Pave It...or Save It?

Volume I: The Environmental, Economic, and Social Impacts of Sprawl

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I. EXECUTIVE SUMMARY

Sprawl – haphazard, auto-oriented development characterized by strip malls outside of existing downtown centers and McMansion subdivisions in formerly rural areas – is threatening water resources and quality of life in the East-of-Hudson New York City Watershed and throughout the Hudson Valley. Over the last 30 years, the New York City-metro area experienced a 13% population increase, but a 60% increase in urbanized land. Citing sprawl as the chief culprit, in 2000 the National Trust for Historic Preservation designated the Hudson Valley as one of America's most endangered historic places. Under the false guise of economic growth, careless development is consuming precious resources, disrupting local economies, undermining civic life, and threatening public health. Moreover, as sprawl persists, drinking water quality declines.

This report discusses the environmental, economic, and social impacts of sprawl, with an aim to educate citizens and public officials about sprawl and to give them the ammunition necessary to fight sprawl projects in their communities. The report is written in a fact-sheet style, buttressed by numerous legal and scientific citations. The fact sheets, which can be used individually or collectively, cover topics such as sprawl's impact on wetlands, air quality, taxes, race, and transportation.

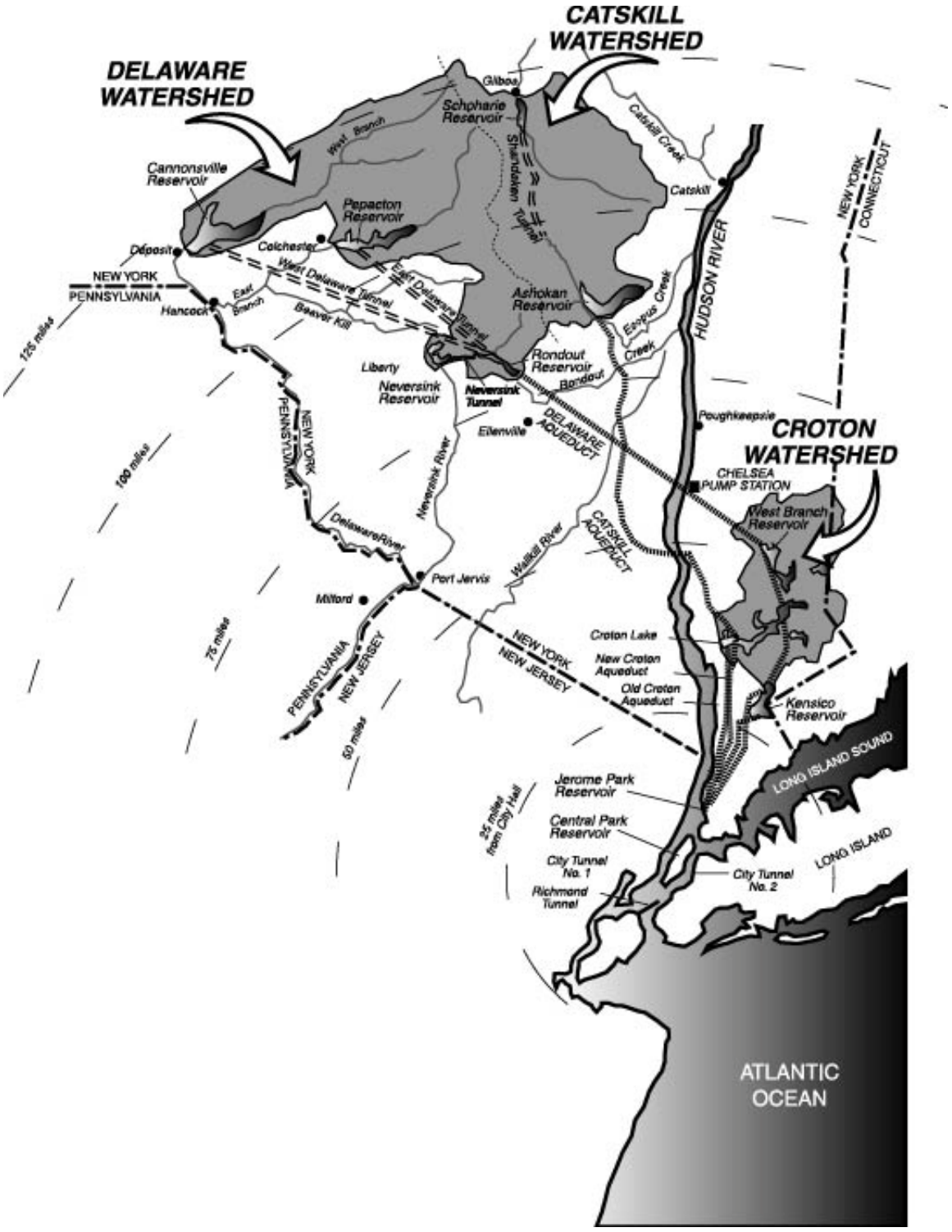
Two substantial environmental impacts resulting from sprawl involve declining water quality and increased air pollution. As natural soils are replaced or covered with roads, parking lots, buildings, and other impervious surfaces, the landscape loses its ability to purify stormwater naturally. Consequently, sprawl threatens the quality of drinking water, and thus the health of over 9 million New Yorkers. Additionally, increased reliance on automobiles leads to more vehicular emissions that are linked to a plethora of health conditions including asthma, allergies, heart disease, and osteoporosis.

As sprawl degrades the environment, it also impairs the local economy. New infrastructure in sprawling areas, including new roads, water lines, and sewer lines, along with expenditures for new schools and increased police and fire protection cost taxpayers millions of dollars. Planning that keeps development in community centers leads to more efficient distribution of services, and therefore lower property taxes.

A more concealed consequence of sprawl is its negative effect on community health. Sprawl simultaneously dismantles the social fabric of existing communities and gives way to urban decay. As homes move farther away from places of employment, grocery stores, and post offices, community members without access to cars are further alienated. The elderly, the young, and the poor are particularly prone to isolation from communal and daily functions. Meanwhile, as more families redistribute to newly developed neighborhoods, poor, usually minority families are left behind. Decaying urban centers are host to a declining tax base, fewer employment opportunities, and a failing educational system, circumstances which reinforce the status of the underprivileged.

Communities in the East-of-Hudson portion of the New York City Watershed need to preserve more open space and are ripe for smarter development. There is a broad base of citizen support for better planning and open space preservation. In fact, according to the Westchester Land Trust, 15 Westchester communities have raised nearly $35 million land acquisition projects since 2000. With this report, communities will have more tools to fight sprawl, preserve open space, and protect community vitality.

