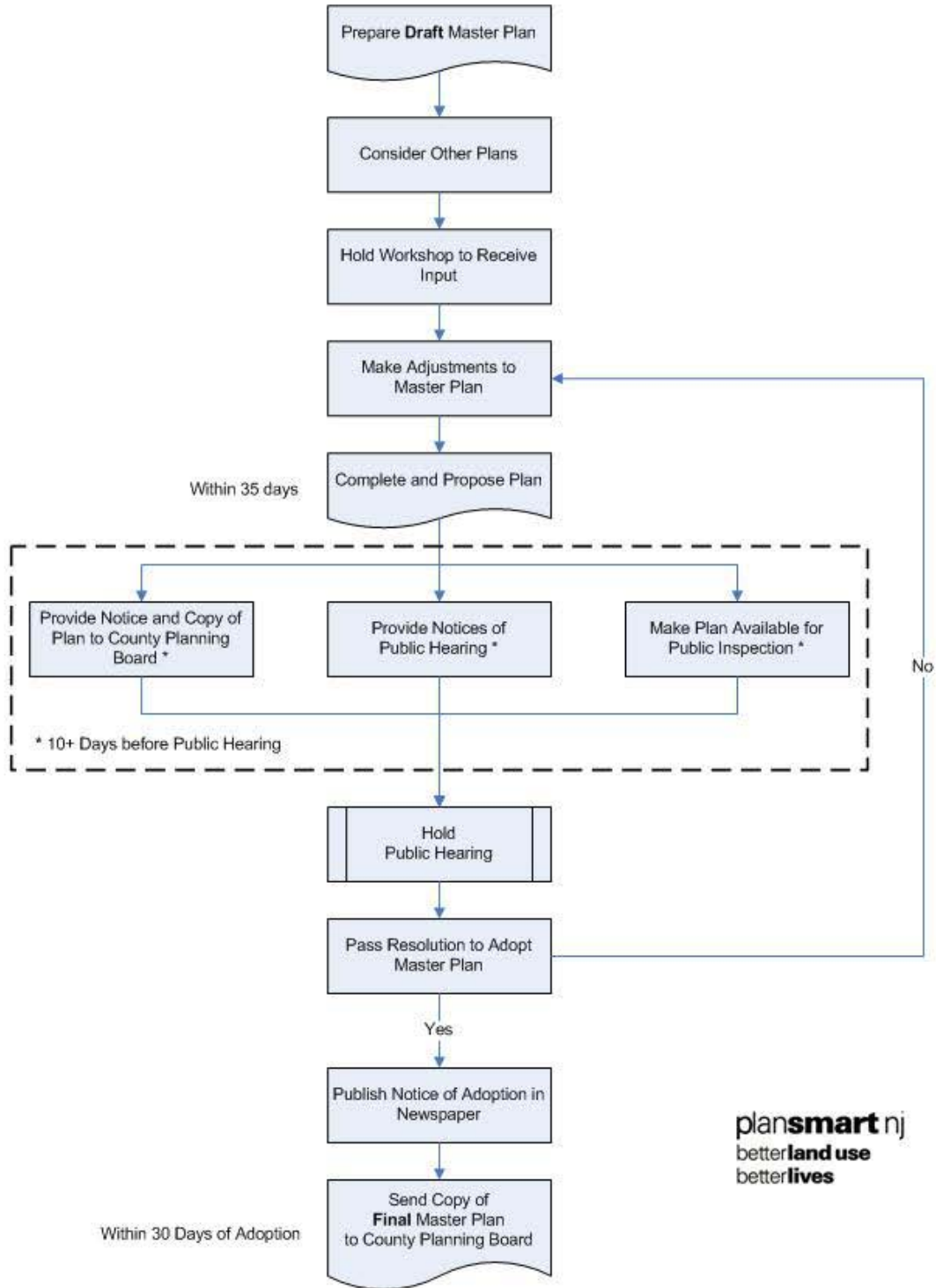
GOAL - 6 : Include Natural Capital Information as Part of the Data Collected and Monitored by the State

Strategy Recommendation Policy		Tactics	Impact	Agency Impact/ Funding or Planning Assistance	Time Frame
6.1	Priority Ecosystems for Carbon Sequestration	❖ Develop a GIS layer, based on the Landscape Data and Natural Capital data that identifies at a scale appropriate for municipalities, priority ecosystems for mitigating greenhouse gases through carbon sequestration.	High	Medium, NJDEP would need to rescale the existing mapping	Medium
6.2	Priority ecosystems for Flooding and Tidal Surge Protection	❖ Develop a GIS layer, based on the Landscape Data and Natural Capital data that identifies for municipalities priority ecosystems for mitigating the effects of flooding and tidal surges.	High	Medium NJDEP would need to rescale the existing mapping	Medium
6.3	Priority ecosystems for Drinking Water Protection	❖ Develop a GIS layer, based on the Landscape Data and Natural Capital data that identifies for municipalities priority ecosystems for protecting drinking water quality and supply.	High	Medium NJDEP would need to rescale the existing mapping	Medium
6.4	Cost Avoidance	❖ Provide an analysis of typical replacement cost that natural capital provides	High	Medium NJDEP would need to rescale the existing mapping	Medium
6.5	Monitoring	❖ Provide data on the loss of natural capital in the analysis of land use/ land cover changes NJDEP monitors	High	Medium NJDEP would need to rescale the existing mapping	Medium-Long

