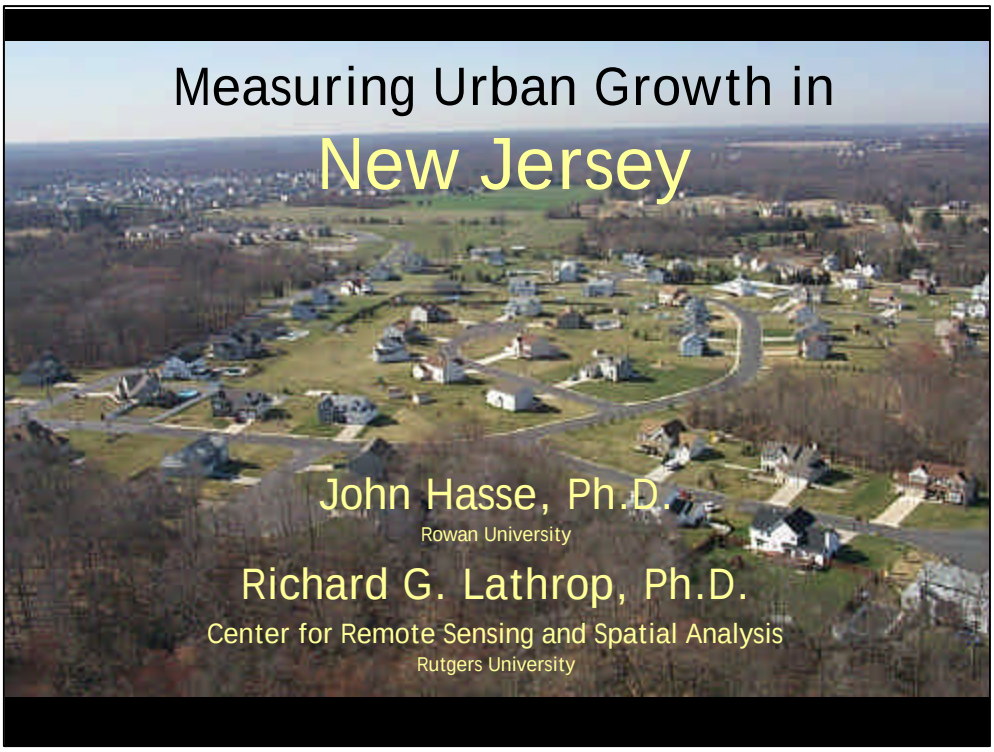
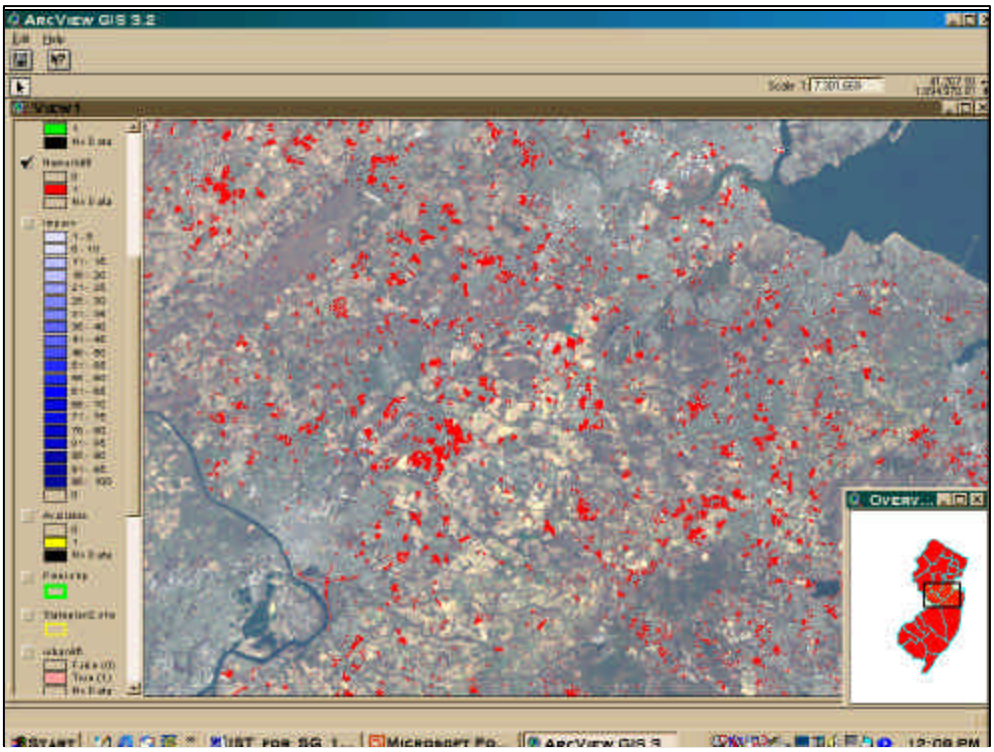
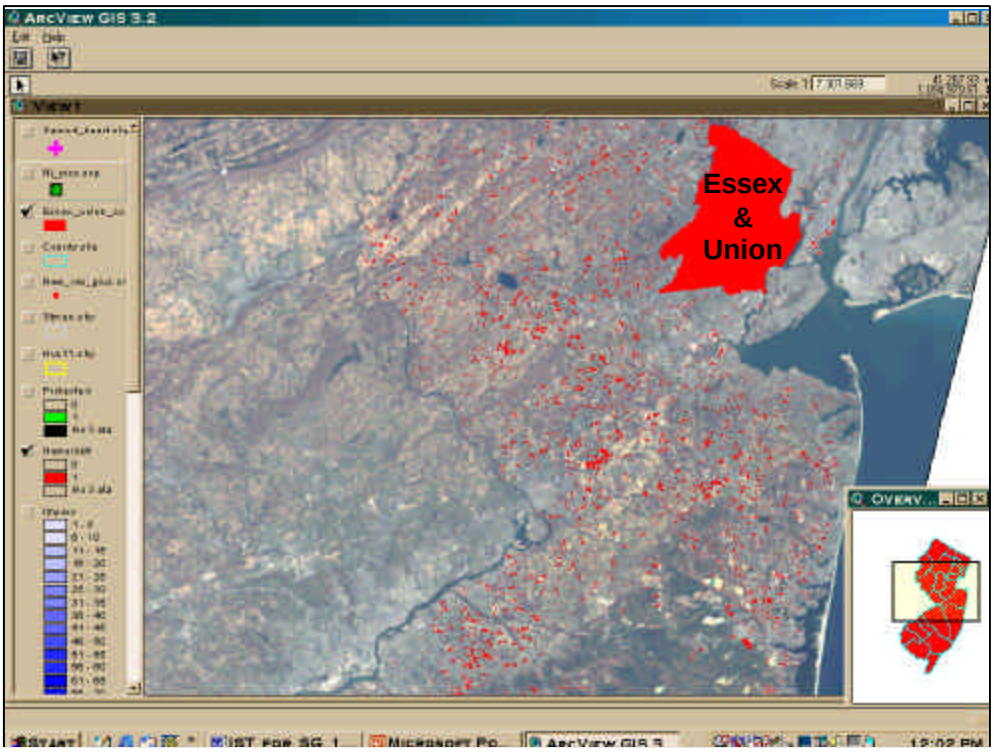