New York City Watershed Map



II. PAVE IT…OR SAVE IT?
PARTS A. – C.

"A hundred years after we are gone and forgotten, those who never heard of us will be living with the results of our actions." – Oliver Wendell Holmes, U.S. Supreme Court

A. Introduction

In New York City and several surrounding counties, nearly 9 million New Yorkers rely on approximately 2,000-square-miles of mountain streams, wetlands, trees, and open space to ensure a source of clean, unfiltered drinking water. The New York City watershed reservoirs, streams, and wetlands are not only sensitive waters but also ecological treasures. In terms of human benefits, one would be hard pressed to name a more critical natural area anywhere on the globe. In addition to containing important wildlife habitat, cultural and historical resources, and spectacular landscapes, the watershed provides prize-winning, unfiltered drinking water to over half the population of New York State.

These streams, wetlands, meadows, and forests sustain life, drive tourism and other economic growth, and support, in New York City, one of the world's greatest financial and cultural centers. The catastrophic consequences of not protecting these priceless resources are economic and social as well as environmental. As such, it is inconceivable that we would allow short-sighted developers to get rich on short-term gains at the long-term expense of millions of New Yorkers. But we are doing just that. Sprawl is consuming our most precious resources.

The Croton Reservoir – a natural beauty and a source of drinking water that must be protected from sprawl. Photo by Kyle Norton.

Streams, wetlands, and other natural resources in the New York City watershed are under considerable development pressure. In particular, the East-of-Hudson (EOH) watershed of the New York City drinking water supply – located primarily in northern Westchester and Putnam Counties – is suffering from an onslaught of real estate development. Developers are pushing into every remaining unoccupied corner of the watershed, building roads, warehouses, strip malls, office complexes, apartment buildings and residential subdivisions. In the process, they are paving wetlands with parking lots and roadways, filling fragile streams, building in stream, lake and wetland buffers, excavating hillsides, and clearing forestland. These activities are having devastating impacts on water resources.

Despite this burgeoning sprawl and its attendant impacts, communities in the East-of-Hudson portion of the New York City watershed are ripe for smarter

development. Several towns throughout the watershed enjoy Metro-North access to New York City and an extensive bus system, which carries passengers throughout Westchester and Putnam Counties. These areas provide ample opportunity for more pedestrian-friendly, transit-oriented development that will help preserve village centers and the open space that is so critical to the health and welfare of half of New York State's population. Moreover, there is a broad base of citizen support for better planning, environmental protections, and open space preservation. In fact, according to the Westchester Land Trust, "[f]ifteen communities have raised almost $35 million for local land acquisition [since 2000]. The most recent was North Castle, whose residents voted overwhelmingly to approve a $3 million open space proposition on Election Day 2004."[1]

Nevertheless, barriers to smart growth and open space preservation remain. Many towns require excessively wide roads for subdivision access. These same towns allow only low-density development in town centers and do not allow for a range of mixed use, pedestrian-friendly neighborhoods. And some communities that tout strong zoning laws grant waivers and variances at an alarming rate. Citizens in these towns often complain that their hometown lacks a sense of community.

Riverkeeper prepared this report in order to help citizens and communities in the New York City watershed better understand the long-term impacts of sprawl and address them with a proactive approach. The first volume discusses sprawl and documents the many impacts it has on our environment, economy, and society.[2] The report is divided into a series of fact sheets that are supported by legal and scientific citations. The fact sheets can be used individually or collectively. The forthcoming second volume will rely on meetings and conversations with citizens and officials to develop a vision for the East-of-Hudson New York City watershed and to propose a number of local, state, and federal solutions to achieve this vision. Although discussed in the context of the East-of-Hudson New York City watershed, sprawl and its impacts apply throughout the Hudson Valley and, in fact, the United States.

B. What is Sprawl?

Sprawl has been defined as "low-density, land consumptive, centerless, auto-oriented development, typically located on the outer suburban fringes."[3] Over the past decade, sprawl has become a dirty word to land use planners, environmentalists, and many sectors of the general public. Sometimes, citizens are not even aware that sprawl is the source of many of their problems.

Sprawl increases traffic, air pollution, noise pollution, and infrastructure costs.[4] At the same time, sprawl degrades water quality, reduces biodiversity, reduces open space, and deteriorates existing hamlets and village centers.[5] Sprawl also raises taxes by increasing the costs of roads, housing, schools, utilities, and transportation.[6] Sprawl lowers the quality of life by decimating agricultural lands and natural areas; concentrating poverty and accelerating socio-economic decline in cities, towns, and older suburbs; and increasing pollution and stress.[7] Furthermore, sprawl deteriorates civic life and social fabric in the United States.[8] Sprawl's greatest threat to water quality is the increase in

impervious surfaces from roads, parking lots, and roofs.

The New York region certainly is "sprawling." For example, the region's population grew 8 percent between 1970 and 1990, while urban land cover increased by 65 percent.[9] According to the 2000 census, Putnam County had population growth of nearly 12,000 from 1990 to 2000 – a 14.1 percent increase in just ten years. This increase made Putnam County the fastest growing suburban county in all of New York State.[10]

Sprawl is imperiling the Hudson River Valley like never before. The National Trust for Historic Preservation designated the Hudson Valley as one of America's most endangered historic places in 2000, citing sprawl as the chief culprit.[11] The New York State Hudson Valley Greenway Authority similarly cites sprawl as the main threat to natural resources in the Hudson River Valley.[12] The New York State Department of Environmental Conservation (DEC) has found that urban runoff is the primary source of impairment for one-third of the rivers and lakes on the Priority Waterbody List.[13] As DEC wrote, "growth is reflected in the frequent listing of occurrence of streambank erosion, failing and/or inadequate on-site septic systems, and municipal discharges as primary sources of water quality impairments."[14] Yet, one needs only to experience the congestion and visual blight from the region's roads to find evidence of unchecked sprawl. Due to the East-of-Hudson watershed's close proximity to New York City, the region's population likely will continue to increase and sprawl will continue to threaten water resources, including our [the region's] drinking water, unless we make better planning decisions.

These "McMansions" are becoming commonplace in the NYC watershed. Photo by William Wegner.

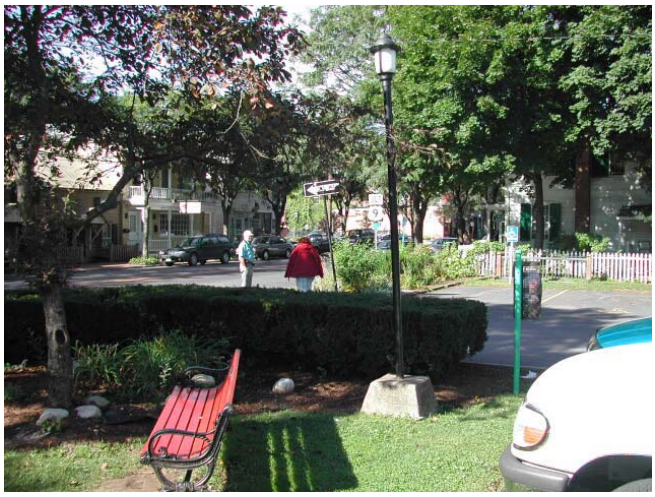
C. What is Smart Growth?