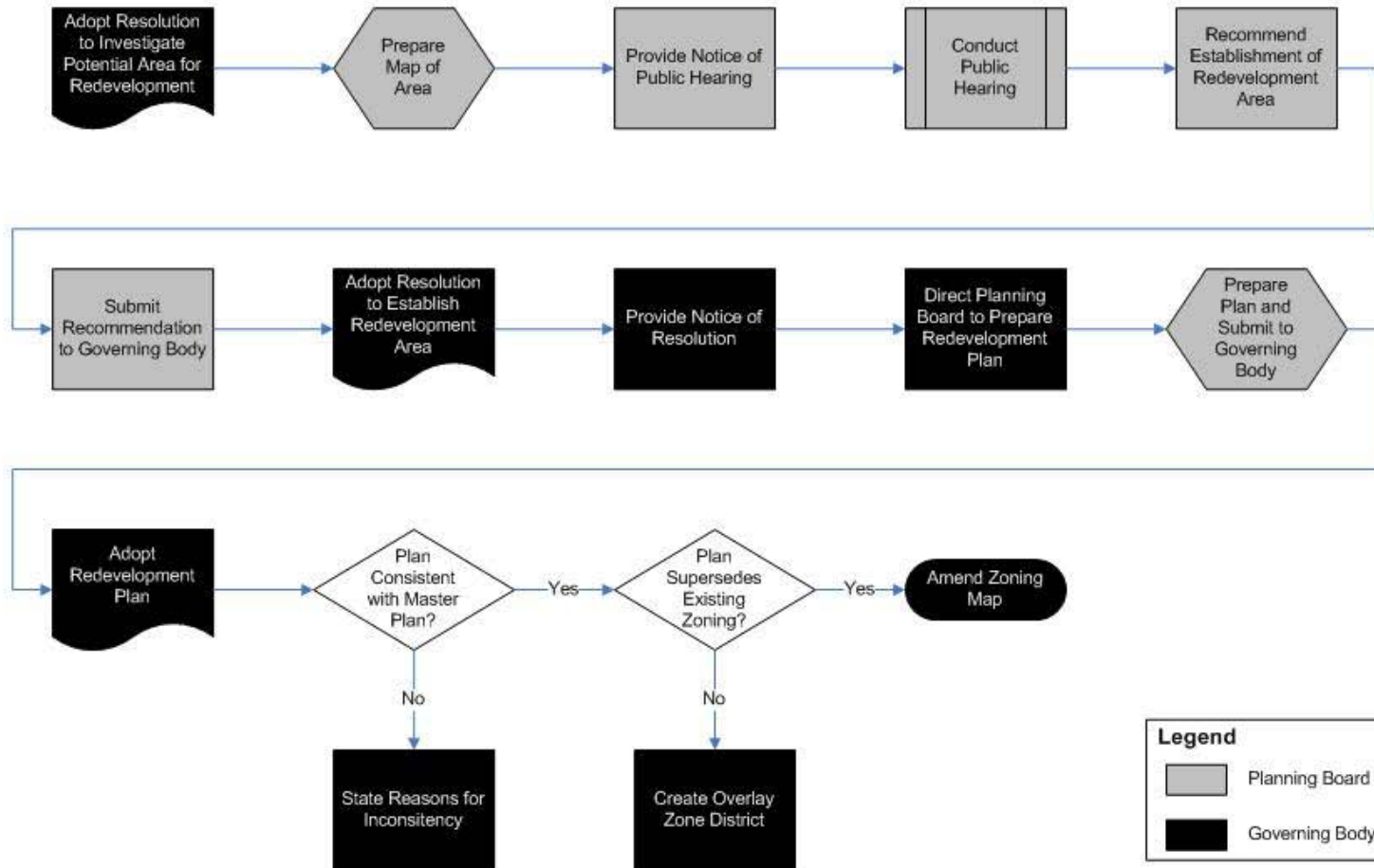
Appendix A

Development of the Municipal Master Plan

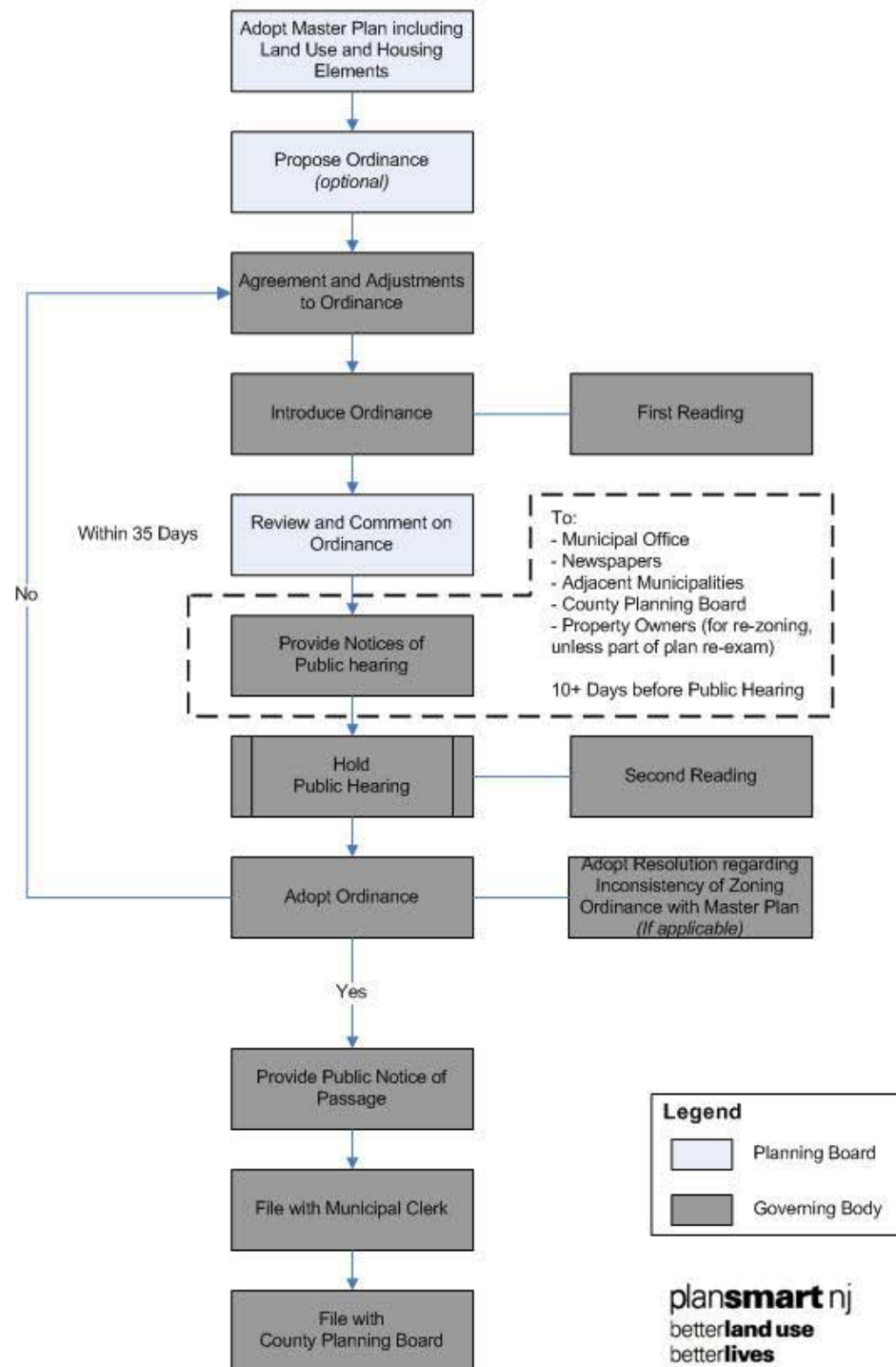
The following steps are to be implemented
by the Municipal Planning Board



