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ANALYZING THE EFFECTIVENESS OF THE NEW JERSEY PINELANDS MANAGEMENT PLAN

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ABSTRACT: *This paper investigates the changes of urban development within the New Jersey Pinelands between 1995 and 2002 in an attempt to determine whether the Pinelands Comprehensive Management Plan (PCMP) has been effective in controlling development within the Pinelands. Since 1981, land development in the region has been controlled by the PCMP. One of the roles of the plan is as a set of guidelines to push development into the desired areas and keep development out of areas that are preserved. As a result, the PCMP divides the Pinelands into nine planning areas allowing varying levels of development and housing densities within those zones. The study examines the effectiveness of the plan by comparing urban growth in the Pinelands to the rest of New Jersey, comparing urban growth among the nine management areas, and documenting the specific categories of urban development that have occurred within each management area. Utilizing Geographic Information Systems (GIS), land use/land cover data from the New Jersey Department of Environmental Protection (NJDEP) for 1995 and 2002 was processed and analyzed at these three levels. The results confirm that urban growth is occurring at a slower rate within the Pinelands than the rest of New Jersey and the majority of new urban development did occur inside the growth areas. Furthermore, the categories of development were largely consistent with the goals of each planning area. The findings indicate that the PCMP has had a positive effect in controlling development in the New Jersey Pinelands*

Keywords: *Planning, Management plan, Land development, Pinelands, New Jersey*

INTRODUCTION

As the most densely populated state in the nation, New Jersey remarkably contains one the largest unbroken stands of forest along the eastern seaboard. The New Jersey Pine Barrens (also known as the Pinelands) is a one-million acre pine and oak forested area located in the outer coastal plain of the southern portion of the state. The unique and fragile ecosystem of the Pinelands has been widely recognized not only by state, but also nationally and internationally. In 1978, the National Parks and Recreation Act established the Pinelands as the nation's first national reserve, and in 1988, the United Nations (UN) designated it a Biosphere Reserve.

The Pinelands does not have the fortune of being located in a distant region, unaffected by the demands of new land development. It is bound by the suburbs of four major cities. As seen in Figure 1b, Philadelphia is located to the west, both Trenton and New York City to the north, and Atlantic City to the east. The importance of protecting this unique resource in the face of these tremendous development pressures led to a course of action mandated by state, federal and UN resolutions. The result was the creation of a commission to oversee the management of activities within the region and the creation of the Pinelands Comprehensive Management Plan (PCMP) to guide and coordinate preservation and development throughout the region.

Regional planning is difficult in New Jersey as it is a strong home rule state. Local towns fiercely defend their purview to manage their own land use decisions. Each of the 53 local municipalities found within the PCMP are primarily responsible for their own land use planning. The prospects of creating a regional plan that was able to effectively address the preservation goals of the region while maintaining local land use control was daunting. The PCMP took a collaborative approach in order to develop buy-in and consensus of the municipalities who are within the PCMP. This was accomplished by coordinating the land planning activities between towns while attempting to maintain local planning decision making. Concerns over property values (Beaton,

1991) and political acceptability were poised against ecological preservation goals (Good and Good, 1984).

Furthermore, the diverse set of objectives for the PMCP were not just to be achieved by imposing strict regulation but through a multi-pronged approach that would experiment with new concepts such as Transfer of Development Rights (Johnston and Madison, 1997) and collaborative consensus making between national, state, and local stakeholders (Innes, 1992). The resulting PCMP was unique in the U.S. at the time and has been held up as a model of regional planning for subsequent plans such as the Highlands Regional Master Plan (Highlands Council, 2007). However, this claim of Pinelands success has had little empirical verification.

Twenty-five years after its creation, the Pinelands Commission and the Comprehensive Management Plan have long been in place and have been influencing development activity. But how well has the PCMP fared in accomplishing its stated goals of promoting "orderly development of the Pinelands so as to preserve and protect the significant and unique natural, ecological, agricultural, archaeological, historical, scenic, cultural and recreational resources of the Pinelands (Pinelands Commission, 2006)?" Past research has suggested some positive impact of the PCMP from a biosphere reserve approach (Walker & Solecki, 1999). Hasse and Lathrop (2002) demonstrated that growth patterns within the various zones of the Pinelands exhibited indications of consistency with the PCMP up through the year 1995. However, more current data and more direct analytical approaches could provide a better indication of actual effect on development patterns. This paper explores the success of the PCMP by examining urban development between 1995 and 2002. This was done by comparing urban growth in the Pinelands to the rest of New Jersey, comparing urban growth among the nine management areas, and documenting the specific categories of urban development that have occurred within each management area.