In response to our Nation's sprawl epidemic, many planners, public officials, and environmentalists are pushing for smart growth. Smart growth means:

> better planning, concentrating development where schools, roads, and sewer lines are already in place, and reinvesting in older communities instead of abandoning them. It places homes near major transit stations or within walking distance of shops, restaurants, and offices. Smart-growth communities not only help preserve natural, open spaces, but also are more livable and attractive than their sprawling counterparts.[15]

Generally, the main objectives of smart growth are to:

- Create a range of housing opportunities and choices [that reflect the actual needs of the community];
- Create walkable neighborhoods;
- Encourage community and stakeholder collaboration;
- Foster distinctive, attractive communities with a strong sense of place;
- Make development decisions predictable, fair and cost effective;
- Mix land uses;
- Preserve open space, farmland, natural beauty and critical environmental areas;



The Village of Rhinebeck (not in the NYC watershed) provides citizens with walkable neighborhoods, an attractive community with a strong sense of place, and a mix of uses. Photo by Audrey Scott.

- Provide a variety of transportation choices;
- Strengthen and direct development towards existing communities; and
- Take advantage of compact building design.[16]

By taking advantage of smart growth principles, communities can reduce costs and protect their environment. Moreover, these principles can be a boon to developers: "[a] study of six developments in the Southeast [U.S.] – incorporating higher densities, central public spaces, and a mix of uses – showed 25 to 45 percent rates of return compared with 9 percent for more standard subdivisions."[17] As one developer noted, "[t]he reason I call it 'smart growth' is that I can build on 10 acres what would probably require 50 acres if you developed it using a traditional sprawl model with tract homes and shopping centers. Smart growth conserves land, our most precious resource."[18]

A number of communities throughout the United States have implemented smart growth techniques with great success. When compared to sprawling projects, the differences are obvious. To move toward smarter growth in the EOH watershed, we need

strong leadership from our local and state officials. However, it is important to note that the aforementioned objectives of "smart growth" are not a one-size-fits-all panacea for sprawl in every watershed town. Moreover, proponents of smarter development must remain vigilant, as some developers and public officials have hijacked the concept of "smart growth," like many popular ideas, to push through unwise development for private profit. As one editorial noted, "[s]mart growth occurs only with smart leaders."[19]

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[1] *See* WESTCHESTER LAND TRUST, Key Parcels Preserved With Local Acquisition Funds, *available at* Hhttp://www.westchesterlandtrust.org/Accomplishments/landpurchases.htmlH (last visited Feb. 2, 2005).

[2] Although the fact sheets are separated into the categories of environment, economic, and social impacts, many issues fall into more than one category.

[3] NATIONAL TRUST FOR HISTORIC PRESERVATION, CHALLENGING SPRAWL: ORGANIZATIONAL RESPONSES TO A NATIONAL PROBLEM 7 (1999). Ten major characteristics of sprawl include:

1. Predominance of low density residential and commercial settlements, especially in new growth areas;
2. Unlimited outward extension of new development;
3. Leapfrog projects jumping beyond established settlements;
4. Single use development that separates shopping, working and residential activities;
5. Low density, single use work places and strip retail development typically located at the periphery of metropolitan areas;
6. Reliance on auto transportation for virtually all trips;
7. Fiscal disparities among localities;
8. Lack of adequate housing choices located close to work opportunities, thus forcing many workers to commute upwards of 45-90 minutes in each direction;
9. Reliance mainly on trickle-down to provide housing to low-income households; and
10. Fragmented land use decisions by local governments.

Id.

WILL FLEISSIG & VICKIE JACOBSEN (IN COLLABORATION WITH THE CONGRESS FOR NEW URBANISM & U.S. ENVIRONMENTAL PROTECTION AGENCY), SMART SCORECARD FOR DEVELOPMENT PROJECTS 3 (2002).

[4] *See generally* CLARION ASSOCS., THE COSTS OF SPRAWL IN PENNSYLVANIA: FINAL REPORT (Jan. 2000).

[5] *See id.*

[6] *See id*. at 6; E-mail from Karen Argenti, The Gaia Institute, to Marc Yaggi, Riverkeeper, Inc. (Feb. 14, 2001, 12:21 AM) (on file with authors). An analysis of a recent New Jersey study revealed that roads built to serve sprawling new development in the pattern of Montgomery Township or Raritan Township (500 people per square mile) cost local taxpayers on average $10,000 per person. Taxpayer costs drop all the way to $3,000 per person when new roads are built in the denser communities of Princeton, Red Bank, Montclair or Collingswood (5,000 to 7,500 people per square mile). Even better, residents of new urban-style development in the pattern of Hoboken or Jersey City pay less than $2,000 per person—the smallest costs for new roads. *Id.*

[7] *See* CLARION ASSOCS., *supra* note 4, at 10, 11; *see generally* CENTER FOR URB. POLICY RESEARCH, EDWARD J. BLAUSTEIN SCH. OF PLANNING AND PUB. POL'Y, RUTGERS, THE STATE UNIV. OF NEW JERSEY, THE COST AND BENEFITS OF ALTERNATIVE GROWTH PATTERNS: THE IMPACT ASSESSMENT OF THE NEW JERSEY STATE PLAN (Sept. 2000), *available at* Hhttp://www.state.nj.us/dca/osg/plan/impact.shtmlH (last visited Oct. 20, 2004).

[8] *See* ROBERT D. PUTNAM, BOWLING ALONE 187, 208, 407 (2000).

[9] *See* DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 4 (2002) *available at* Hhttp://www.pewoceans.org/reports/water_pollution_sprawl.pdfH (*citing* H. DIAMOND & P. NOONAN, LAND USE IN AMERICA (Island Press 1996)).