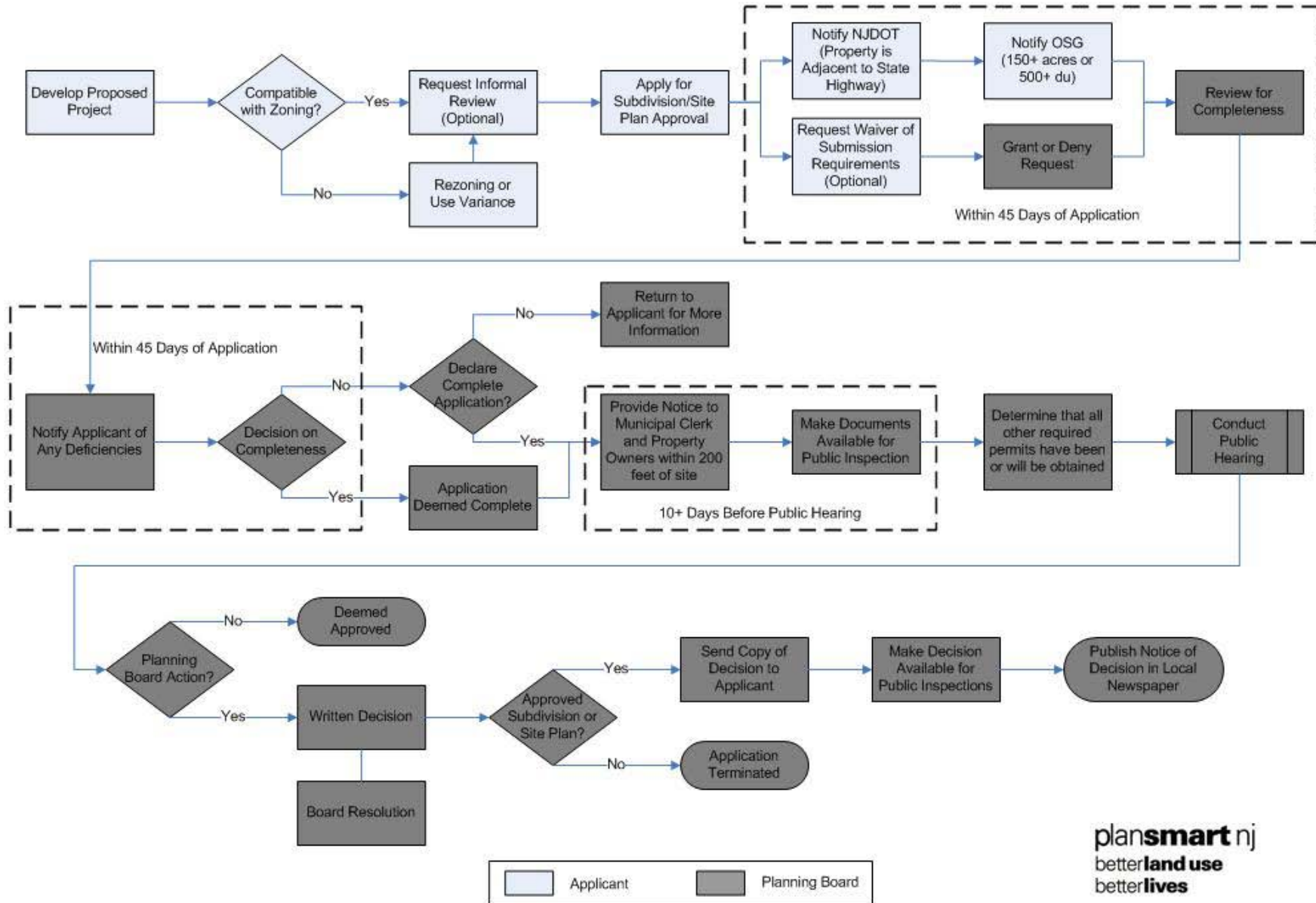
Process for Redevelopment



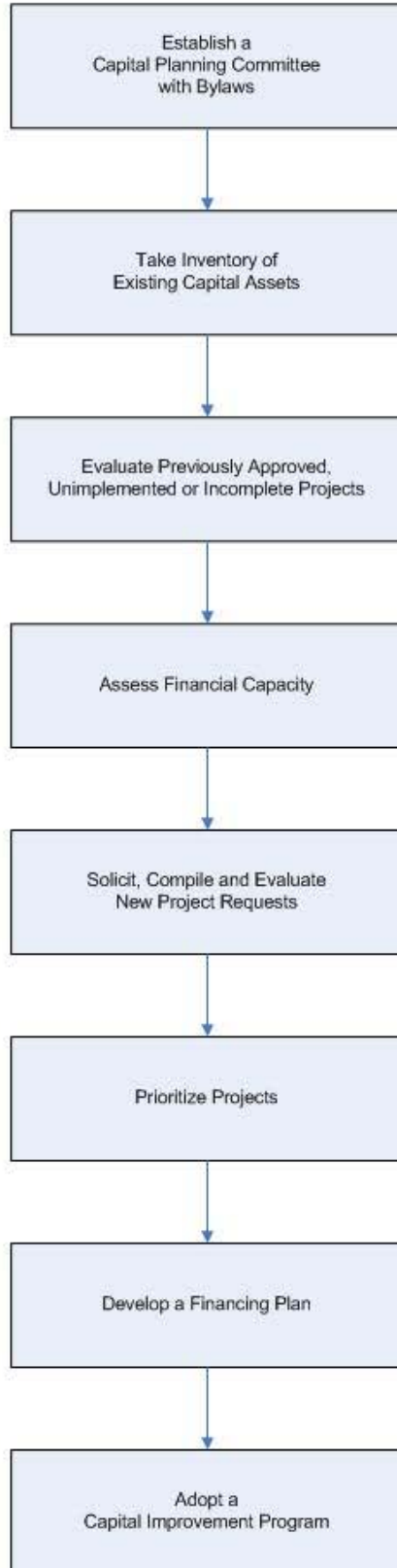
Development of Municipal Ordinances



Municipal Development Review – Major Subdivision or Site Plan



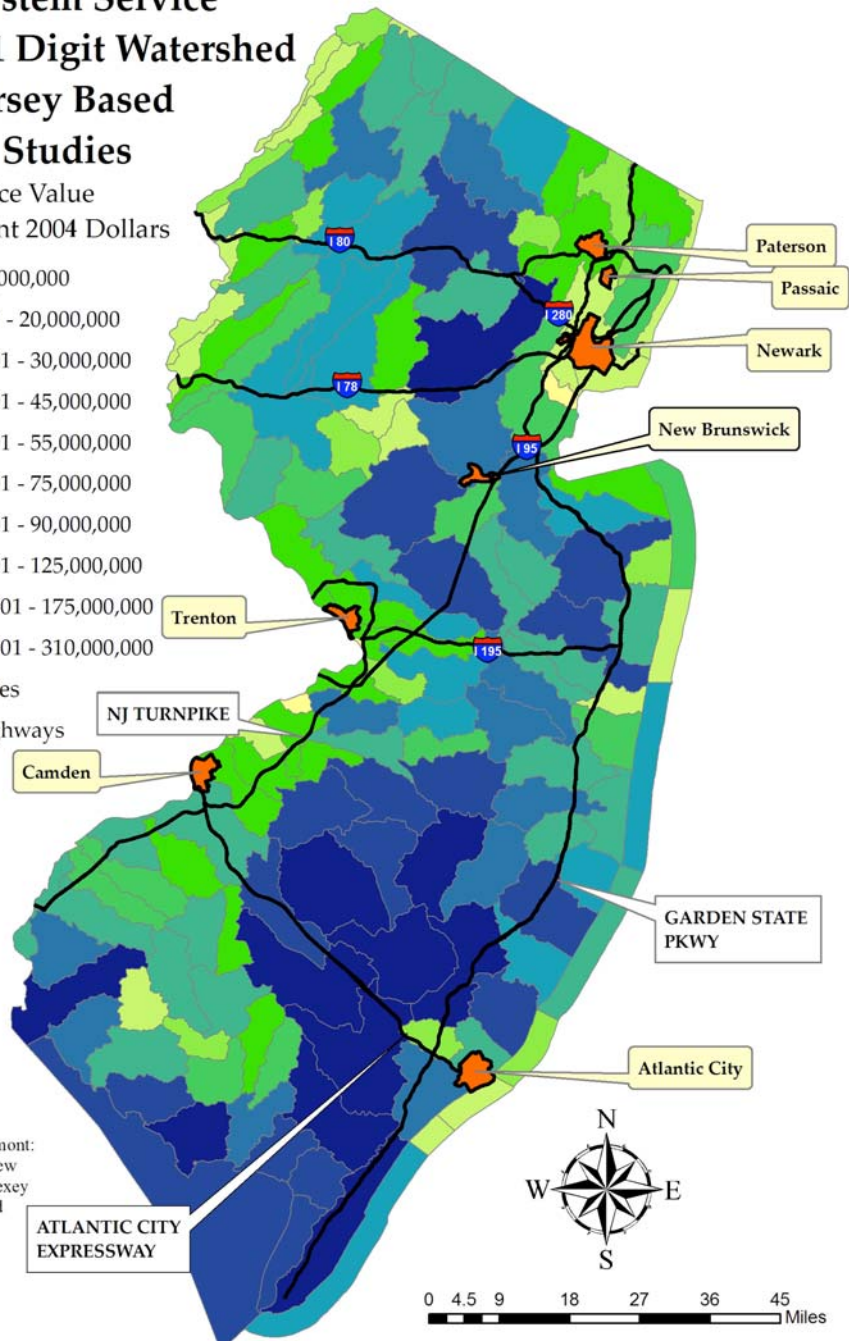
Capital Improvement Plan



Appendix B

Total Ecosystem Service Value by 11 Digit Watershed for New Jersey Based on "A List" Studies

Ecosystem Service Value Flows in Constant 2004 Dollars



The New Jersey Ecosystem Service Valuation Project Team at the University of Vermont: Robert Costanza, Matthew Wilson, Austin Troy, Alexey Voinov, Shuang Liu and John D'Agostino

Map Produced by Austin Troy and John D'Agostino

Figure 4: Total Ecosystem Service Value by watershed for New Jersey based on Type A studies

Appendix C

**Environmental Roundtable on the Use of the
Natural Capital Report
PlanSmart NJ 118 W. State St. Trenton NJ 08608
April 24, 2008**

Attendees: Dianne Brake, PlanSmartNJ; Susan Craft, Department of Agriculture; Bill Mates, NJDEP; Ken Najjar, Delaware River Basin Commission/Lawrence Environmental Commission; Dave Peifer, ANJEC; Marvin Reed, Princeton Regional Master Plan Committee; Noelle Reeve, PlanSmart NJ; Leslie Sauer, Forest Ecologist/Delaware Township Environmental Commission; Liz Semple, NJDEP; Laura Szwak, NJ Conservation Foundation; Jeannine Varnais, Bowman's Hill Wildflower Preserve

i) About half of the attendees were unfamiliar with the report before they were sent a summary prior to the meeting.

ii) Have you ever had a conversation where you wished you had a dollar value for nature?

Yes. In the case of a pipeline that was being laid in Morris County, a \$50,000 payment was proposed for the diversion of the use of vacant land for 6 weeks with no consideration of the loss of the lowland beech forest that existed there. The consultants did their own research to try to put a dollar value on the habitat and couldn't find anything so they *shifted to a consideration of the costs of restoring habitat*. Because of a paperwork error, the right-of-way had to be re-approved. At this point, the consultants focused the discussion on the habitat that would be damaged by the pipeline construction. The company therefore reduced the size of the right-of-way by half and increased the payment to a one time disbursement of \$300,000.

[The opinion was offered that a one-time payment undervalued the resource.]

In another example, when a gas line exploded near the D&R Canal a number of years ago, Jim Amon objected to the offer to simply seed the area along the Canal with grass. He felt there had been habitat loss and negotiated a one-time \$400,000 payment.

There have been other instances where pipeline right-of-ways have been moved because the cost of restoration would be too high.

However, even in these instances, there is no recognition that non-monetary values are important and should be recognized.

On the other hand, for mayors trying to convince a developer that they should be donating wetlands for open space because they have no value, the concept of

natural capital value could backfire. A developer might then say to a town, either buy the value of the wetland back from me or give me a density bonus.

iii) Barriers

The problem with trying to use the concept of natural capital in the planning process is that no entity pays the cost of harming the habitat and similarly no one person or group gets the benefit of protecting the ecosystem service. The costs and benefits aren't closely enough connected to make the information useful. The costs are too far in the future. Without the resource being of value to someone no one will protect it.

Another concern is that the values in the Natural Capital report are likely to be underestimated. How can you value what is priceless? It is imperative to identify who owns the values. Who do they belong to? To the people that own the land that performs the services? These people might then demand to be compensated. I want to be paid for the value or I will chop it down.

The ecological service values are a public trust like beaches, water, tidal areas. Not the goods – like a cranberry farm – they belong to an owner. This Trust Resource Doctrine has received recent support in case law in Hawaii and California. The question raised by the Trust Doctrine is: how much forest can a land owner take before infringing on the public trust value of the natural capital?

How will ecological service values be paid for? The state has no money, nor do municipalities.

When towns put in goals of natural resource protection and amend the zoning ordinance to preserve trees, the owner already asks for a payment per tree or a density bonus. However, ANJEC, NJ Conservation Foundation, SADC all state that it is not a taking and therefore no compensation is required, if you do not remove all value from the property and the town is neither “arbitrary nor capricious”.

It is frustrating that in public's mind land has value if it is built on but not if it is vacant. Education is important. What would the public pay to ensure there were songbirds in a forest?

It is hard to use the map for a site or municipality with the dollar values. It would be better to have an index of priority from 1-5 or 10 than dollars.