The Pinelands Comprehensive Management Plan

The PCMP is a regional plan that designates several different planning zones. While local municipal planning and zoning still exists within the area, local plans are required to be consistent with the goals of the PCMP. Planning areas have specific goals ranging from preservation in the "core" area to higher density development consistent with the principles of smart growth in designated growth areas. Each management area allows a different level of development and housing densities, ranging from almost no new development to areas where development is encouraged (New Jersey Chapter American Planning Association, 2004). Table 1 provides a listing of the management areas and their description.

Another effort to move development from preserved areas to growth areas has come in the form of the Pinelands Development Credit Program. The program works by giving credits to land owners in the Preservation Areas, Agricultural Production Areas, and Special Agricultural Production Areas.

Table 1. Pinelands Management Area

Preservation Area	The "core" of the Pinelands. Residential development limited to one acre lots in designated infill areas and special "cultural housing" exceptions on minimum 3.2 acre lots for property owned by families prior to 1979.
Special Agricultural Production Area	Primarily designated for berry agriculture. Residential development limited to farm-related housing on a minimum of 40 acre lots.
Forest Area	The area is similar to the Preservation area. However, residential housing densities average 2 home for every 28 acres.
Agricultural Production Area	Active agricultural area. Residential development limited to farm-related housing on 10 acre lots and non-farm housing on 40 acre lots.
Rural Development Area	A transitional area. Limited, low density residential development, averaging one home for every five acres.
Regional Growth Area	Existing growth area, with residential housing densities of approximately three homes per acre. Commercial and industrial uses are permitted.
Town Area	Six large settlements throughout the Pinelands. Residential development limited to one acre lots if not sewered and two to four homes per acre with sewers. Commercial and industrial uses are permitted.
Federal/Military Area	All uses associated with the function of the installation and other land uses.
Village Area	47 small settlements throughout the Pinelands. Residential development is limited to one acre lots if not sewered

The credits can then be bought by developers to increase housing density allowances within the Regional Growth Areas. This allows Preservation Area land owners to receive value out of the land which otherwise can not be developed, thus lowering land values in the preserved zones, and giving incentive for higher density development in sections of the Regional Growth Areas.

METHODS

The study employed two main data sources: 1) a digital land use/land cover map for New Jersey developed by the NJDEP (NJDEP, 2007), and 2) a GIS dataset, available at the Pinelands Commission website, delineating the Pinelands Management Areas (Pinelands Commission, 2007). Considering that the purpose of the analysis is to determine whether Pinelands legislation has had an effect on development in the Pinelands, it was decided that the analysis would only include those areas where the PCMP has final jurisdiction. Subsequently areas that are inside the Pinelands National Reserve, but outside the state designated Pinelands area were excluded.

The amount and type of urban growth that occurred in each PCMP area was then evaluated in a three tiered approach. The first level compares the urban growth between the Pinelands and the rest of New Jersey. The second level compared the urban growth in the Pinelands among the nine management areas. At the third and final level, the specific types of new urban development were analyzed to determine whether they fall within the specified types of development that are allowed to occur.

In order to analyze urban growth in the 1995-2002 study period, the NJDEP land use/land cover dataset was processed to exclude all areas that do not meet the criteria of urban growth. Urban growth was defined as all land that was not urban in 1995 that became urban in 2002. The management areas dataset was then overlaid on the new urban growth and the area tabulations calculated. A third GIS layer was also created and employed that estimated the availability of land for future development based on current land use and status of preservation from future development. All areas were tabulated in square feet and converted to acres.

RESULTS

The first step in the analysis compared the level of urban development in the Pinelands to the rest of New Jersey. Table 2 shows total land area and total available land inside and outside the Pinelands in acres. Based on current land use and the amount of land that is preserved from future development, the Pinelands have a total area of 938,175 acres, with 315,319 acres that are still considered available to be developed. The rest of New Jersey has a total land area of 4,046,000 acres, with 906,482 acres of available land. 115,546 acres of the total 124,905 acres of new urban development in the 1995-2002 study period occurred outside the Pinelands, while only 9,259 acres occurred within the Pinelands.