This presentation summarizes a report produced at the Rutgers University, Center for Remote Sensing and Spatial Analysis. The report is available for download at http://crssa.rutgers.edu/projects/lc and click on "urban growth."

Analyzing Landscape Change with Satellite Remote Sensing and Geographic Information Systems



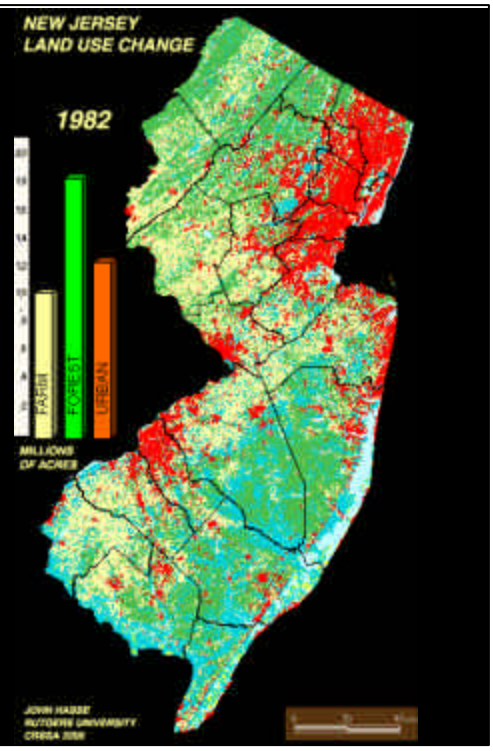
This image demonstrates Geographic Information Systems (GIS) technologies that are utilized analyze landscape changes in New Jersey. The map consists of a Landsat TM satellite image of central New Jersey with areas of new development that occurred between 1986 and 1995 colored red.



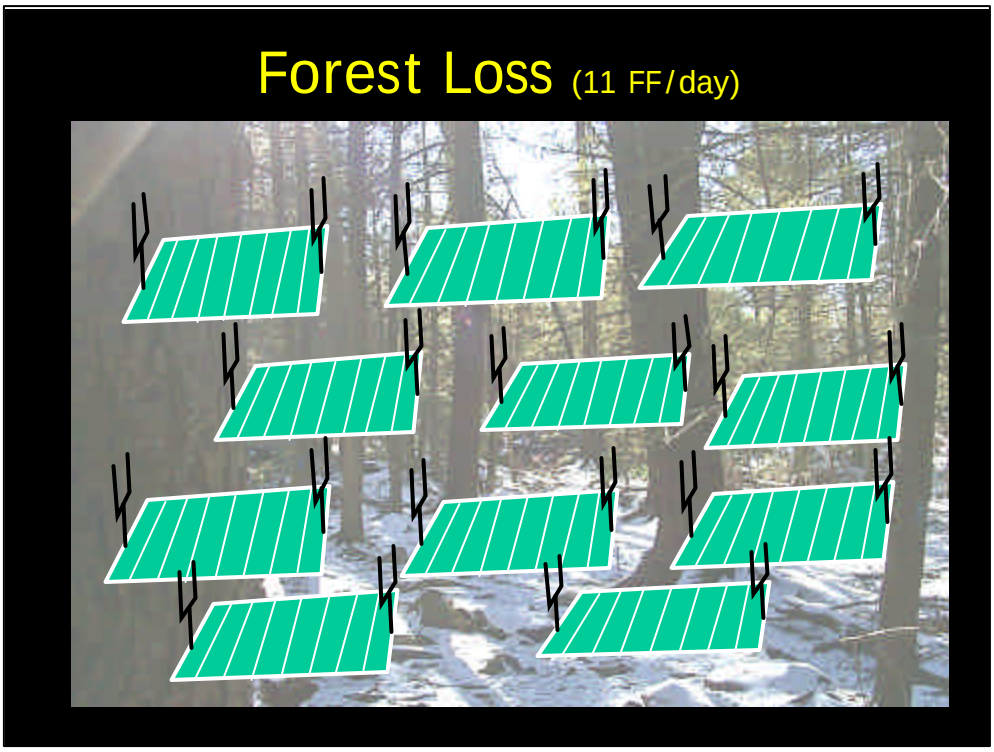
If one were to gather all the new development into a single pile, the accumulated urban growth that occurred between 1986 and 1995 totaled 135,000 acres. This is an area equivalent to the total land occupied by Essex and Union counties combined. New Jersey is developing at a rate of two counties filled wall to wall with new development every 9 years.