The current capital plan is not tied to the Master Plan so it will be hard to get Natural Capital tied to good fiscal planning.

We can't zone for open space. New Jersey needs better conservation zoning like in Lancaster PA.

Incentives

In Vermont, landowners pay reduced property taxes for maintaining the resource. No cash is paid out. The reduction in property taxes is placed in a trust so a preservation easement could be purchased for the farmland or woodland.

In New Jersey there already exists the Landowner Incentive Program where landowners are paid \$150/acre to delay mowing of grassland bird habitat and the Wildlife Habitat Incentives Program which provides technical and financial assistance for creating, enhancing and maintaining wildlife habitat on non-federal lands.

Zoning should provide for a land use pattern where if a developer is doing the right thing they get rewarded for it by expedited permits, etc. Zoning would lay out what the setbacks and clustering requirements would be depending on the ranking of the natural capital value.

The Natural Capital report could give support to a town's down-zoning so that it would not be perceived as "arbitrary or capricious".

The Plant Stewardship Index could be added to the subdivision checklist for completion. Delaware Township's woodlands protection ordinance includes patch size information as the trigger for doing the Index survey. If the result of the survey is higher than 3.6 the site is considered a high quality woodland and setback requirements are collapsed in order to protect the resource.

A cost avoidance score would be useful – if you fill this wetland or cut down forest, a developer will have created a cost.

The community facilities map process could be used to protect natural capital.

The Master Plan could be framed around the natural capital data in the form of priorities for protection.

iv) State Level Implications

The threshold of when a natural resource loses its public trust natural capital value needs to be determined by the state and enforced locally. A whole forest is providing more value than any one landowner's two acres of forest.

Could be managed in a way similar to the stormwater program where a state goal was identified and an implementation agency was identified – the municipality. The state should identify a goal that states " x% of ecosystem services of high value must be preserved." Municipalities should then be encouraged to meet this goal through incentives or penalties.

The state must adopt the data as ecosystem indicator data that towns are responsible for protecting and producing reports on whether natural capital is increasing or decreasing.

Providing a legal shield to a municipality that wanted to protect a forest on the basis of its public trust value would be helpful.

An impact fee could be levied at the county or regional level if a forest was proposed to be cut up or other resource was threatened. The State is currently the trustee of Game species.

A tax differential could be levied accounting for a greenfield's value as a natural resource. The SLERP Commission recommended higher taxes for development in Planning Areas 3,4,5.

There was thought to be a piece of legislation proposed to provide a stewardship tax incentive.

The state could endorse the use of the Plant Stewardship Index that ranks plant value based on what ecosystem they belong to. Michigan has used the Index for 25 years to prioritize acquisitions.

Restoring natural capital should be part of redevelopment planning, e.g., the Staten Island Blue Belt.

Model zoning overlay language would be helpful as overlays are easier than changing zoning.

Appendix D

Land Use Planners & Academics Natural Capital Roundtable
PlanSmart NJ 118 W. State St., Trenton NJ 08608
April 28, 2008

Attendees: Dianne Brake, PlanSmartNJ; Patrick Hossay, Stockton College; Debbie Lawlor, Meadowlands Commission; William Mates, NJDEP; Bob Melvin, Group Melvin; Noelle Reeve, PlanSmartNJ; Carlos Rodrigues, Regional Plan Association; Marty Rosen, NJDEP. (Bob Bzik, Somerset County, emailed comments in before the meeting as he could not attend.)

i) Most of the planners were not familiar with the report, *Valuing New Jersey's Natural Capital*, before the invitation to participate.

ii) Have you ever had a conversation where you wished you had the dollar value for nature?

Clearly the state has thought in the past that there is value in land that is undeveloped: the Pinelands, Meadowlands and Highlands were set up based on this principle. Pinelands credits reflect some concept of value.

Wetlands mitigation requirements also reflect a dollar value.

Towns in South Jersey have recognized the value of forests or cost of reforestation and Mantua has a tree protection ordinance, Monroe requires replacement and in Woolwich the value of open land has been articulated in order to develop a Transfer of Development Rights program for the town.

iii) How and Where in the Planning Process

The Master Plan is the key if it has more meaning. (With the way the re-examination process is allowed, a Master Plan can be 12 years out of date.) Towns need to invest in a Master Plan built around Natural Capital values. A lot of time and money are spent on a development application producing stacks of documents on traffic studies, stormwater studies, etc. This money would be better spent by developers figuring out the bigger picture outcome of their project. The Land Use Element is mandatory and that is where natural capital should be primarily considered.

Natural capital could support prioritizing open space or stream corridors, etc. in the Open Space sub-element.

Mandatory clustering would only be useful if it truly produces a village or hamlet. Otherwise a 100 acre development on 50 acres still has the same carbon footprint because it lacks density for transit and lacks mixed uses so people still drive everywhere.

Towns could use the natural capital information during site plan approval if towns had the opportunity to access pro-rata impacts for a larger array of issues than they currently can for traffic. For example, an impact could be charged for cutting down trees.

iv) Barriers

If there does not appear to be a rational connection between a town's attempts to protect natural resources and the resource, the court will overturn the town's attempts. The Builders' Association sued Woolwich and won, forcing Woolwich to "dumb down" their ordinances.

The report provides information at the state and regional level without translating it to the local level. (This is the same problem with the State Plan and Infrastructure Assessment Report and why it has not been used by towns.) Would the state be willing to translate the information for every watershed or keep the data current?

What incentive does the landowner have to protect natural capital outside of the obligations imposed by regulations when the benefits are accrued by society as a whole?

Regulations can be in conflict at the site level. Currently, to manage stormwater and direct it, a lot must be regarded, therefore losing the forest natural capital. Where master planning for stormwater has been tried (Washington Town Center) implementation has been thwarted because there was no way to do cost-sharing across property lines.

Concern expressed that with the natural capital value data available, the equation may be undertaken that whenever development value exceeds natural capital value, it is a go for development.

Another concern was that if a landowner knows he can get more for his land (because it has a higher natural capital value) he will ask the state for more and make Green Acres acquisitions more expensive for the state.

The concern was expressed that the lifecycle value of an ecosystem is not the same as the value of an acre of an ecosystem. So on the one hand the acquisition cost of an acre might not be affected but where does the threshold exist for destruction of the lifecycle value?

Because watersheds are not bound by municipalities the concept could be difficult to implement at a level lower than the county.

The cost of protecting or replacing natural capital will be pawned off to developers as an impact fee because municipalities currently rely on developers

to handle impacts because the Planning Board is not an entity that makes appropriations or bonds.

Municipalities have a very short timeframe. The current Mayor and Council are not concerned about the cost of water management twenty years from now. They are focused on short term crises. This is especially true if the municipality is focused on increasing development to meet its tax base. Even when towns get a developer to build green or grey infrastructure the town doesn't include a calculation for maintenance. They just get a one-time construction of a curb, or a wider road without thinking they will have to re-pave it late, etc.

The ranges of value provided in the report make it hard to use, especially for a site assessment. The HMDC currently uses land appraisers to set value for wetlands mitigation so would need to understand how the report values relate to a site.

Wetlands are highly regulated by the state. If these other natural capital values are not equally regulated they will be ignored.

Incentives

The information needs to be presented in such a way that towns see the direct impact and costs associated with a non-attainment groundwater area due to pollution vs one without environmental constraints. Towns would be more proactive in protection if they knew the potential public costs of not doing so.

Towns could give developers a credit for retaining trees as a stormwater benefit (if the information was available to towns).

Floodplain zoning currently indicates higher fees for development in the 100 year floodplain. Create natural capital zoning along these lines.

Development that plugs into a town's Master Plan that has been well thought through should have its permits streamlined by a technical review committee not the full Planning Board process because the public already approved the use at the Master Plan process.

v) State Level Implications

State regulation is needed to protect natural capital value. Groundwater availability does not drive land use decisions because of its external economic value, but is a scarce resource that is protected by DEP, Highlands, and Pinelands for existing and future generations.

Assessed land values could be tied to protecting natural capital values e.g., protecting prime recharge areas.

A pilot project to translate the state data to the local level would be useful.

Resolving conflicting regulations would be helpful e.g., requiring curbs and a certain amount of parking under the RSIS vs encouraging swales under LID for stormwater management.

Regional planning and utilities for stormwater management would facilitate retention of forests and their natural capital. Providing a stormwater credit towns could pass on to developers who retain forests would be useful.

A standard way of measuring ecological value is needed so swapping ecological value can be done rationally (i.e., how much forest for wetland, grassland for water quality, etc.). Therefore, if a town loses a certain number of trees to impervious surface there is a formula for knowing where to replace the trees to achieve an equivalent ecological value. Just scattering an equal number of trees around a campus will not replicate the ecosystem value of an intact stand of trees. People might use the natural capital report to provide an equivalent economic value of land they had disturbed but it might not give the same environmental return.

Currently DEP wants an apples to apples trade-off. If they could be open-minded and include a range of environmental aspects better outcomes might be produced. For example, a number of years ago Duck Island in Trenton was regraded and a forest cut down to create a wetland mitigation project.