Figure 1 shows the available land as a percentage of the total available land in New Jersey. It also shows the new urban development that occurred 1995-2002 as a percentage of the total new urban development that has occurred in New Jersey for the study period. While the Pinelands had 25.8% of the total available land in New Jersey, as of 1995 it only experienced 7.5% of the total urban growth that occurred by 2002. In contrast, the rest of New Jersey had a total of 74.2% of the land available for development in 1995 but incurred 92.5% of the total development that occurred statewide by 2002. If the effect of land regulation was equal within and outside of the Pinelands, one would expect the acres of new development to be proportional to the amount of available land in a given area. However, the Pinelands experienced significantly less total new development than its proportion of available land compared with the rest of the New Jersey.

The next step was to compare the nine individual management areas. Figure 2 shows the total land area versus the area of available land for each of the management areas in acres. The difference between total and available land reflect the amount of land that is unavailable for future development due to restrictions (i.e. wetlands, preservation or already developed). The proportion of available land varies significantly by management area. The Preservation Management Area has the greatest total land area with 294,609 acres. However, it only had 42,069 acres of available land since much of the zone is already permanently preserved. The

Table 2. Available Land, Total Land Area, and New Urban Development in Acres

	Available Land (1995)	Total Land	Urban Growth (1995-2002)
Pinelands	315,319	938,175	9,359
Outside Pinelands	906,482	4,046,000	115,546
New Jersey land acreage	1,221,800.79	4,984,174.72	124,905

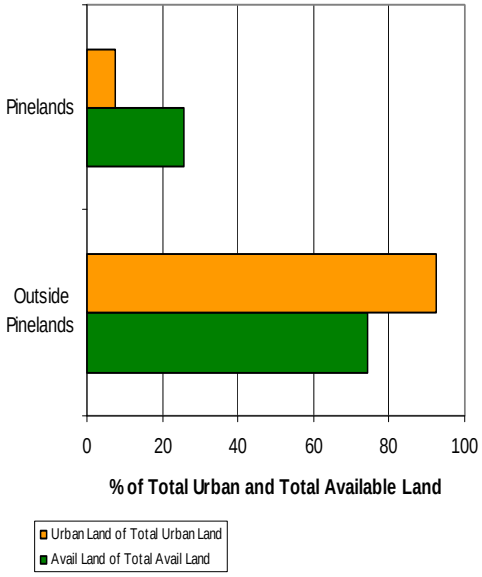

Figure 1a. Available land and urban growth as a percentage of the totals for New Jersey.

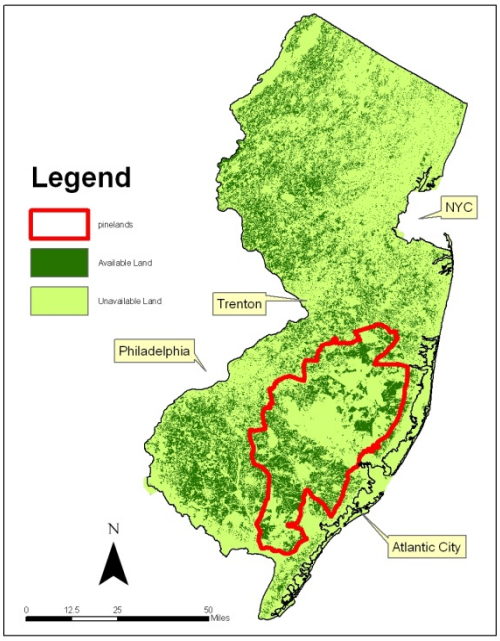

Figure 1b. Map of land available for development.