Recent Landscape Changes in New Jersey

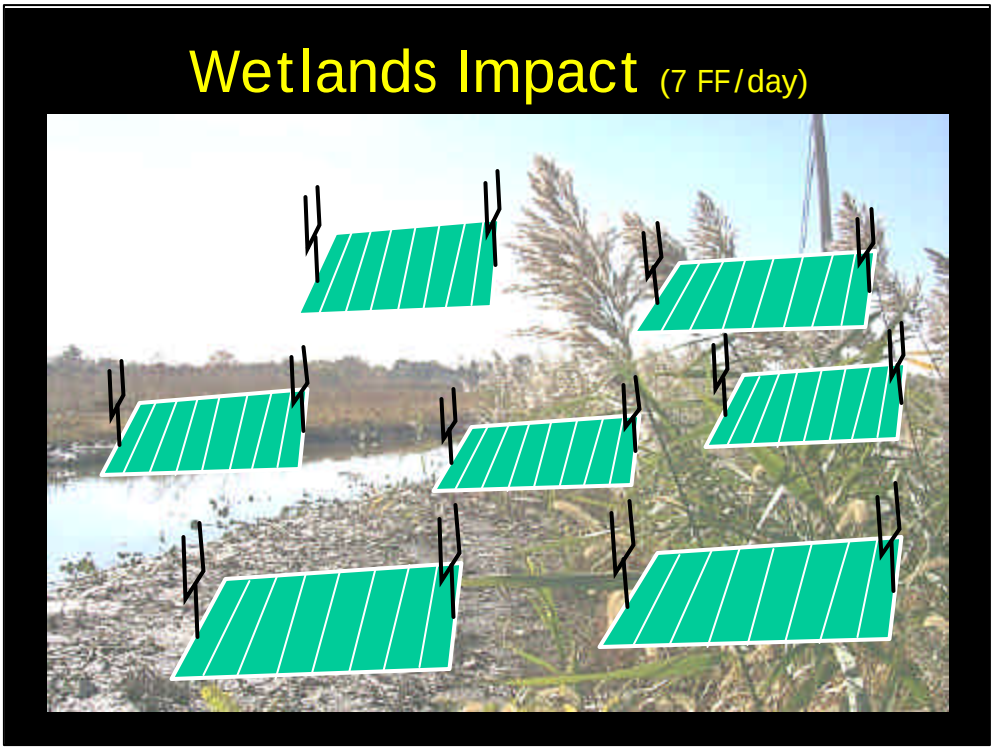
	annual change in acres
Urban	15,083
Agriculture	-9,654
Forest	-4,249
Water	571
Wetlands	-2,642
Barren	889



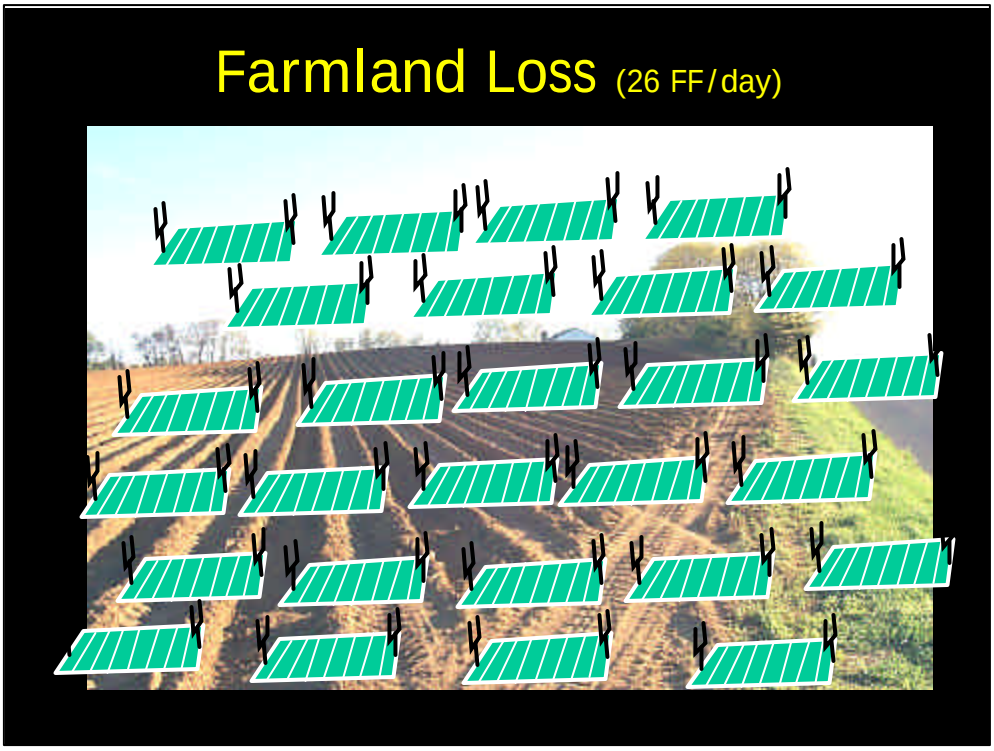
New Jersey's remarkable growth during the 1990's increasing development at the rate of over 15,000 acres per year. For each acre that became urbanized, an acre of forest, farmland, or wetlands was lost.