Put carbon sequestration out front as a benefit as that has regulations developing around it and a market developing for it.

DEP should test the natural capital data against other scores used in the state (e.g., agricultural value) to see if they would be competing with each other.

Could the state create a county-wide 3-D matrix to guide acquisition: carbon sequestration, watershed value and biodiversity value?

The Hackensack Meadowlands Development Commission could perhaps use the suggestions in the document more quickly than a municipality because of its special powers e.g., permit fee reductions, expedited permits if a developer does the “green” thing like mixed use or clustered development.

The state needs to provide a score to interpret the report values. If you want someone to do something on a 100 acre lot that decision needs to have been made in the context of the 10,000 acre ecosystem the lot sits in.

Towns need training to understand how to use the data. The HMDC spends a lot of time training municipalities to go in the direction the Commission wants.

The state needs to crack the nut of TDR so the natural capital value can be protected and landowners' equity can be transferred. Towns and counties need this incentive to act. An exchange system like TDR (or as part of TDR or some tax sharing mechanism) could be developed for ecological services transfer.

Individual state agencies need to figure out which natural capital values are important to their mandate. Natural capital decisions should influence NJ Transit decisions.

Will DEP allow sewer to support new hamlets or villages or only fool itself with supporting clustering?

The state needs to assist in the creation of a market that pays for biodiversity and strengthen the market for carbon credits. A baseline year should be set so that any degradation is what gets compensated for.

A property tax adjustment should be made if an owner is preserving natural capital value. Ecological credits should be used to pay town's services.

Change the MLUL to require natural capital be considered in the Master Plan.

Move toward the New York system of land use planning where impacts are assessed when the zoning is passed not on an application by application basis. It is too late at the application stage. Form based codes code be helpful.

The state should pay more to towns to do proper master plans. A Master Plan that costs \$30,000 is easy to ignore and shallow.

Use RGGI dollars for land use planning pilot.

Do a % flat rate for natural capital like is being proposed for COAH.

Appendix E

Natural Capital Interviews

Jennifer Senick, Executive Director of the Rutgers Center for Green Building at the Edward J. Bloustein School of Urban Planning and Policy Development (also Redevelopment Officer for Highland Park, former Chief Redevelopment Officer for Patterson) **4/17/08**

i) Not aware of the report, *Valuing NJ's Natural Capital*.

ii) How and Where in the Planning Process

Zoning is key to protecting natural capital value. Conservation development should be allowed by right in the zoning so no special approvals are required. The municipality can add conservation design to the permitted uses in an existing district or the municipality can create a conservation design district or form based code as an overlay district (including in redevelopment areas).

Zoning ordinances for green design are part of the LEED neighborhood design process. Paul Pogorzelski is writing green ordinances for Hopewell Township in Mercer County based on a Green Buildings project Jen led, to be reviewed by the Planning Board June 10, 2008.

iii) Barriers

There is no capacity at the municipal level. Planners can barely keep up with day to day work.

Municipal officials have short time horizons and ecosystem services protection requires considering the long term impacts.

Even with the new data from the DEP report, the information is still an externality. Municipalities need a way to operationalize the information. It is not clear who the ecosystem service provides value for besides the too general concept of "everyone."

If ecosystem services were to be protected, who would monitor that they are continuing to be protected?

Incentives

If towns had a code to follow for what it meant to protect ecosystem services (e.g., low impact site development), reduced fees for permits or expediting of permits could be a possibility as the Meadowlands has done for Green Buildings. Highlands Park hasn't expedited permits but in its redevelopment area can lay out the parameters of how it would like to see development occur.

iv) State Level Implications

Focus on forests as wetlands and beaches have protection already. If you identify the different types of value the resource possesses and who is interested in that value you can identify how to protect it. For example, one value forests possess is carbon sequestration. Utilities are a group that are being regulated to reduce greenhouse gases so they may be interested in making payments to save forests to obtain the benefit of carbon sequestration.

A trading mechanism is needed to make this a viable prospect, something equivalent to Solar Renewable Energy Credits (SRECs) that pay you cash annually are needed to incent individuals and municipalities to protect natural capital.

Another idea would be for the state to identify the value of forests as an energy system e.g., in cooling buildings. Stockton College has gone a step farther with this in combination with their geothermal energy wells.

The state tax credit for forested lands should be reviewed. Currently a landowner must harvest an amount of their forested land each year to be considered managing a woodlot in order to receive the tax credit. Natural capital would be protected better without the harvesting.

The state regulates energy use of buildings through insulation requirements in the ASHRAE standards of the energy subcode, based on NOAA data on degree days. Perhaps development could be regulated through degrees of impact allowed with regard to the natural capital data.

Note to file: Jen suggested I investigate SRECs and LEED further.

The following is a summary of an article I found on-line by Renewable Energy World, written September 14, 2007 called **New Jersey Establishes REC-Only Market for Solar**

<<http://www.renewableenergyworld.com/rea/news/story?id=49955>>.

Last year BPU approved the transition of New Jersey's solar program from an up-front rebate system to a commodity market based upon Solar Renewable Energy Credits (SRECs).

The key is the state set renewable energy goals requiring utilities to generate 22.5 percent of their electricity from renewable resources by 2020 with two percent of that renewable energy procurement obligation to come from solar energy.

The BPU established a solar market that focuses on the sale of SRECs. Under the program, solar system owners earn SRECs for solar electricity production, which are registered and traded among electricity suppliers and other buyers within an established infrastructure. Electricity suppliers are required to buy the SRECs, or pay a Solar

Alternative Compliance Payment (SACP) in lieu of purchasing SRECs. Earlier this week, the Board set an 8-year schedule for the SACP. Full implementation of the SREC program will begin around March of 2009 after a hearing process, comment period and final approval by the Board.

Because of delays in application approvals associated with the popularity of up-front rebates, the BPU decided that the SREC-only system is the best way to ensure rapid adoption of solar in New Jersey. And because the system is not tied to a budget, said Mike Winka, Director of the BPU's Office of Clean Energy, there will be no chance that the budget will run out or that it will be diverted to another program.

"There is no one pot of dollars for this program. Here, you're setting a structure that's going to put the money into the financial market and is never going to be touched by a state regulator," said Winka.

The Board also said that the SREC program will safeguard against prohibitive electricity costs by including a limit on the total cost to ratepayers of meeting the solar RPS.

LEED's *Pilot Neighborhood Development Rating System* chapter on "Smart Location" includes criteria for:

- protecting imperiled species and ecological communities;
- conserving water quality, natural hydrology and habitat and biodiversity through conservation of water bodies or wetlands;
- restoration;
- conservation management; and
- preserving irreplaceable agricultural resources by protecting prime and unique farmland and forest lands from development.

<<http://www.usgbc.org/ShowFile.aspx?DocumentID=2845>>

Natural Capital Interviews

Jon Carnegie, Exec. Director Voorhees Transportation Center, Rutgers University (Planning Board member and former Chair, Highland Park, former consultant planner for Metuchen, Vernon with Looney, Ricks, Kiss) **4/18/08**

i) Not aware of the report, *Valuing NJ's Natural Capital*.

ii) How and Where in the Planning Process

Master Plan seems appropriate place for inserting natural capital information. It seems like natural capital is a different take on the Natural Resource Inventory but thinking more systematically than looking at each resource separately. Right now the NRI could use some advancement in the Master Plan Process so maybe natural capital information would bolster these considerations. The town sends the signal that if the developer embraces natural capital considerations it will benefit their application.

Acquisition decisions could also benefit from the natural capital information for helping to prioritize open space and farmland preservation.

iii) Barriers

Under the MLUL, the land development process is very strict. Review and approval are based on certain criteria being met. If a proposal meets those criteria – within the building envelope, setbacks, parking spaces – and receives permit approvals from DEP (e.g., for wetlands) the Planning Board can't deny a proposal.

For example, Highland Park will be considering an application to subdivide two adjacent lots into three parcels. There are a number of very old, large trees on the site and even though Highland Park has a tree protection ordinance, the Planning Board will not be able to refuse the subdivision permit with its outcome that the trees will be removed.

We have lots of information right now about the benefits of Smart Growth, etc. but zoning is still not giving us what we want for our communities.

Has a concern about whether the information can be presented at the municipal level (the maps are at HUC 11 watershed level).

In many towns there is a disconnect between environmental information (NRI) and decision-makers.

Incentives

Possibly tie the developer using the natural capital information to planning review process as one determination of completeness of application. Time is money for

developers so it would be to their benefit to show they have included natural capital considerations.

Voorhees did a survey of developers who want to build Transit Oriented Design projects asking them how they would rank a set of incentives. The number one incentive was supportive zoning. Number two was a quicker approval process to do what the town says it wants.

iv) State Level Implications

Maybe natural capital information could be one criteria for Planning Area definition or delineation.

Maybe do some pilot programs with towns that are planning to update their Master Plans to see how it would look if a town used the natural capital information as the organizing principle to frame the master plan around.