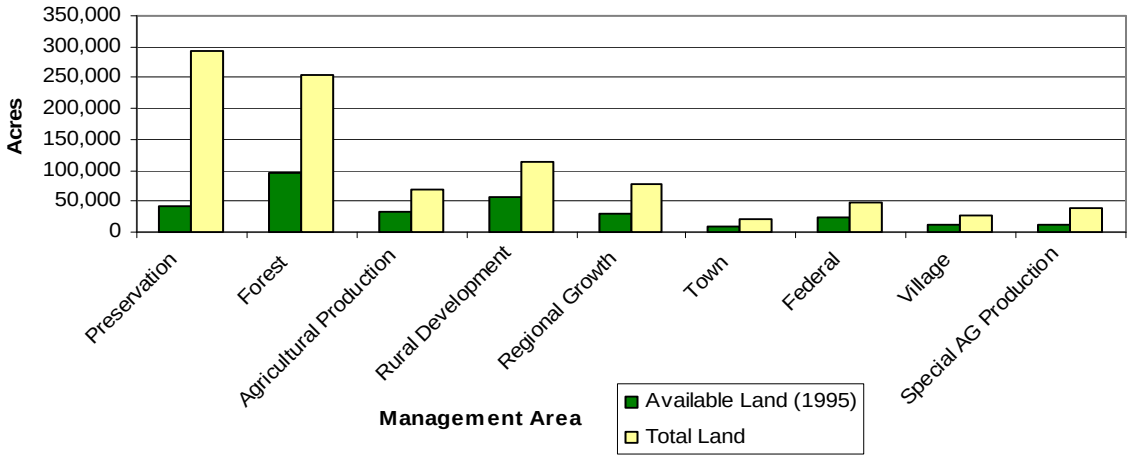

Figure 2. Acres of available and total acres of land.

Forest Area has 252,947 acres of total land, ranking second in total size, yet it has the largest amount of available land at 94,976 acres. The Rural Development Areas have the third largest total area at 112,768 acres, with total available land of 56,855 acres. The Regional Growth Areas, where most of the development occurs in the Pinelands and ranking fourth in total size, has a total land area of 76,628 acres, and 31.266 acres of available land. The Agricultural Production Area is the fifth largest area with 33,066 acres and had 68,425 acres of available land.

Again, if the Pinelands Management Plan did not have an effect on guiding where development happened, one would expect urban growth to occur with equal probability to the amount of available land in each planning area. Figure 3 shows the new urban development that occurred 1995-2002 as a percentage of available land in each management area. The Regional Growth Areas rank the highest, with 13.1% of the management area's available land being developed. The Pinelands Towns had the second highest proportion of land developed at 10.2%. The Pinelands Villages rank third with 5.2%

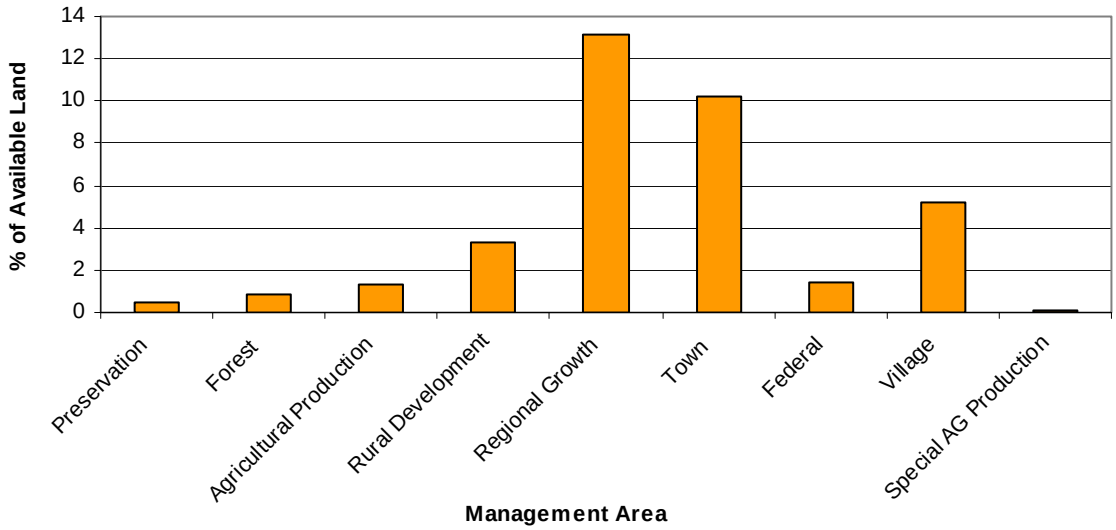

Figure 3. New urban development as a percentage of available land.

and Rural Development Areas fourth with 3.3%. The Forest Areas, Preservation Areas and Special Agricultural Production Areas had the smallest percentage of urban growth, with 0.9%, 0.4% and 0.1% respectively.