It is difficult to get a handle on the amount of landscape change represented by 1,000, 10,000 or 100,000 acres. In order to make the analysis more understandable, we've converted the annual number of acres of landscape change to "football fields per day". During the 1986 to 1995 period of analysis, New Jersey lost forest at the rate of 11 football fields per day.



Wetlands were also significantly impacted. Approximately 7 football fields per day were lost, modified or quantifiably impacted during the 1986 – 1995 period.



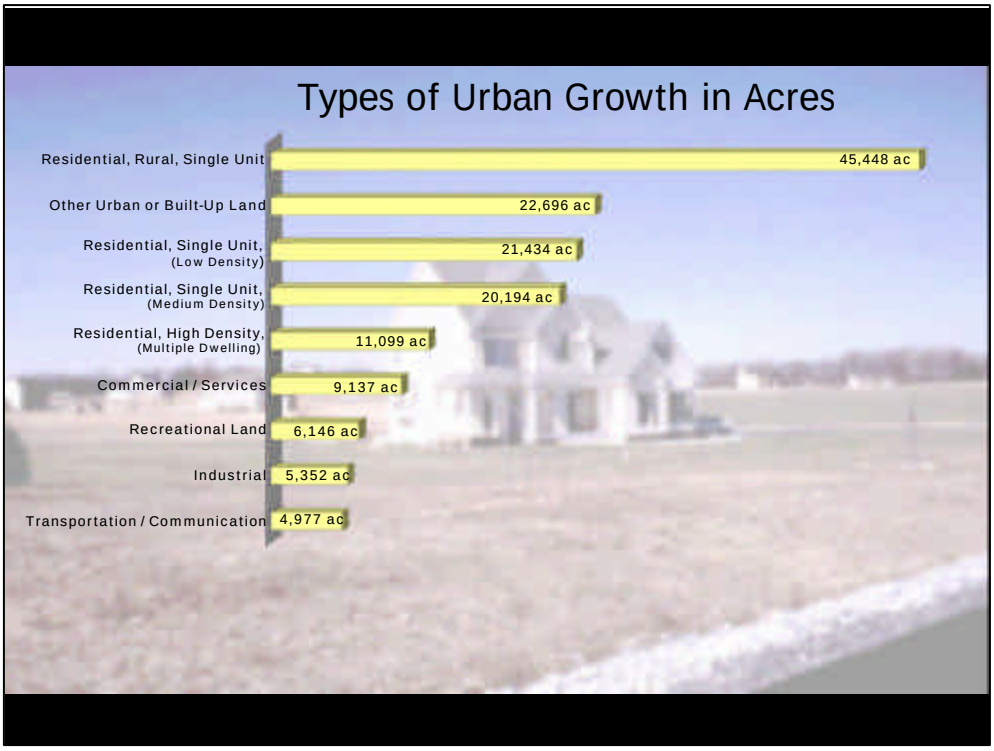
New Jersey farmland lost ground at the rate of 26 football fields per day.

From a geographer's perspective, we are interested in the process of land change as it occurs at the landscape level. This image simulates the amount of growth that occurred in Mullica Hill, Gloucester County in only 9 years.

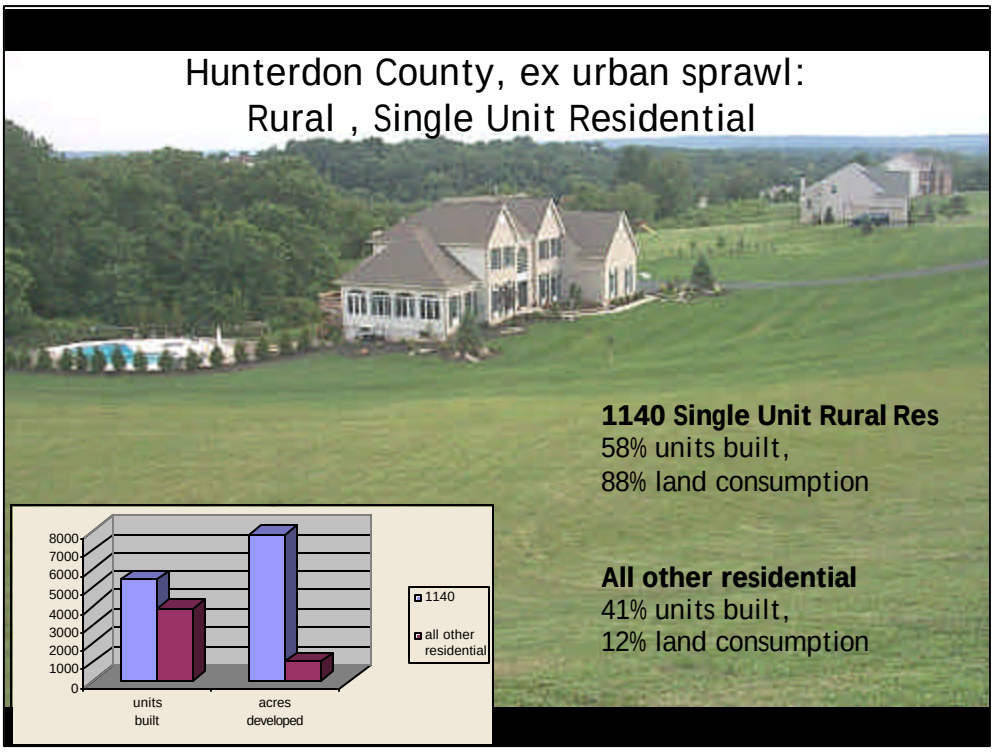
Utilizing GIS, we estimate that New Jersey has approximately 1.6 million acres of unprotected land suitable for development still remaining. If growth continues at the current rate measured in this analysis, New Jersey will be the first state in the nation to reach build-out sometime in the middle of this century.