[10] This information is culled from a county-by-county review of the 2000 Census. *See* U.S. CENSUS BUREAU, *New York Quick Facts*, *at* Hhttp://quickfacts.census.gov/qfd/states/36/36079.htmlH (last revised Jul. 9, 2004).
[11] *See* NATIONAL TRUST FOR HISTORIC PRESERVATION, AMERICA'S 11 MOST ENDANGERED HISTORIC PLACES 2000: HUDSON RIVER VALLEY, NEW YORK STATE, *available at* Hhttp://www.nthp.org/11most/2000/hudson.htmH (last visited Oct. 20, 2004).
[12] *See* HUDSON RIVER VALLEY GREENWAY AUTHORITY, RESOURCES OF THE HUDSON RIVER VALLEY NATIONAL HERITAGE AREA - AN INVENTORY AND ANALYSIS, app. A at 12; *available at* Hhttp://www.hudsongreenway.state.ny.us/heritage/Appendix%20A%202%20Web.pdfH (last visited Oct. 20, 2004).
[13] *See* NEW YORK STATE DEP'T OF ENVTL. CONSERVATION (NYSDEC), *The 1999 Lower Hudson River Basin Waterbody Inventory and Priority Waterbodies List*, at 6. "This is a list of surface waters determined by NYSDEC staff, with public input, to have their uses precluded (P), impaired (I), stressed or threatened." *See* NEW YORK STATE DEP'T OF ENVTL. CONSERVATION, *Legend Information for Matrix and Maps*, *available at H*http://www.dec.state.ny.us/website/dow/uwa/mapinfo.htmH (last visited Oct. 20, 2004).
[14] *Id*.
[15] NATURAL RES. DEF. COUNCIL, IN CONTRAST: SMART GROWTH VERSUS SPRAWL, *available at H*http://www.nrdc.org/cities/smartGrowth/contrast/contrinx.aspH (last visited Feb. 9, 2005).
[16] SMART GROWTH NETWORK, SMART GROWTH ONLINE, *available at H*http://www.smartgrowth.org/about/default.aspH (last visited Oct. 20, 2004).
[17] *Id.* at 2.
[18] Laura Hagar, *The There There: How Developer Orrin Thiessen is Single-handedly Remaking North Bay Downtowns*, NORTH BAY BOHEMIAN, Apr. 21-27, 2004, *reprinted in* METROACTIVE, *available at H*www.metroactive.com/papers/sonoma/04.21.04/thiessen-0417.htmlH (last visited Feb. 9, 2005).
[19] *Smart Growth Occurs Only With Smart Leaders,* BILOXI SUN HERALD, May 16, 2004, *available at* Hhttp://www.sunherald.com/mld/thesunherald/news/editorial/8678267.htmH (last visited Feb. 9, 2005).

II. PAVE IT…OR SAVE IT?
PART D.
The Environmental Impacts of Sprawl

D.1. Sprawl and Stormwater

What is stormwater runoff?

Stormwater runoff is precipitation and snowmelt that drains from land surfaces into streams or other receiving waters.[1] Stormwater runoff occurs when a portion of rainfall moves over the ground toward a lower elevation and does not infiltrate into the ground. Under natural conditions, most rainwater seeps into the ground and is filtered as it recharges ground water supplies. Impervious surfaces, such as roads, parking lots and rooftops, prevent natural infiltration and thereby increase stormwater flow over land. If no pervious surfaces or stormwater capture practices intercept runoff before it reaches a stream, wetland or reservoir, the runoff is added to the volume of surface water that flows during storm events.

Why is stormwater important?

Stormwater runoff is the greatest threat to water quality today. According to the U.S. Environmental Protection Agency (EPA), 40% of U.S. waterbodies do not meet water quality standards, and the leading source of water quality impairment is polluted stormwater runoff.[2] In the New York City watershed, the City's Department of Environmental Protection (DEP) estimates that 84% of all phosphorus in Croton watershed surface waters is the result of non-point sources such as stormwater.[3] The process of sprawl attends the construction of buildings, roads, parking lots and other impervious surfaces. As runoff volumes and velocities increase from added watershed imperviousness, water quality problems such as sedimentation, increased water temperatures, habitat alteration, and impacted aquatic plant and animal populations become more pronounced.[4] Principal sources of contaminated stormwater runoff are construction and industrial activities.[5] Municipal storm sewer systems convey stormwater to receiving waters and often discharge it with inadequate treatment.[6] Reducing and/or capturing and treating stormwater runoff before it reaches streams and other receiving waters enhances their protection and allows streams to perform their function as natural processors of waterborne contaminants.[7]

What are the impacts of stormwater runoff to streams?

When stormwater scours pavement and other impervious surfaces associated with urbanization, numerous anthropogenic (manmade) pollutants are transported in runoff to receiving waters. These runoff-borne pollutants include sediments, toxic metal particles, pesticides and fertilizers, oil and grease, gasoline, harmful viruses and bacteria, excess nutrients, wastepaper and other forms of debris.[8] Chemical compounds and toxic metals found in stormwater include chloride, polycyclic aromatic hydrocarbons (PAHs), copper, lead and zinc.[9] When these pollutants enter streams along with bacteria, viruses and other pathogens, they compromise the streams' ability to maintain the balance of naturally occurring aquatic organisms and contaminate drinking water supplies in watersheds. In addition, because impervious surfaces heat up stormwater runoff and thus

increase the temperature in receiving waters, aquatic organisms requiring cool water conditions – trout, in particular – are adversely impacted.[10]

Infiltrated stormwater recharges groundwater supplies, which in turn provide steady base flow to streams. When imperviousness associated with sprawl compromises infiltration, a net decrease in stream base flow occurs and can cause seasonal drying of streams containing aquatic organisms that depend on a steady base flow.[11] In addition, stormwater impacts stream channels as the volume and velocity of runoff increases. When streams fill above their bankfull capacity, stream channels erode and enlarge, and streambank habitat is degraded.[12] The process of streambank erosion transports additional sediment into stream channels, which impacts fish, and aquatic plant and insect populations by reducing light penetration, impairing respiration with suspended and settled sediment, degrading aquatic habitat and increasing water temperature.[13] Increased stream flows also increase the frequency of overbank flooding and expand floodplain boundaries, which degrade riparian wetland and forest habitats.[14]

A sprawling subdivision in the Croton watershed. The developer has failed to maintain stormwater controls. Photo by William Wegner.

Degradation of receiving waters and stream channels due to accelerated stormwater runoff also impacts the health, safety, and quality of life of people who use water resources for recreation and commerce. For example, in Tampa, Florida, city planners directed runoff into sinkholes that ultimately fed into the Sulphur Spring. Eventually, the spring became so polluted from the accumulation of runoff that the once popular tourist attraction and swimming spot was closed. The Sulphur Spring is just one example of the many invaluable water resources damaged by stormwater runoff. Also, the contamination of coastal waters in some areas by stormwater runoff has closed local shellfish industries.[15] In addition to the public health threat of contaminated fish, shellfish, and drinking water supplies, stormwater impairs recreational uses, aesthetics, tourism and related businesses, threatens public safety and property with increased frequency and severity of flooding, and increases the cost of drinking water and wastewater treatment.[16]

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[1] *See* U.S. ENVTL. PROT. AGENCY, TERMS OF THE ENVIRONMENT: RUNOFF, *available at* http://www.epa.gov/OCEPAterms/rterms.html (last visited Feb. 7, 2005).