Natural Capital Interviews

Jaclyn Rhoads, Director for Conservation Policy, Pinelands Preservation Alliance

4/22/08

i) Aware of the report, *Valuing NJ's Natural Capital*.

ii) How and Where in the Planning Process

In open space acquisition the report could be useful for prioritizing acquisitions. It might make a difference at the individual level when someone is making up their mind whether to preserve land or not if they knew that the natural capital value was “x” and they were contributing to preserving that value.

iii) Barriers

Unless the dollar value identified in the natural capital report translates into actual money to go into a municipality's budget, the report won't make a difference.

It is hard for current agricultural preservation or open space preservation programs to compete with the market price of the land. You have to just look for individual farmers who value nature already in order to find someone willing to preserve their land.

The resource value extends beyond the municipal level but it is not managed at a regional scale.

Incentives

Towns would need some kind of property tax relief for protecting natural resources.

iv) State Level Implications

Education statewide is needed so that constituents will exist who say that natural capital matters to them so the local government will take the issue seriously. We have technical processes that work to identify natural capital (e.g, Natural Resource Inventories). But the political process is not working because the NRI is not on the radar screen of the Planning Board.

There needs to be a balanced consideration of access to natural capital. For example, according to DEP's perspective, a wetland is protected for animals. But when no trail is allowed, the wetland loses friends. Maybe the natural capital report could be used to augment management of natural resources so that some are purely pristine for nature and some allow limited access to build goodwill and support for nature.

Natural Capital Interviews

Tim Dillingham, President, American Littoral Society 4/23/08

i) Thought the report was going to be used by DEP internally for Natural Resource Damages, etc.

ii) How and Where in the Planning Process

The Master Plan is where this makes sense because these values represent long term considerations and the Master Plan also has a longer term time frame.

iii) Barriers

Short term political considerations and a focus on short term benefits outweigh long term benefits of ecological services.

Have some concern that the report feels it can ascribe the full value of ecosystem services. The Littoral Society believes there are intrinsic value services that don't have a market value that aren't captured by the report, e.g, in maintenance of the functioning of the planet.

Incentives

The information has to be translated into something towns can see an immediate benefit from. There needs to be a market for the values so towns get paid for doing the right thing.

iv) State Level Implications

It would be helpful if the state supported this information on the web so that the benefits of social networking could be brought to bear on changing people's awareness and attitudes. Education is the key so that there is a constituency for politicians to respond to.

Natural Capital Interviews

Tracy Carluccio, Delaware Riverkeeper and Highlands Council **4/24/08**

i) Using information from the report, *Valuing NJ's Natural Capital*, in a paper the Riverkeeper is writing to alert communities to the resources they have. They also see a use for the report for natural resource damages.

ii) How and Where in the Planning Process

The information could be useful in the Master Plan. The information could also be useful in stormwater management because the Riverkeeper advocates the use of “in place systems” for managing stormwater.

iii) Barriers

People are not used to putting a dollar value on nature so it doesn't have a level playing field. People are used to putting the emphasis on the dollar value of structures not natural services so it isn't part of the thinking process.

Incentives

A manual or how-to guide to including natural value in decisions would be helpful.

iv) State Level Implications

It needs to be regulated at the state level, like stormwater, to give municipalities a framework to operate in.

Note to file: This was a brief discussion right after the Environmental Roundtable when Tracy called and apologized for not being able to make the meeting.

Gary Toth, Senior Director, Project for Public Spaces (and 23 years at DOT) **5/1/08**

i) Not aware of the report, *Valuing NJ's Natural Capital*.

ii) How and Where in the Planning Process

No politician or mayor can run on the benefits of long term ecological services. No one can say “elect me” and your tax rate will stay the same ten years from now when we don't have to put in a filtration plant.

It could be useful in the Master Plan.

iv) State Level Implications

It needs to be regulated at the state level because the benefits are too vague to be implemented at the local level.

Note to file: This was a brief discussion at the beginning of a meeting on Sustainable Transportation at the local level where Gary was advocating DOT's manual on *Mobility and Community Form* which took a regional system (traffic) and provided recommendations for increasing Smart Growth/livability at the local scale. Why not Ecosystems and Community Form?

Appendix F

Annotated Literature Review

Beatley, Timothy. 2000. Preserving Biodiversity: Challenges for Planners. *APA Journal* 66(1): 5-20.

Taking as his starting point that one third of U.S. plant and animal species are imperiled or vulnerable from habitat destruction due to low density urban, suburban, and ex-urbanization, Beatley calls for land use planning efforts that are “multispecies in emphasis and protect the integrity of broader habitats and ecosystems.” He suggests following plans such as *Austin Tomorrow* which used ecological analyses to pick a growth corridor that minimized ecological damage. Going beyond protecting habitat corridors to contain urban growth in a compact form is advocated as is protecting green infrastructure.

Specific tools proposed for protecting biodiversity included: Habitat Conservation Plans, GAP Analysis, adopting a statewide ecological network such as Florida’s Greenways Implementation Plan (funded through a document stamp tax), Oregon’s Metro Greenspaces masterplan (funded through a bond costing \$12/yr per homeowner, the cost of a cheap haircut), conservation banking, mitigation fees, transfer of development rights, fiscal and financial incentives (beyond CREP and Partners for Fish and Wildlife), inclusion as an element in the local comprehensive plan, an addendum to the local budget, biodiversity audits, and safe harbor agreements.

One additional interesting implication made by the article is that by identifying species that might be listed as endangered and identifying restoration costs needed, these costs could be avoided if natural capital were protected in the first place. [Are towns liable for restoration costs or only the federal government?]

Bowler, Stephen and D.J. Hirschman. 2003. The Albermarle County Rural Area as a Source of Watershed Ecosystem Services. County of Albermarle, VA, Charlottesville, VA.

This article identifies indicators for connecting watershed services to land use planning in measurable ways including: effective impervious cover from land cover data, presence of waterway buffers, percent forest cover, percent open space, and parcel size.

The article also recommends valuing watershed services in the way preservation of agriculture, forestry, historic resources, etc are weighted and ranked in Rural Area planning zones in Virginia. It also recommends using Rural Preservation Developments, land use taxation, easement donations, cost-share programs, and conservation easements to protect priority land.

Objectives suggested for inclusion in master plans include: miles of streams with buffers and percent forest canopy. Estimating the cost of finding an alternative to key watershed services is suggested e.g., water supply. Apply Low Impact Development concepts in site design.

Brody, Samuel, et al. 2006. Measuring the Adoption of Local Sprawl Reduction Planning Policies in Florida. *Journal of Planning Education and Research*. 25: 294-310.

This article evaluated 46 comprehensive plans in Florida and found socioeconomic and demographic characteristics influenced the adoption of sprawl-reduction planning policies (SRPPs). Five SSRPs were examined: transfer of development rights, conservation easements, clustering, environmental mitigation/restoration, and density bonuses.

The regression analysis found that jurisdictions with wealthier populations have lower SSRPs while those with higher levels of education and planning capacity have higher SSRPs.

Bengston, David. 2003. Public Policies for Managing Urban Growth and Protecting Open Space: Policy Instruments and Lessons Learned in the United States. *Landscape and Urban Planning*. 69:271-286.

This article reviews policies for managing urban growth and protecting open space and concludes that “administrative efficiency and other details of policy implementation—rather than the type of policy—determine effectiveness”; “the use of multiple policy instruments that reinforce and complement each other is needed to increase effectiveness and avoid unintended consequences”; “meaningful stakeholder participation is a cornerstone of effective growth management”.

Brown, Katrina. 2003. Integrating Conservation and Development: A Case of Institutional Misfit. *Frontiers in Ecology and the Environment*. 1 (9): 479-487.

This article asserts that the integration of conservation and development in poor countries has proven difficult because of a mismatch between institutions and ecosystems and between different groups of stakeholders. The article proposes to include people in the concept of biodiversity and develop adaptive co-management strategies that promote resilience, sustainability and respect for anarchy (e.g. allowing extractive reserves) and inclusionary decision making to overcome the mismatch. Interestingly, the article proposes to increase property rights at various scales (to overcome the problem of common resources) and a federation rather than hierarchical structure for managing the resource.

While focused on a case study in Nepal, Table 4 provides a useful template for assessing potential sources of misfit between local planning processes in New Jersey and natural capital consideration.

Cathcart, James, et al. 2007. Carbon Storage and Oregon's Land Use Planning Program. *Journal of Forestry*. 105 (4):167-172.

This article examines the impact of Oregon's land use planning on maintaining forest and agricultural zones while limiting growth to within urban growth boundaries. The analysis further determines the effect land use planning has had on carbon storage (by estimating average carbon stocks for different land uses) and concludes that carbon storage through land use planning has led to a reduction of 1.7 million metric tons of CO₂ emissions per year.

Chan, Kai M.A., et al. 2006. Conservation Planning for Ecosystem Services. *PLOS Biology*. 4 (11): 2138-2152.