Rural Exurban Sprawl

The analysis indicates that “rural exurban sprawl” has become the most highly impacting form of residential development.



The data reveals that the majority of residential development that occurred during the 90's was low-density single residential units. These are typically large lots of 1, 2, 3 acres or larger. This type of development consumed the majority of land while housing relatively few people.



For example, in Hunterdon County, a minority of housing units consumed the majority of land that became developed during the period of analysis. This consumption of land has less to do with population growth pressure than it does with housing upgrades.

The other end of the sprawl equation is New Jersey's deteriorating cities. As of the 2000 census, New Jersey is the wealthiest state in the country. Ironically, New Jersey contains several of the nation's top 10 poorest cites. Sprawl and urban decay are intricately interconnected. Policies that encourage rural development also have the effect of neglect and abandonment of older urban and inner ring suburbs.

While the sheer magnitude of land development is remarkable, perhaps more significant is the pattern, configuration, and location of new growth. Sprawl (scattered, low density unplanned development) has a far greater social and ecological impact than smart growth (efficiently designed compact, highly livable communities) patterns. Contrast the differences between the example of a sprawl subdivision (lower right) and smart growth example of Blairstown, Warren County (upper left).

The recent trends of development in NJ are becoming even more sprawling. New development is spreading out from previous settlements, leapfrogging into the rural countryside.

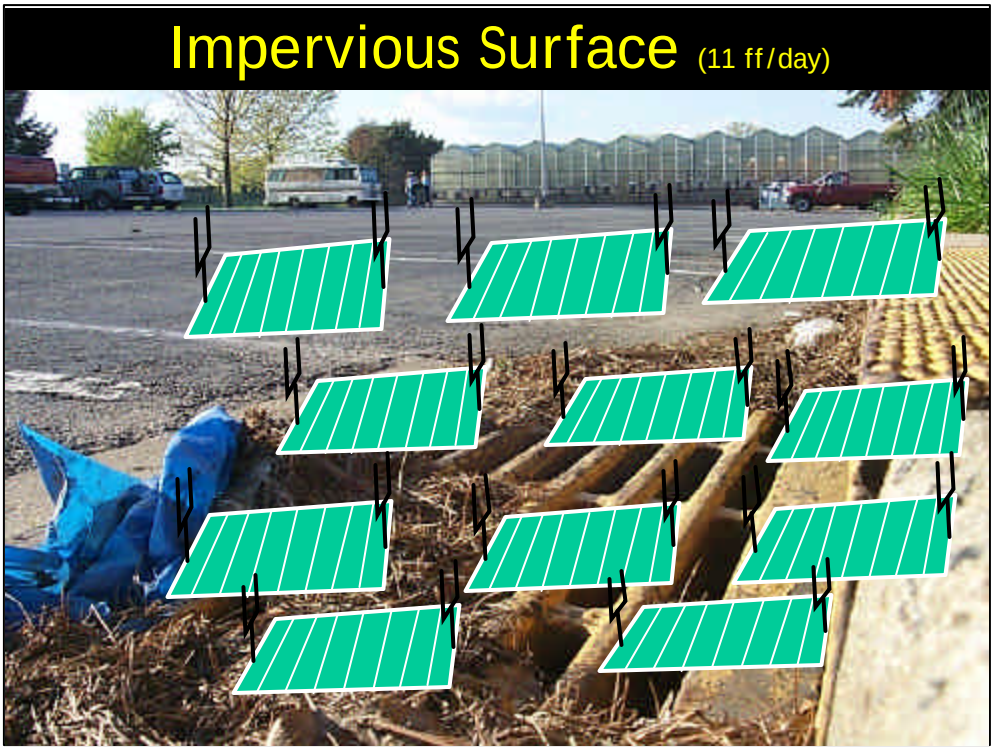
Ecological Footprint of a Housing Unit:

Sprawl patterns of development impart a far greater impact to a landscape per housing unit than Smart Growth patterns of development.