[2] *See* U.S. ENVTL. PROC. AGENCY, STORM WATER PROGRAM BACKGROUND, *available at* http://yosemite.epa.gov/R10/WATER.NSF/0/fd82644588a892f588256c41007d61b6?OpenDocument (last visited Feb. 7, 2005).
[3] *See* DR. KIMBERLY KANE, NEW YORK CITY DEP'T ENVTL. PROT., PERCENTAGE OF PHOSPHORUS FROM NONPOINT SOURCES (2001). Phosphorus is the dominant limiting nutrient for algal and other plant growth in the New York City watershed. The increased production of organic matter leads to eutrophication, which in turn produces an excess of dissolved organic carbon (DOC). The DOC reacts with chlorine during the disinfection process to form carcinogenic byproducts that are of significant health concern in an unfiltered water supply.
[4] *See* U.S. ENVTL. PROC. AGENCY, URBANIZATION AND STREAMS: STUDIES OF HYDROLOGIC IMPACTS, *available at* http://www.epa.gov/owow/nps/urbanize/report.html#01 (last visited Feb. 7, 2005).
[5] *See* U.S. ENVTL. PROT. AGENCY, NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM, STORM WATER PROGRAM, *available at* http://cfpub.epa.gov/npdes/home.cfm?program_id=6 (last visited Feb. 7, 2005).
[6] *See id.*
[7] *See* STROUD WATER RESEARCH CTR., WATER QUALITY MONITORING IN THE SOURCE WATER AREAS FOR NEW YORK CITY: AN INTEGRATIVE WATERSHED APPROACH 1-1 (2001).
[8] *See* NATURAL RES. DEF. COUNCIL, STORMWATER STRATEGIES: COMMUNITY RESPONSES TO RUNOFF POLLUTION, *available at* http://www.nrdc.org/water/pollution/storm/intro.asp (last visited Feb. 7, 2005).
[9] *See* NEW YORK STATE DEP'T ENVTL. CONSERVATION, STORMWATER MANAGEMENT DESIGN MANUAL 2-3 (2002), *available at* http://www.dec.state.ny.us/website/dow/toolbox/swmanual/index.html (last visited Feb. 7, 2005).
[10] *See id.* at 2-6.
[11] *See id.* at 2-7.
[12] *See id.* at 2-9.
[13] *See id.* at 2-14.
[14] *See id.* at 2-13.
[15] *See* NORTH CAROLINA DEP'T OF ENV'T AND NATURAL RES., STORMWATER PROBLEMS & IMPACTS, *available at* http://h2o.enr.state.nc.us/su/Manuals_Factsheets.htm (last visited Feb. 7, 2005).
[16] *See id.*

D.2. Sprawl and Impervious Surfaces

What are impervious surfaces?

Impervious surfaces are surfaces that seal over natural surface soils and prevent infiltration of water into soil.[1] Examples of impervious surfaces are roads, driveways, parking lots, sidewalks, and rooftops. Impervious surfaces impact water quality by increasing the volume and magnitude of stormwater runoff and facilitating the delivery of pollutants into receiving waters.[2] Stormwater scours pavement, transporting a multitude of pollutants including motor oil, engine coolant, brake linings, rust, nutrients, litter, animal waste, sand, salt, and other materials found on roads, parking lots, and sidewalks.[3] Moreover, impervious surfaces generate pollutants by attracting traffic, pesticides, fertilizers, and various land uses.[4]

How do impervious surfaces impact our water resources?

The addition of impervious surfaces to watershed lands adversely impacts water quality, aquatic ecosystems, stormwater control, streambank stabilization, soils, vegetation, and human health. In addition to its direct environmental impacts, the imperviousness associated with sprawl supplants open space with roads and other infrastructure, increases traffic and vehicle emissions, and degrades the natural aesthetics and community character of areas undergoing urbanization.

Although sound stormwater management practices can reduce pollutant loadings from impervious surfaces to surface waters, eventually a threshold is crossed at which it is impossible to maintain predevelopment surface water quality.[5] The Center for Watershed Protection classifies stream quality levels by the percent imperviousness of their watershed basins.[6] For example, watershed stream basins in a range of 1 to 10% impervious cover are classified as "stressed streams."[7] In 11-25% impervious cover areas, streams are "impacted."[8] And in areas of 26-100% impervious cover, streams are "degraded."[9]

Acres of pavement being constructed to serve big box stores located near Interstate 84. Photo by Marc A. Yaggi

Most notable is that stream degradation occurs at levels of impervious cover as low as 10%.[10] In fact, recent research indicates that watersheds are demonstrably and irreversibly degraded when as little as 10% of their surface area is covered by impervious

surfaces.[11] The steepest rates of decline in biological and physical indicators of stream systems occur in the 0-5% impervious range as a watershed undergoes initial urbanization.[12] Sprawl exacerbates the degradation of water quality; the post-construction runoff from suburban residential development can be up to 10 times that of pre-development conditions and runoff from new commercial development can be as much as 18 times higher.[13]

Impervious surfaces also convey to surface waters a multitude of toxic contaminants associated with sprawl. Pesticides, herbicides, fertilizers, and heavy metals are transported in stormwater runoff via impervious surfaces. The organic compound Alachlor, which can lead to eye, kidney, brain, spleen, heart, prostate and ovary problems, is an herbicide that occurs in runoff.[14] Herbicides also can contain endothall, which is linked to stomach problems, brain and skeletal malformations, weight loss, and kidney and adrenal discoloration.[15] Parking lots, shopping areas, business and industrial areas produce hydrocarbon and metal concentrations that are twice those found in the average urban area.[16] Runoff from paint and batteries sends cadmium, which is linked to kidney damage and cancer, into surface waters.[17]

A significant public health issue associated with runoff is the addition of pathogens to receiving waters.[18] When stormwater scours pollutants off pavement it can transport to receiving waters protozoa such as *Cryptosporidium* and *Giardia*, which lead to gastrointestinal illnesses and other health problems associated with human and animal fecal waste.[19] Further, the increased levels of disinfection required to combat the increased levels of pathogens magnify the risk of haloacetic acids, which are disinfection byproducts linked to an increased risk of cancer and may cause pregnant women to miscarry.[20]

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[1] *See* Chester L. Arnold, Jr. & C. James Gibbons, *Impervious Surface Coverage: The Emergence of a Key Environmental Indicator*, 62 J. AM. PLANNING ASS'N 243, 245 (1996).
[2] *See* Jayne E. Daly, *The Protection of New York City's Drinking Water*, 1995 PACE L. REV. 69.
[3] *See id.* at 69-75.
[4] *See* ARNOLD & GIBBONS, *supra* note 1 at 245.
[5] *See* TOM R. SCHUELER, *The Importance of Imperviousness,* 1 WATERSHED PROT. TECHS. 100, 102 (1994).
[6] *See id.* at 107.
[7] *See id.*
[8] *See id.*
[9] *See id.*
[10] *See* SCHUELER, *supra* note 5, at 107.
[11] *See* Derek Booth & C. Rhett Jackson, URBANIZATION OF AQUATIC SYSTEMS: DEGRADATION THRESHOLDS, STORMWATER DETECTION, AND THE LIMITS OF MITIGATION, 33 J. AM. WATER RESOURCES ASS'N 1077, 1084 (1997).
[12] *See* HORSELY & WITTEN, INC., AN EVALUATION OF IMPERVIOUS SURFACE COVER THRESHOLDS IN THE NEW YORK CITY WATER SUPPLY SYSTEM EAST OF HUDSON 2 (2002).
[13] *See* F. KAID BENFIELD, ET AL., NATURAL RES. DEF. COUNCIL, ONCE THERE WERE GREENFIELDS: HOW URBAN SPRAWL IS UNDERMINING AMERICA'S ENVIRONMENTAL ECONOMY & SOCIAL FABRIC (1999).
[14] *See* U.S. ENVTL. PROT. AGENCY, *IRIS: Integrated Risk Information System for Alachlor, available at* http://www.epa.gov/iriswebp/iris/subst/0129.htm (last visited Feb. 7, 2005).
[15] *See* U.S. ENVTL. PROT. AGENCY, *IRIS: Integrated Risk Information System for Endothall, available at* http://www.epa.gov/iriswebp/iris/subst/0155.htm (last visited Feb. 7, 2005).