This article examined how to integrate biodiversity and ecosystem services in a conservation plan for the Central Coast ecoregion of California to achieve the greatest biodiversity protection. Targeting six ecosystem services directly (crop pollination, forage production, carbon storage, flood control, outdoor recreation, and water provision) resulted in 44% loss of biodiversity. Targeting biodiversity and four ecosystem services (carbon storage, flood control, outdoor recreation, and water provision) offered more promise as only 7% of biodiversity was lost. The analysis was based on understanding how much of each service was being generated by each land parcel using MARXAN v1.8.2.

Chesapeake Bay Foundation. 2008. *The Critical Area Act: Intent, Reality and the Need for Reform*. < www. > Accessed 2/22/08.

Maryland's Critical Area Act was created in 1984 to minimize damage to water quality and natural habitats by strictly managing development within 1,000 feet of the Bay's tidal waters. While analysis found that the majority of development had shifted away from sensitive areas to Limited Development Areas, the report asserts that the law has failed because of variances (approved 76% of the time), exemptions (approved 85% of the time), and development resulted in the loss of 6,000 acres of Critical Area land being developed in four counties. It also presents evidence that the Commission has insufficient jurisdiction to define and enforce regulations to protect the Critical Area.

In particular, the report criticized the lack of an assessment of cumulative impacts as site plans, subdivisions, variances and other applications were reviewed on a project-by-project basis; the low number of fines issued compared to the number of violations; and the failure of growth to meet the standards set for conserving natural lands (compact, higher density, well located).

Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems. 2004. *Valuing Ecosystem Services: Toward Better*

Environmental Decision-making. Water Science and Technology Board, Division on Earth and Life Studies, National Research Council of the National Academies. Washington, D.C.: The National Academies Press.

This report identifies methods for assigning economic value to ecosystem services and calls for greater collaboration between ecologists and economists in such efforts. It recommends when possible, concepts of willingness to pay or willingness to accept should be included in an analysis. Value should be measured in a way that makes analysis of trade-offs possible. The benefits and costs associated with the *changes* in an ecosystem service must be evaluated. Measure changes in ecosystem services, rather than the value of an entire ecosystem. Make sure that economic and ecological models are appropriately linked. Seek to value the goods and services most important to a particular policy decision. Base economic valuation of ecosystem changes on the total economic value framework by including both use and nonuse values. Consider all relevant impacts and stakeholders.

deGroot, Rudolf S., et al. 2002. A typology for the Classification, Description, and Valuation of Ecosystem functions, Goods and Services. *Ecological Economics*.

This article provides a framework for analyzing the value of 23 ecological services by either direct market pricing, indirect market pricing, contingent valuation, or group valuation.

Ecosystems Services Council. 2007. National Ecosystems Services Council Formed to Promote Expansion of Environmental Trading Practices. <<http://www.sustainablenorthwest.org/quick-links/press-room/press-releases/national-ecosystem-services-council-formed-to-promote-expansion-of-environmental-trading-practices>>

An alliance of business, environmental and government leaders in Oregon have created an Ecosystem Services Council, the first non-profit to establish an ecosystem services marketplace going beyond carbon markets. The Council intends to advance the pace and effectiveness of the U.S. investments in environmental restoration by modeling the U.S. Green Building council's certification program.

Egoh, Benis, et al. 2007. Integrating Ecosystem Services into Conservation Assessments: A Review. *Ecological Economics*. 63:714-721.

The authors identify 16 ecosystem services ranging from carbon sequestration, supporting productive soils, to recreation. They assess the frequency of the inclusion of ecosystem services in conservation assessments and find that ecosystem services are infrequently included. One reason for the lack of inclusion is the difficulty in identifying beneficiaries of the services. The article also emphasizes the difference between biodiversity protection through

acquisition by conservation agencies and ecosystem services protection through resource management.

The authors identify tools such as irreplaceability analysis, and payment for services as methods of prioritizing and protecting ecosystem services.

Forman, Richard and Sharon Collinge. 1997. Nature Conserved in Changing Landscapes With and Without Spatial Planning. *Landscape and Urban Planning*. 37:129-135.

Grossman, Elizabeth and Laura Watchman. Assessing the Wealth of Nature Using Economic Studies to Promote Land Conservation Instead of Sprawl. <www.defenders.org/assessingwealth > Accessed on 2/18/08.

Describes examples of natural capital education for planners in Florida, Colorado, Arizona, Oregon, Illinois, Ohio, Michigan, Massachusetts, Connecticut, Maryland, Kentucky, and North Carolina. However, changes to the planning process were only achieved in Colorado, Florida and Illinois.

In Colorado a new land use planning rule encouraging clustering was adopted and a purchase of development rights program through a tax that averaged \$20 per property. In Florida the study *Investing In Nature* contributed to a provision in a growth management act passed in 2005 that encourages local governments to review the benefits of all land uses for any proposed new developments outside the urban service boundary including economic value of conservation lands. In Illinois tree planting and restoration occurred in several cities including Chicago following the release of the report showing heating and cooling costs were reduced by \$50-\$90/ dwelling when tree cover was increased 10%.

Kahan, Joshua. 2007. *A Framework for Ecosystem Services Conservation Zoning: An Integration into Land Use Planning*. Philadelphia, PA: University of Pennsylvania.

This article is very theoretical and provides “an ecosystem service conservation zoning framework” i.e., ways to think about ecosystem services but does not provide an ecosystem services zoning ordinance. It argues that investing in conservation of services is “similar to investing in other necessary...infrastructures” especially in the context of the degradation to services that has occurred. It advocates a cost benefit approach to determine if “expected costs might be offset by payments for environmental services”.

It advocates developing functional inventories of Ecosystem Service Providers (key species) based on the Millennium Ecosystem Assessment to monitor whether the services are being retained or degraded. It also advocates market incentives for sustaining the ecosystem services (tradable permit schemes, credit based programs, and resource banking). It relies heavily on the

concept of conservation zoning (referenced from Australia) but does not relate the concept in a U.S. context.

Meck, Stewart and J. Zelinka. 2007. *Planning and Zoning in New Jersey A Manual for Planning and Zoning Board Members*. New Brunswick, NJ: Center for Government Services, The State University of New Jersey.

This manual provides a detailed description of the planning process in New Jersey. It describes the composition of planning and zoning boards in New Jersey and their roles in reviewing master plans and the various types of development applications allowed under the *Municipal Land Use Law*.

Millenium Ecosystem Assessment: A Framework for Assessment. Island Press: Washington D.C. 2003.

The MA classifies ecosystems along the functional lines of: provisional services e.g. ; regulating services; cultural services; and supporting services. It suggests indicators for assessing policy decisions must relate directly to policy options, goals, or targets (such as the Millennium Development Goals) and must:

- ⌚ capture change over time;
- ⌚ identify critical thresholds or the irreversibility of a change;
- ⌚ provide early warning; or
- ⌚ characterize the optimal, sufficient, or insufficient level of a given ecosystem service.

Ontario Ministry of Natural Resources. 2005. *Protecting What Sustains Us Ontario's Biodiversity Strategy*. Toronto:OMNR. <www. > Accessed on 1/6/08.

This strategy identifies four ecological regions; sets two biodiversity goals (protect the genetic, species and ecosystem diversity of Ontario and use and develop the biological assets of Ontario sustainably to capture benefits); identifies specific plans for biodiversity to be directed by (e.g., the Greater Golden Horseshoe Growth Management Plan, Greenbelt Protection Plan, Natural Heritage System); and identifies specific elements for Significant Habitat and Natural Heritage within Municipal Official Plans.

Opdam, Paul, et al. 2006. *Ecological Networks: A Spatial Concept for Multi-Actor Planning of Sustainable Landscapes*. *Landscape and Urban Planning*. 75: 322-332.

This article suggests that species diversity targets are necessary to determine the spatial scale that is relevant to that target in order to influence land use development. It admits that “an unsolved problem is how much species diversity of what kind we need in which regions to fulfill the requirement that the services delivered by biodiversity are maintained for future generation” and takes as its starting point the assumption that a regionally defined conservation aim exists.

The article proposes ecosystem networks as the spatial bridge between site conservation in a steady state and spatial change “by spreading the risk of local change across the landscape”. Ecological networks are made up of four features (total network area, quality, network density and permeability of the matrix) as distinct from greenways which are linear or sites which are disconnected.

Oregon Department of Forestry. 2007. Client Meeting Summary.
<<http://oregon.gov/ODF/BOARD/FRTAC/PNWClientMeetingSummary.pdf> >

This summary describes the results of a meeting of 180 family forest owners, industry, farmers, environmentalists, land trusts, bankers, farmers and government officials to identify interest in and barriers to developing an ecosystem services market for water quality, quantity, wetland mitigation, species conservation banking, recreation, habitat restoration, flood storage credits, and carbon.

Incentives include: leasing of services rather than one-time payment; recognition of past good stewardship; better coordination of regulatory agencies; third party certifiers for credits, federal regulations that create demand (e.g. carbon emission cap); rapid permitting for early adoptors; clear description of risks; and multiple agencies working together on a geographic area.

Barriers include: difficulty with regulatory hurdles; uncertainty of market; no legal framework; incentives under funded; and regulatory agencies are too narrowly focused.