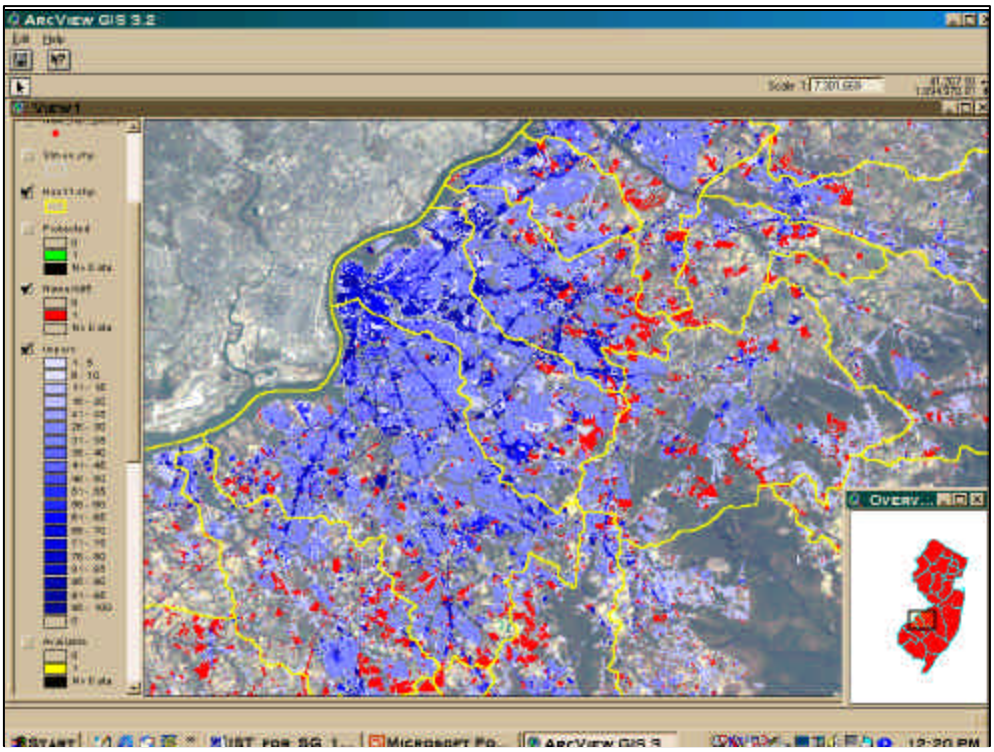
All development carries some kind of benefits and also carries some kinds of costs (both environmental and social). Sprawl development is problematic because it carries a much greater impact per each housing unit accommodated. (i.e. greater costs for fewer people housed)

A single unit that occurs in the wrong place can have a much more devastating impact than many units designed in a pattern of smart growth. We utilize 12 Geospatial Indices to analyze each new housing unit to determine the degree to which sprawl impacts the landscape. This image depicts a highly impacting pattern of development.

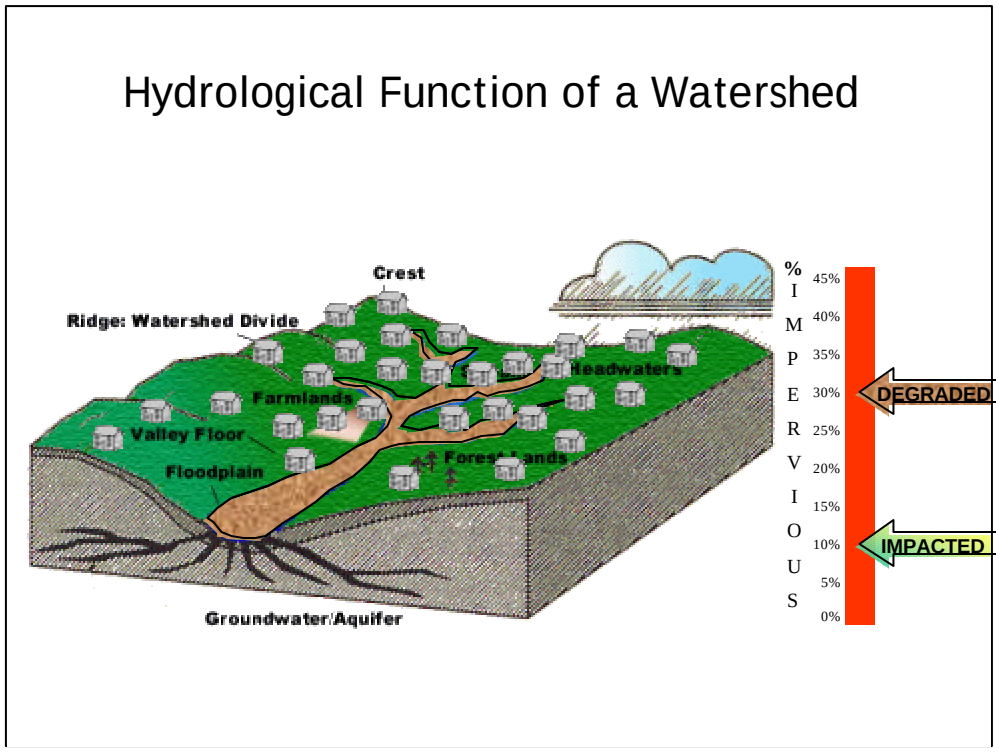
This contrasts with a Smart Growth pattern of development in which housing is efficiently design to have a relatively low impact to the landscape. Smart Growth also strives to create a higher degree of community connectedness. Many of New Jersey's older towns and villages (this is Harrisonville, Gloucester County) already demonstrate the patterns associated with Smart Growth.



Impervious surface is one of the most significant impacts that urbanization imparts to a landscape. Impervious surface is ground covering that prevents the natural percolation of ground water into the soil and rapidly channels the runoff into the local stream network. Impervious surface is related to water quality degradation and increased flooding. Impervious surface was created at the rate of 11 football fields per day during the 86-95 study period.

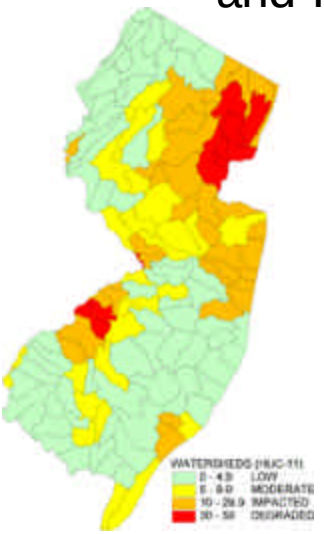


In this Geographic Information System map for the greater Camden area, impervious surface is depicted in shades of blue in 5% increments. Darker shades of blue indicate greater proportions of impervious surface. Yellow indicates the watershed boundaries of the region and red indicates new urban growth which contributed additional impervious surface from 1986 to 1995.