[16] *See* GEODIGITAL MAPPING, INC., SIGNIFICANT SOURCES OF URBAN STORM WATER RUNOFF IN UNINCORPORATED AREAS OF THE SOUTH COAST OF SANTA BARBARA COUNTY IDENTIFIED FROM LANDSAT IMAGERY: REPORT TO THE SANTA BARBARA COUNTY WATER AGENCY 2 (2000).
[17] *See* Occupational Safety and Health Standards: Purpose and Scope, 29 C.F.R. § 1910.1 (2000).
[18] *See* Daly, *supra* note 2 at 69.
[19] *See* COMM. TO REVIEW THE NY CITY WATERSHED MGMT. STRATEGY, NAT'L RESEARCH COUNCIL, WATERSHED MANAGEMENT FOR A POTABLE WATER SUPPLY: ASSESSING THE NEW YORK CITY STRATEGY 97 (2000); U.S. ENVT'L PROT. AGENCY, *National Primary Drinking Water Standards* (2001), *available at* http://www.epa.gov/safewater/mcl.html (last updated May 26, 2004).
[20] *See* U.S. DEPT. OF INTERIOR, BUREAU OF RECLAMATION, DBP: HALOACETIC ACID FACT SHEET (2003), *available* at http://www.usbr.gov/pmts/water/media/pdfs/DBP%20HAAs.pdf (last visited October 29, 2004).

D.2a. Key Findings of Studies on Imperviousness

Legions of scientific studies confirm the harmful impact on water quality of impervious surfaces such as paved parking lots, roadways, and rooftops. The following are key findings of some prominent studies on impacts of impervious surfaces.

1. Tom R. Schueler, *The Importance of Imperviousness,* WATERSHED PROTECTION TECHNIQUES Vol. 1, No. 3 (1994)

Classifies stream quality levels by percent imperviousness. Streams in an area of 1-10% impervious cover are classified as stressed streams.[1] In 11-25% impervious cover areas, streams are impacted.[2] And in areas of 26-100% impervious cover, streams are degraded.[3] Most notable is that stream degradation occurs at levels of impervious cover as low as 10%.[4]

Runoff volume for a one-acre parking lot is approximately 16 times that produced by a similarly sized undeveloped meadow.[5]

2. Derek Booth & C. Rhett Jackson, *Urbanization Of Aquatic Systems: Degradation Thresholds, Stormwater Detection, and the Limits Of Mitigation,* JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION, Vol. 33, No. 5 (1997)

Indicates that watersheds are demonstrably and irreversibly degraded when as little as 10% of their surface area is covered by impervious surfaces.[6]

3. Lizhu Wang et al, *Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales,* ENVIRONMENTAL MANAGEMENT, Vol. 28, No. 2 (2001)

Stream degradation can occur in areas of impervious cover as low as 8%.[7]

4. TOM SCHUELER, CENTER FOR WATERSHED PROTECTION, SITE PLANNING FOR URBAN STREAM PROTECTION (1995)

Discusses impacts of impervious cover on runoff volume. For example, a 1-inch rainstorm over 1 acre of open space will typically generate 218 cubic feet of runoff. The same storm over a 1-acre paved parking lot will produce 3,450 cubic feet of runoff, nearly 16 times more than the natural setting.[8]

5. KAREN CAPPIELLA & KENNETH BROWN, CENTER FOR WATERSHED PROTECTION, IMPERVIOUS COVER AND LAND USE IN THE CHESAPEAKE BAY WATERSHED (2001)

A study of impervious surface coverage in the Chesapeake Bay watershed found that car habitat (parking and roadways) exceeded the building footprint in every urban land use category, ranging from 55 to 75% of the total impervious surface area for a site.[9]

Lawns have an imperviousness value of 9% and therefore contribute nearly 1/10 of their pollutant loadings to downgrade receiving waters.

6. Jonathan M. Harbor, *A Practical Method for Estimating the Impact of Land Use Change on Surface Runoff, Groundwater Recharge and Wetland Hydrology,* 60 J. AM. PLAN. ASSN. 95 (Winter 1994).

Finding that the 25-year average stormwater runoff volumes for Akron, Ohio are 26,000 gallons per square mile (GPM^2) per day for woodlands; 83,000 GPM^2 per day for agriculture and low-density residential; 284,000 GPM^2 per day for high-density residential; and 494,000 GPM^2 per day for commercial land uses.[10]

7. Tom Schueler, *The Peculiarities of Perviousness*, WATERSHED PROTECTION TECHNIQUES, Vol. 2, No. 1 (1995)

Disconnecting impervious areas can create enough 'runon' to reduce the 'effective' impervious cover by 20-50%.[11]

'Urban' pervious areas, such as lawns, can produce runoff in volumes several multiples greater than natural pervious areas.

8. Chester C. Arnold & C. James Gibbons, *Impervious Surface Coverage: The Emergence of a Key Environmental Indicator*, JOURNAL OF THE AMERICAN PLANNING ASS'N, Vol. 62, No. 2 (1996)

Stream health can be characterized as 'protected' with 10% impervious coverage, 'impacted' at 10-30%, and 'degraded' above 30%. Degradation first occurs at 10% and is severe to the extent of being unavoidable at 30%.[12]

9. Horsley & Witten, Inc., *Evaluation of Impervious Surface Cover Thresholds in the New York City Water Supply at Which the Water Quality Impacts from Development Are Irreparable* (2002)

Literature review shows steepest rates of decline in physical habitat and ecological function occur in the 0-5% impervious range.[13]

Deforestation is an important factor in watershed decline, particularly at low (< 10%) impervious levels.[14]

10. Kent B. Barnes et al, *Impervious Surfaces and the Quality of Natural and Built Environments* (2000-01)

Citing a study showing replacement of forests with 25%, 50%, and 75% impervious cover will respectively reduce evapotranspiration by 19%, 38%, and 59%.[15]