To this point, it has been determined that the rate of urban growth for the study period has been smaller in the Pinelands than the rest of New Jersey. It has also been shown that urban development within the Pinelands has occurred to a greater extent in the desired area, such as the Regional Growth, Rural Development, Town and Village Areas. While the amount of development in various management areas is important, the type of development is also equally informative. The third leg of this study looked at the specific types of urban development that has occurred in each of the management areas. By tabulating areas of overlap between management area and development type for new development 1995-2002 a breakdown of what went where can be calculated. Table 3 is a matrix showing the type of new urban on the y axis and the name of the management area on the x axis. The matrix also shows the total acres of new urban development for each management area.

Beginning with the Preservation Area, the highest proportion of residential development that occurred is rural, single unit at 22.1% and single unit, low density at 7.4%. These two types are the least dense of the four residential types. The Forest Areas follow the same trends with residential development, with 68.5% and 6.8% respectively. The Regional Growth Area is the one area that showed a high proportion of residential development that has a density greater than single unit, low density. The area had 40.1% of single unit, medium density of the total development in its area. The Village and Town Areas also show a high proportion of new residential development. Village Areas had 46.0% rural, single unit and 20.6% single unit, low density. Towns follow the same trend with 12.2% rural, single unit and 20.7% single unit, low density. Little residential development is evident on Federal lands, and any proportion of residential land in the Special Agricultural Production Area is insignificant, with only 8.2 acres of land development in the seven year study period. For the purpose of the discussion, those areas are excluded.

DISCUSSION

The statewide analysis provides a means to determine the level of development in the Pinelands compared to the rest of New Jersey. If the PCMP was equivalent to land management controls outside the Pinelands then one would expect the proportion of land developed to be about the same inside and outside the Pinelands territory. However, the results demonstrate that the proportion of new urban development to available land in the Pinelands is much lower than outside the Pinelands. Factors other than regulatory control, such as geographical location and context, could also account for this lower propensity for development within the Pinelands. Most significantly, the lack of development in the PCMP could simply be an effect of the distance that the Pinelands are located away from urban centers. However, New Jersey's small size and the fact that the Pinelands is surrounded by metro New York, Philadelphia and Atlantic City on all sides put the

Table 3. Percent Land Use Types of Each Management Area

	Preservation	Forest	Agricultural Production	Rural Development	Regional Growth	Town	Federal	Village	Special AG Production
RES, RUR, SIN UNIT	22.09	68.50	70.69	43.70	9.12	12.24	0.89	46.04	30.30
RES, SIN UNIT, MED DENSITY	3.02	1.73	0.18	2.32	40.05	10.13	0.00	8.31	0.00
RES, SIN UNIT, LOW DENSITY	7.41	6.82	3.17	18.36	11.85	20.67	0.07	20.64	0.00
RES, HIGH DENSITY	0.14	3.57	0.00	1.46	4.83	6.37	0.00	0.00	0.00
INDUSTRIAL	0.41	2.17	4.22	3.63	0.77	3.78	0.00	3.55	45.45
OTHER URBAN OR BUILT-UP	41.15	6.26	6.45	6.94	6.53	15.41	44.89	7.24	0.00
MAJOR ROADWAY	0.00	0.03	0.00	0.00	0.15	0.00	0.00	0.00	0.00
MANAGED WETLAND	0.27	0.12	0.70	0.76	1.18	0.33	4.74	0.04	0.00
STORMWATER BASIN	2.33	2.25	4.51	1.42	5.20	4.42	0.00	2.65	0.00
COMMERCIAL/SERVICES	8.50	1.81	1.64	2.77	8.44	9.43	0.00	3.08	15.15
RECREATIONAL LAND	8.50	4.36	7.91	16.85	10.09	8.38	0.00	6.27	0.00
TRANS/COMM/UTIL	4.25	1.84	0.53	1.36	1.12	4.92	4.52	1.00	9.09
ATHLETIC FIELDS	0.00	0.00	0.00	0.01	0.28	3.56	0.00	1.18	0.00
UPLAND RIGHTS-OF	0.00	0.03	0.00	0.00	0.00	0.19	0.22	0.00	0.00
WETLAND RIGHTS-OF-WAY	1.78	0.00	0.00	0.00	0.00	0.00	41.93	0.00	0.00
MILITARY INSTALLATION	0.00	0.50	0.00	0.35	0.07	0.00	0.81	0.00	0.00
UPLAND RIGHTS-OF-WAY	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.00
CEMETERY	0.14	0.00	0.00	0.07	0.27	0.11	1.93	0.00	0.00
Total Acres:	181.01	848.20	423.60	1892.30	4107.65	892.39	335.21	693.01	8.19