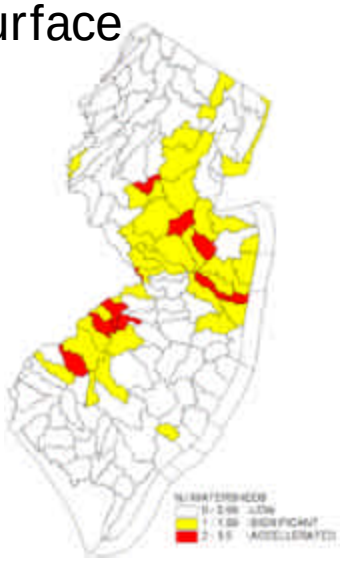


The total amount of impervious surface within a watershed has a direction correlation to the hydrological function of a watershed and the corresponding water quality. Research has demonstrated that there are thresholds of impact attributable to the creation of impervious surface. As as watershed develops over time, the amount of impervious surface increases accordingly. When a watershed reaches 10% impervious surface the water becomes demonstrably impacted. When a watershed becomes 30% covered with impervious surface, the water quality reaches irreversible degradation.

New Jersey Watershed Conditions and Impervious Surface



% TOTAL IMPERVIOUS COVER

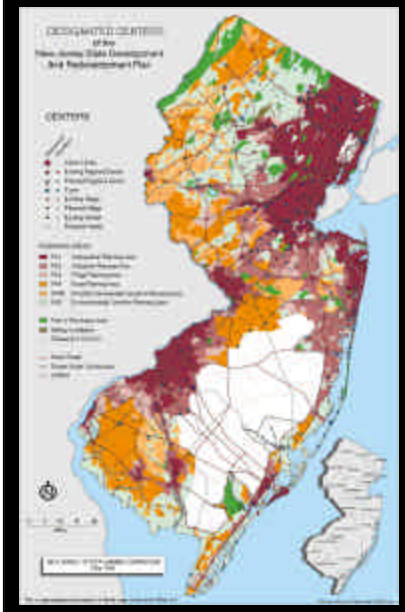


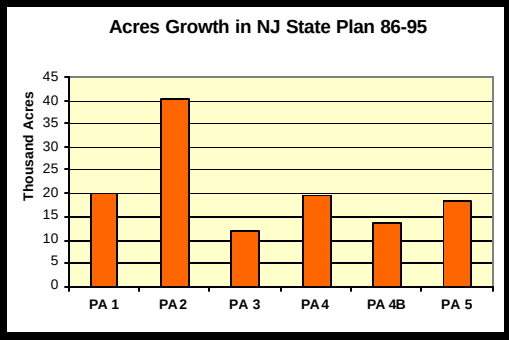
IMPERVIOUS INCREASE

Many of New Jersey's watershed are already beyond the impacted threshold. The map on the left depicts % total impervious cover. Watersheds with less than 5% impervious coverage are green, 5-10% yellow. Watersheds with between 10 and 30% impervious surface (orange) are considered impacted. Greater than 30% impervious coverage (red) is considered degraded.

The map on the right depicts the increase in impervious surface occurring to development. Many watersheds experienced a significant increase in total impervious surface coverage from 1986 to 1995. Watersheds with significant total impervious surface increase are colored yellow. Watersheds with accelerated increase in impervious surface are colored red.