11. GEODIGITAL MAPPING, INC., SIGNIFICANT SOURCES OF URBAN STORM WATER RUNOFF IN UNINCORPORATED AREAS OF THE SOUTH COAST OF SANTA BARBARA COUNTY IDENTIFIED FROM LANDSAT IMAGERY: REPORT TO THE SANTA BARBARA COUNTY WATER AGENCY (2000)

Citing studies showing stream degradation occurs when impervious area approaches 5-20% of a watershed.[16]

12. Richard R. Horner et al, *Effects of Watershed Development on Water Quality and Soils,* WETLANDS AND URBANIZATION: IMPLICATIONS FOR THE FUTURE (2000)

Citing work suggesting impervious area be limited to 10%, and forest cover maintained at minimum 15%, for watershed protection.[17]

13. John Irwin, *Importance of Being Pervious*, at http://www.alternatives.com/aqualibrium/pervious.htm

Citing studies showing urban streams can average twice the width of rural streams. Bankfull flows in rural or natural watershed occur once annually; at 40% imperviousness this increases to thrice annually; at full development occurs on average 5.6 times annually.[18]

14. Dana Beach, South Carolina Coastal Conservation League, *Coastal Sprawl: The Effects of Urban Design on Aquatic Ecosystems in the United States* (Pew Oceans Commission 2002)

Citing generally accepted 10% threshold for damage to streams and rivers; also mentions that at 10% streams become physically unstable, causing erosion and sedimentation; at that threshold, nitrogen exceeds background levels.[19] At 10% imperviousness, diversity of macroinvertebrates declines sharply.[20]

[1] *See* Tom R. Schueler, *The Importance of Imperviousness,* 1 WATERSHED PROTECTION TECHNIQUES 100, 102 (1994).
[2] *See id.*
[3] *See id.* at 107.
[4] *See id.* at 100.
[5] *See id.*
[6] *See* Derek Booth & C. Rhett Jackson, *Urbanization Of Aquatic Systems: Degradation Thresholds, Stormwater Detection, And The Limits Of Mitigation,* J. OF THE AM. WATER RES. ASSOC., Vol. 33, No. 5, 1077, 1088 (1997).
[7] *See* Lizhu Wang et al., *Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales,* ENVIRONMENTAL MANAGEMENT, Vol. 28, No. 2, 255, 264 (2001).
[8] *See* TOM SCHUELER, SITE PLANNING FOR URBAN STREAM PROTECTION 22 (1995).
[9] *See* CENTER FOR WATERSHED PROT., IMPERVIOUS COVER AND LAND USE IN THE CHESAPEAKE BAY WATERSHED, Executive Summary at iii (2001).
[10] *See* Jonathan M. Harbor, *A Practical Method for Estimating the Impact of Land Use Change on Surface Runoff, Groundwater Recharge and Wetland Hydrology,* 60 J. AM. PLAN. ASSN. 95, 105 (Winter 1994).
[11] *See* Tom Schueler, *The Peculiarities of Perviousness*, WATERSHED PROTECTION TECHNIQUES, Vol. 2, No. 1 (1995)
[12] *See* Chester C. Arnold & C. James Gibbons, *Impervious Surface Coverage: The Emergence of a Key Environmental Indicator*, JOURNAL OF THE AMERICAN PLANNING ASS'N, Vol. 62, No. 2, at 243, 246 (1996).
[13] *See* HORSLEY & WITTEN, INC., EVALUATION OF IMPERVIOUS SURFACE COVER THRESHOLDS IN THE NEW YORK CITY WATER SUPPLY AT WHICH THE WATER QUALITY IMPACTS FROM DEVELOPMENT ARE IRREPARABLE 2 (2002).
[14] *See id.*
[15] *See* KENT B. BARNES ET AL, IMPERVIOUS SURFACES AND THE QUALITY OF NATURAL AND BUILT ENVIRONMENTS 4 (2000-01).
[16] *See* GEODIGITAL MAPPING, INC., SIGNIFICANT SOURCES OF URBAN STORM WATER RUNOFF IN UNINCORPORATED AREAS OF THE SOUTH COAST OF SANTA BARBARA COUNTY IDENTIFIED FROM LANDSAT IMAGERY: REPORT TO THE SANTA BARBARA COUNTY WATER AGENCY 2 (2000).
[17] *See* Richard R. Horner et al, *Effects of Watershed Development on Water Quality and Soils,* WETLANDS AND URBANIZATION: IMPLICATIONS FOR THE FUTURE 237 (2000).
[18] *See* John Irwin, *Importance of Being Pervious*, *available at* http://www.alternatives.com/aqualibrium/pervious.htm (last visited Oct. 20, 2004).
[19] *See* DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 9-10 (2002), *available at* http://www.pewoceans.org/reports/water_pollution_sprawl.pdf (last visited Feb. 9, 2005).
[20] *See id.* at 11.

D.3. Sprawl and Construction Activities

What are construction activities?

Whenever forested land is cleared for residential, commercial or industrial development, contractors must remove trees and other vegetation, grade land surfaces, build roads and other infrastructure, and erect buildings. These activities require land disturbance that alters the natural topography and habitat and removes vegetation that shields surface soils from erosion by wind and stormwater.

What are the impacts of construction activities?

When construction activities remove vegetation and expose soils, forest canopies no longer intercept stormwater and root systems no longer hold soils in place. Construction site runoff can erode exposed soils and transport sediment to receiving waters. In fact, without sound erosion controls in place, construction sites can discharge more than 1,000 tons of sediment per acre per year.[1] In contrast, forested lands contribute on average only 1 ton of sediment, or 0.1% of the amount from construction site runoff.[2] Construction sites also generate sanitary wastes and slurry from truck washouts (dirt, concrete, and other residue materials that are washed from construction vehicles) that can be transported to receiving waters.[3] To minimize the area of land disturbed during large construction projects, New York State's General Permit for Construction Activities limits – without prior approval – disturbance to 5 acres at any one time.[4] But even this can result in significant water quality problems.

The processes of erosion and stormwater runoff from construction sites can result in chemical, physical, and biological impacts to water quality.[5] Toxic contaminants, including nutrients, pesticides, heavy metals and industrial wastes, attach to sediment particles and are transported to surface waters. Plants, wildlife, and humans can assimilate these toxics through ingestion or physical contact with contaminated water supplies.[6] Sediment particles also can shield pathogenic microorganisms, such as *Giardia* and *Cryptosporidium*, from detection, which can result in waterborne disease outbreaks.[7] In addition to these health hazards, sediment can affect the aesthetic quality of drinking water by imparting undesirable taste, odor or color.[8]

The sediment in construction site runoff also blocks ditches, irrigation canals, and other stormwater conveyances, thereby facilitating the transport of sediment to receiving waters.[9] By raising streambeds and burying floodplain wetlands, sediment increases the probability and severity of floods. Suspended sediment in aquatic systems also degrades aquatic habitat and damages commercial and recreational fisheries.[10]

Siltation, or the process of depositing sediment, is the leading cause of impaired water quality in streams.[11] Streams are affected not only in proximity to construction sites, but can be impacted more than 5 km downstream from construction activities.[12] The U.S. Environmental Protection Agency (EPA) reports that "erosion rates from construction sites are typically an order of magnitude larger than row crops and several

orders of magnitude greater than rates from well-vegetated areas, such as forests or pastures."[13]

Muddy water from the construction of one single-family home enters the inlet of a neighbor's pond in Southeast, New York.