entire Pinelands area well within acceptable commuting distance for a high concentration of people. Furthermore, when one views the location of the urban growth that occurred statewide 1995-2002, significant tracts of new development can be identified around the entire boarder of the Pinelands with the exception of the extreme southern portion. It should be recognized that there is also substantial local, county and state land management controls outside of the Pinelands including the Coastal Area Facility Review Act on the ocean-side of the Pinelands boundary. Nonetheless, the effectiveness of the PCMP seems to be significantly stronger. The ring of development outside of the Pinelands boundary is a compelling indication that regulation is having a different effect on alternate sides of the regulatory line. The findings clearly demonstrate that overall rates of urban growth are substantially slower within the Pinelands compared to the rest of New Jersey.

The first part of the study establishes that the Comprehensive Management Plan has effectively slowed growth. The second leg explores where the development has occurred within the Pinelands itself. By comparing acreage of new urban development among the nine management areas the analysis revealed that a higher proportion of development occurred in the desired areas, which include the Regional Growth, Towns, Villages, and Rural Development Areas, as opposed to the more protected Preservation, Special Agricultural and Forest Areas. Again this makes that assumption that development will only happen on available land and that, all other things being equal, the amount of development that occurs in any given zone would be proportionate to the amount of available land within the zone. Some of the weaknesses of this assumption are that there may be other geographical factors that could drive development to occur in some areas rather than others such wastewater infrastructure or proximity to the amenities of a town. On the other hand, the regulatory effect of each planning area is arguably the driving factor on how much development will occur in any given planning area. It's important to note that the amount of available land for each management area is significantly different between zones and that the amount of available land in each management area is substantially less than its total area of land. The results of part 2 of the study show that the areas intended to receive growth have a substantially higher proportion of their available land area that became developed.

Equally important to where the development is occurring is what type of development is occurring. Low density development will consume substantially more land per person housed than high density growth. While areas intended for discouraging growth may have a significant total number of acres of development, if the development is low density then the total population growth will be less than if those same numbers of developed acres were

occupied by high density growth. The final level of analysis examined the specific types of land use in each of the management areas. As the majority of residential development in the Preservation Area, rural, single unit and single unit, low density are consistent with the permitted housing densities for the area at one half to one acre lots. A low density of one housing unit to 10 to 40 acres is allowed in the Agricultural Production Areas, which was 70.69% rural, single unit. This type of residential development has the lowest housing density.

Conversely, when looking at the zones intended to receive growth, the types of development that occurred are substantially higher density. This indicates that a higher population will be housed for each acre developed. The results of the third leg of the study clearly demonstrate that the types of development that occurred are consistent with goals of the management plan.

CONCLUSION

This research examined urban development pertaining to the Pinelands at three different levels. It showed that the rate of urban development has been slower within the Pinelands than the rest of New Jersey and the development is occurring at a higher rate within the desired areas. It has also shown that within the Pinelands Management Areas, the types of development matches the types and densities that are envisioned within the PCMP. We interpret these findings as strong evidence that the plan is largely functioning as envisioned, especially when compared to the New Jersey State Development and Redevelopment Plan which is in place throughout the rest of the state not covered by the PCMP. Hasse and Lathrop (2002) found that more than 40% of acres development occurred outside of the state's intended smart growth zones of the state plan while we find that more than 84% of development did occur in the growth areas of the PCMP and the growth that occurred in preservation zones was low density, as seen in Table 3.

The databases that were utilized are highly accurate and the results have a high level of confidence because they are based on a total inventory of development within and outside the Pinelands. This provides a clear window into effects of the PCMP on actual land development patterns. The conclusion is that the PCMP has been remarkably effective at attaining its goals of land management in the face of tremendous development pressure in this ecologically unique region.

This research approach can be applied to evaluate other parts of New Jersey land management such as the state plan and the recently instituted Highlands Management Plan as well as other applications in other regions. Also, the analysis can be expanded upon by adding the New Jersey Department of Environmental Planning land use/land cover data for 1986. The 1986 to 1995 time period could then be compared to the 1995-2002 study period. Such a multitemporal analysis would provide valuable insight into how the effect of the PCMP may change over time. This multitemporal analysis can be expanded even further when the next addition to the NJDEP land use/land cover data for the year 2007 becomes available.

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