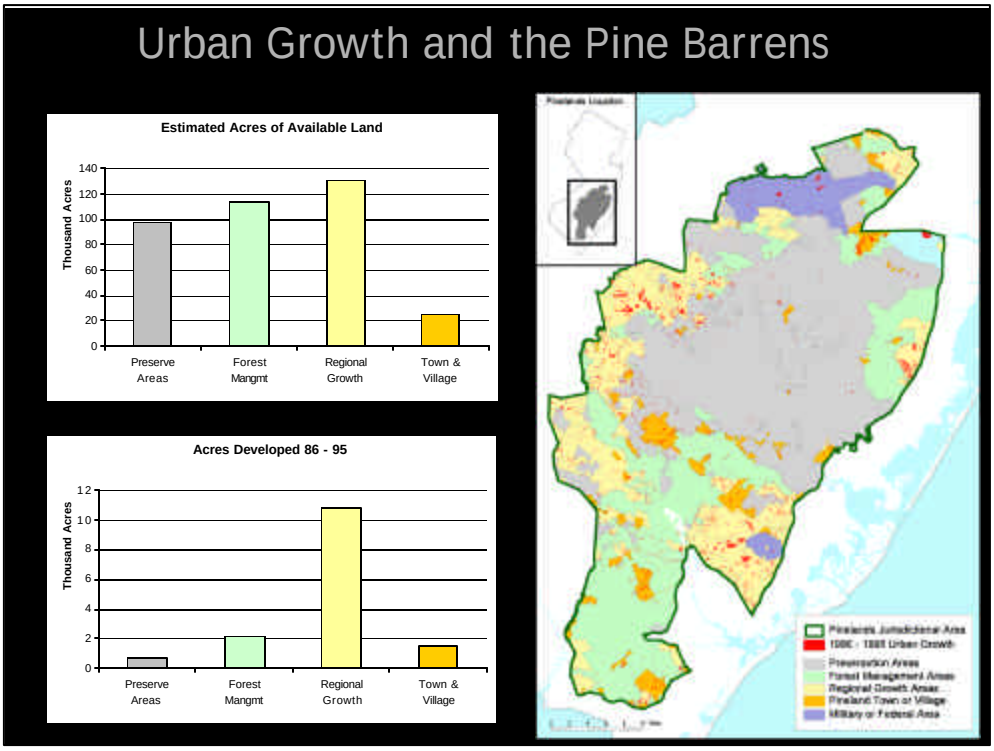
Urban Growth and the State Plan





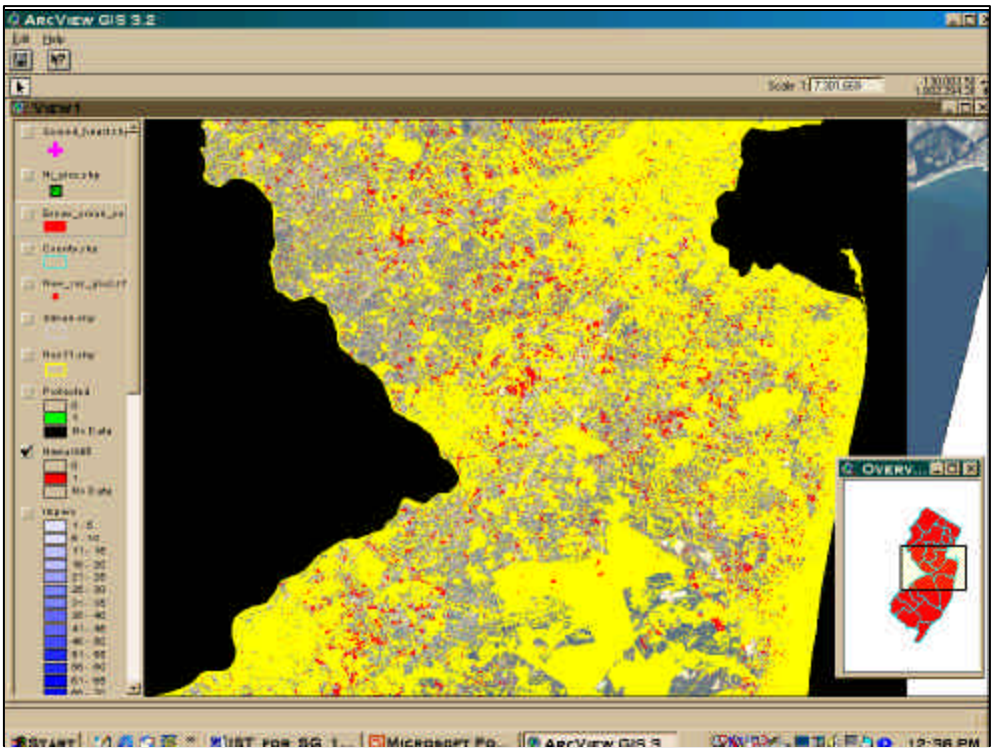
PLANNING AREA	URBAN ACRES IN 1986	URBAN GROWTH 1986-1995	PERCENT OF TOTAL GROWTH
PA1 Metropolitan Planning Area	62,4914 ac	20,053 ac	15.5%
PA2 Suburban Planning Area	196,466 ac	40,431 ac	29.8%
PA3 Fringe Planning Area	41,522 ac	12,020 ac	8.9%
PA4 Rural Planning Area	74,599 ac	19,688 ac	14.5%
PA5 Environmentally Sensitive Planning	13,7580 ac	18,497 ac	13.6%
PA4B Rural/Environmentally Sensitive	46,155 ac	13,780 ac	10.2%
Pinelands and H.M.D.C.	86,825 ac	9,436 ac	7.0%

Analyzing urban growth for the State Development and Redevelopment Plan reveals patterns of development in environmentally sensitive and rural lands. Of the 135,000 acres of new development that occurred from 1986 to 1995, 13.6% occurred in the environmentally sensitive planning PA5, 14.5 % of growth occurred in rural planning area PA4 and 10.2% occurred in the environmentally sensitive rural planning area PA4B. Although the goals and objectives envisioned in the state plan of channeling growth toward centers and away from sensitive lands have been hailed by both researchers and planners, this analysis demonstrates that the non-regulatory status of the SDRP has had limited success in meeting those goals.



The New Jersey Pine Barrens demonstrates one area of the state in which the patterns of development that occurred during the 86-95 study period were much more in line with the principles of smart growth than in other parts of the state. In the PCMP Area, sensitive lands remained reasonably intact while planned growth areas and existing towns and villages received the majority of new development growth.

Remaining Available Lands



In this Geographic Information System map for central New Jersey, all land that is already developed, already preserved as open space or otherwise unavailable for development is colored yellow. New development is colored red. The areas of the satellite image that are visible between the patches of yellow and red depict New Jersey's remaining available land. An estimated 1.6 million acres of available land remain. As development and open space preservation continue in the coming decades this map will become increasingly yellow. How will New Jersey's remaining land change in the future? Ultimately it is the Land management policies that are in place today that will determine how this remaining land will be utilized. Sound land management policies are vital because they are in essence the "design" for New Jersey's inevitable final landscape.

1) NJ is undergoing dramatic landscape change and will eventually reach build-out

2) The pattern and location of development has as much significance as magnitude (i.e. sprawl is more damaging than smart growth)

3) Sprawl has many impacts. One of the most significant impacts is impervious surface.

4) The Pinelands demonstrates an effective land management plan.

5) Land management policies in place today will in effect be "designing" NJ's final landscape as it becomes built out in the coming decades.

Acknowledgements

- Dr. Richard G. Lathrop, Rutgers University
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- Larry Thornton, and the entire GIS team at NJDEP