Pejchar, Liba, et al. 2006. Evaluating the Potential for Conservation Development: Biophysical, Economic, and Institutional Perspectives. *Conservation Biology*. 21(1): 69-78.

Conservation development is an alternative to low density residential development. Conservation development clusters homes on one part of a property the “manage the most ecologically important land for the conservation of biodiversity and ecosystem services”. This article assesses the benefits and shortcomings of conservation development for developers, homeowners, and the environment.

It emphasizes that simply “setting aside land may be insufficient...conservation development must occur in the context of regional planning...[with] property-level ecological resource assessment.” It also emphasizes that local jurisdictions will need to use incentives to achieve the ecological benefits desired.

Pendall, R. 1999. Do Land-use Controls Cause Sprawl? *Environment and Planning B: Planning and Design*. 26:555-571.

This article analyzes the attempts made to reduce sprawl in the US and concludes that “land use controls that shift the cost of development to builders and away from the general public reduce sprawl; those that mandate low densities cumulatively increase sprawl, whereas urban containment systems have limited cumulative effects.” In addition, jurisdictions that use property taxes to fund services and infrastructure tend to “sprawl more than those that rely on a broader tax base”.

The author recommends that local government growth management programs seeking compact development should “make growth pay its own way” but not use annual limits on building permits or low density zoning.

Smith, Robert J. et al. Revisiting the Links Between Governance and Biodiversity Loss. *Conservation Biology*. 21 (4) 899-906.

Taylor, Jason J. et al. 2007. Preserving Natural Features: A GIS-based Evaluation of a Local Open Space Ordinance. *Landscape and Urban Planning*. 82:1-16.

This article reviews the outcome of a local open-space ordinance on the preservation of natural features in Fenton Township, Michigan. The authors looked at development on twenty lots (10 before the ordinance and 10 after the ordinance). They found that the ordinance did not fully achieve its objectives – open space was preserved but significant features were not.

The authors recommend that a specific definition of natural features be included in the ordinance along with a requirement that they be preserved (i.e., not developed within or directly adjacent to); and that a spatial context for design be included (i.e., define a pattern of land covers and uses appropriate to the types of sites in the town).

Termorshuizen, Jolande et al. 2006. Incorporating Ecological Sustainability into Landscape Planning. *Landscape and Urban Planning*. 79:374-384.

This article proposes a framework for screening to determine how well ecological considerations are included in planning. The assessment is broken into two categories: i) awareness on the part of decision-makers of the need to consider ecological benefits and ii) the level of ecological data included in the plan. There are fifteen criteria for assessing awareness and six criteria for assessing the quantitative conditions of the plan.

Though developed in the Netherlands, these criteria should be useful as potential benchmarks for New Jersey planning.

Theobald, David, et al. 2000. Incorporating Biological information in Local Land-Use Decision Making: Designing a System for Conservation Planning. *Landscape Ecology*. 15:34-45.

This article points out that urbanization occurs disproportionately on lands with high levels of biodiversity (fewer than 10% of endangered species occur exclusively on public land). It calls for local, bottom-up approaches to impact land use decision-making based on accessible information. The authors led a collaborative design team made up of potential users (a county commissioner, planner, developer, land owner, wildlife manager, and some environmental advocates) and technical experts (ecologists, geographers, a land use attorney, and computer programmers) to produce a spatial database to address three parts of the local land use planning process: master planning, site review, and assessment of cumulative impacts.

Seven conservation principles to be used as the basis for planning were distilled from the literature and translated into map requirements for the planning process represented by potentially suitable habitat (based on Landsat vegetation mapping). For site planning, a user could then click on the map and the system would build a report describing the biological attributes for the area and produce a “concerns if developed” report. For master planning, maps were prepared ranking areas that were and were not valuable for habitat to help planners “steer concentrations of development away from high value areas in the same way development is encouraged to avoid viewsheds, floodplains and unstable soils”. Three maps were created: local diversity maps, patch maps, and corridor movement maps. Finally a simulation of the effects of build-out on wildlife habitat was produced showing at low existing densities “the addition of even a few house has large effects”. Data was supplied for areas as small as 50 ha to provide sufficient detail for both long and short range planning and for monitoring conversion of land (e.g., from agricultural to residential land use.)

Two counties in Colorado adopted the mapping into their planning processes. The design process emphasized the finding that “citizens participating in the planning process will not support what they do not understand” and therefore planners must be provided with information that is scientifically based but related to citizen goals. “Therefore, the success of a model should not be measured by its ability to make accurate predictions, but rather by a user’s ability to make and communicate the basis for a decision relative to a clearly articulated goal.”

Theobald, David and N. T. Hobbs. 2002. A Framework for Evaluating Land Use Planning Alternatives: Protecting Biodiversity on Private Land. *Conservation Ecology* 6 (1):5 < <http://www.consecol.org/vol16/iss1/art5/> > Accessed on 2/22/08.

This case study from Summit County Colorado provides information on how to integrate habitat considerations into land use planning using alternative

scenario testing and indicators to evaluate the alternatives. The indicators include: total length of roads, total number of units predicted, total acreage of critical habitat affected and fragmentation.

Turner, R.K. and G.C. Daly. 2008. The Ecosystem Services Framework and Natural Capital Conservation. *Environ Resource Econ.* 39:25-35.

This article describes the capital assets of ecosystems and provides examples where governments have recognized these assets and conserved them: in New York, California, China, Costa Rica, and the UK.

Wilson, Kerrie et al. 2007. Conserving Biodiversity Efficiently: What to Do, Where and When. *PLoS Biology.* 5(9):1850-1861.

This article proposes a framework for guiding the allocation of funds among alternative conservation actions that address threats to ecosystems rather than simply purchasing land. The authors assert that within the 17 ecoregions studied (of the 39 Mediterranean climate ecoregions worldwide) more plant and vertebrate species could be protected by targeting threats (e.g., invasive species, fire management) than by land acquisition.

Appendix G

Bibliography

(Sources not otherwise listed in the Annotated Literature Review)

Arendt, Randall. "Open Space Zoning: What It Is and Why It Works" *Planning Commissioners Journal* Issue 5 July/Aug 1992.

Benedict, Mark and E. McMahon. 2001. *Green Infrastructure: Smart Conservation for the 21st Century*. Sprawl Watch Clearinghouse Monograph Series <www.sprawlwatch.org/greeninfrastructure.pdf>

Brake, Dianne, A. Brady, C. Stark. 2000. *The Green Infrastructure Guide*. Regional Planning Partnership.

Center for Neighborhood Technology. "Green Values Stormwater Calculator". 2004. <<http://greenvalues.cnt.org/calculator>>

Environmental Protection Agency Office of Water. 2008. *Managing Wet Weather with Green Infrastructure Action Strategy 2008*. <www.epa.gov/npdes/greeninfrastructure>

Globe Foundation. "Valuation Profession Declaration" *Vancouver Valuation Summit Conference* March 2, 2007 <http://www.vancouveraccord.org/pdf/VVS_Vancouver_Accord.pdf>

Green Budget Coalition. 2008. *Meeting the Challenge: Recommendations for Budget 2009 Climate Water Nature*. <www.greenbudget.ca/main_e.html>

Hecht, Joy. "Environmental Accounting Where We Are Now Where We Are Heading". *Resources* Issue 135 Spring 1999. <www.rff.org/rff/Documents/RFF-Resources-135-enviroaccount.pdf>

Lepkowitz, Marc. "Green Infrastructure Making the City a Sponge" online posting Green City Blue Lake Nov 27, 2007. <<http://www.gcbl.org/blog/marc-lefkowitz/green-infrastructure-making-the-city-a-sponge>>

Mehan, Tracy. "Coping: Adapting to Climate Change in the Great Lakes Basin". *Preparing for Climate Change in the Great Lakes Region Conference* June 27, 2008. <<http://www.miseagrant.umich.edu/climate/workshop/images/COPING.pdf>>

Milwaukee Sewer District. "Greenseams". <www.mmsd.com/Greenseams.aspx>

National Roundtable on the Environment and Economy. 2003. *Securing Canada's Natural Capital A Vision for Nature Conservation in the 21st Century*. Ottawa: Renouf Publishing.

Nordhaus, W.D. and E.C. Kokkelenberg. 1999. *Nature's Numbers Expanding the National Economic Accounts to Include the Environment*. Washington, D.C.: National Academy Press.

<<http://www.nap.edu/openbook.php?isbn=0309071518>>

Olewiler, Nancy. 2004. *The Value of Natural Capital in Settled Areas of Canada*. The Nature Conservancy of Canada and Ducks Unlimited.

<www.ducks.ca/aboutduc/news/archives/pdf/ncapital.pdf>

Orfield, Myron and T. Luce. 2003. *NJ Metropatterns A Regional Agenda for Community Stability in New Jersey*. NJ Regional Equity Coalition.

<www.njregionalequity.org>

Rutherford, Susan. 2007. *The Green Infrastructure Guide: Issues, Implementation Strategies and Success Stories*. Vancouver, B.C.: West Coast Environmental Law Association. <www.wcel.org/wcelpub/2007/14255.pdf>