Concentrations of suspended sediment from residential construction sites can average 40 times greater than from already-developed areas.[14] Other types of construction also release significant amounts of sediment to receiving waters. During large rain events, as much as 80% of the sediment entering a stream can originate from nearby road construction sites.[15]

Additionally, the sediment discharged from one studied commercial construction site was 75 times greater than both before and after the construction period.[16] Importantly, smaller construction sites – those less than 5 acres in size – can generate sediment in the same proportion as larger sites.[17] The sediment contribution of these smaller sites can be significant. More than three quarters of the construction permits EPA surveyed were issued to sites smaller than 5 acres;[18] therefore, in a given watershed area, the cumulative impacts of numerous smaller sites can be similar to those of the larger sites.[19]

The muddy water from the previous photo turns a neighbor's pond into "coffee." Both photos by Brian Alberghini.

Construction site runoff in receiving waters also increases turbidity, which reduces light penetration, smothers benthic (aquatic insects) communities, causes injury to gilled organisms, and reduces dissolved oxygen concentrations by filling in the interstitial spaces in streambeds.[20] These processes impair the functions of aquatic ecosystems, which results in degraded water quality, loss of aquatic habitat, and reduced biodiversity.[21]

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[1] *See* U.S. ENVTL. PROT. AGENCY, CONSTRUCTION SITE MANAGEMENT MEASURE - III. CONSTRUCTION ACTIVITES, *available at* http://www.epa.gov/OWOW/NPS/MMGI/Chapter4/ch4-3a.html (last visited Feb. 7, 2005).

[2] *See id.*
[3] *See* U.S. ENVTL. PROT. AGENCY, NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM—REGULATIONS FOR REVISION OF THE WATER POLLUTION CONTROL PROGRAM ADDRESSING STORM WATER DISCHARGES, 40 C.F.R. pts. 9, 122, 123, and 124, Final Rule, 1.
[4] *See* NEW YORK STATE DEP'T OF ENVT'L CONSERVATION, SPDES General Permit for Stormwater Discharges from Construction Activities, Part III.D.2.(a)4, GP-02-01.
[5] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 3.
[6] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 1.
[7] *See id.* The diseases resulting from ingestion of these microorganisms produce severe gastrointestinal problems that last as long as two months, or can actually be life threatening to those with weak immune systems such as small children, AIDS patients, and the elderly. *See* CARBON COUNTY GROUNDWATER GUARDIANS, GIARDIA, CRYTOSPORIDIUM AND WATERBORNE DISEASES, *at* www.webdesignpros.net/groundwater/giardia1.html (last visited Feb. 7, 2005). In 1993, approximately 400,000 people in Milwaukee, Wisconsin became ill with Cryptosporidius, with approximately 60 deaths because of tainted drinking water. *See* ENVIRONMENTAL LITERACY COUNCIL, WATERBORNE DISEASES, *at* www.enviroliteracy.org/article.php/707.html (last visited Feb. 7, 2005).
[8] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 1.
[9] *See id.*
[10] *See id.*
[11] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 3.
[12] *See id.*at 2.
[13] *See id.*
[14] *See id.*
[15] *See id.* at 3.
[16] *See id.* at 5.
[17] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 3.
[18] *See id.* at 6.
[19] *See id.*
[20] *See id.* at 3.
[21] *See id.*

D.4. Population Growth vs. Land Consumption

What is the relationship between population growth, land urbanization and sprawl?

A problematic development trend in the U.S. is that most metropolitan areas are adding urbanized land at a much faster rate than they are adding population – in other words, development is growing out ("sprawling"), not up ("densifying"). The Center on Urban & Metropolitan Policy has analyzed this trend and finds that this often happens in older regions that are already dense and have fragmented local government structures.[1] Generally, this is the situation in the Northeast, where underlying densities are high by national standards, but where population growth is outpaced by land consumption, so "marginal" density is, by comparison, extremely low.

Sprawl is particularly problematic in the "coastal zone." This zone is often defined as the band reaching 50 miles inland from the ocean – by 1997, half of the Nation's population lived in coastal zones.[2] Another way to categorize the coast is by coastal watershed area – in 1997, such watershed areas comprised 13 percent of the contiguous U.S.[3] But, population levels alone do not illustrate the actual human impact on these areas. Generally, coastal zone communities are popular tourist destinations that host large numbers of seasonal visitors and house summer residences that are not factored into census statistics. Coastal zone communities also are wealthier and thus, per capita, coastal residents consume more land and natural resources, boat more frequently, and drive more often and farther distances.

By 1997, the Northeast coastal watershed was the second most heavily developed watershed, and 17 percent of the land had been converted for urban uses.[4] All of the East-of-Hudson watershed falls within the coastal zone, and the regional statistics shown later in this fact sheet demonstrate that the entire watershed is threatened by this sprawling trend.

What is the current rate of land consumption?

While difficult to calculate, a true measure of density that accounts for land consumption is not merely a measurement of residential density (a measurement of population density); rather, density should be based on an assessment of all land uses, including residential, commercial, industrial, roads and highways, suburban parks, cemeteries, sewage and water treatment facilities, etc. (which together account for all land converted to accommodate growth of human use).

Data on the local level is often difficult to assess as there are few studies that gather such comprehensive data. At a state and regional level, the U.S. Department of Agriculture conducts the National Resources Inventory (NRI) survey every five years – the most recently available data is from 1997. Surveys from 1982 to 1997 show the following:[5]

1982 – 1997

- *The Nation*: the amount of urban land increased by 47% (from approximately 51 million acres to 76 million acres), while the population grew by only 17%. The rate of urbanization increased in each 5-year period, growing 11.9, 12.6, and 16.7% respectively. Meanwhile, metropolitan density decreased by 15.7% (from 5.00 to 4.22 persons per urbanized acre). The rate of decline in density increased in each 5-year period, declining 0.22, 0.26, and 0.36 persons per acre respectively. Non-metropolitan density dropped even more rapidly, and together, overall land density dropped by over 20%.

- *The Northeast*: Relative to the Nation as a whole, the Northeast (as a Census region) is facing rapid urbanization, despite relatively slow population growth. While urbanized land has increased 19.1%, population has increased only 6.9%. Overall population density declined by 23% (from 5.86 to 4.51 persons per urbanized acre).

- *The New York Metropolitan Statistical Area (comprised of 31 counties in New York, Long Island, Northern New Jersey and Connecticut)*: Here, urbanized land increased by 20.5%, population increased by 6.1%, and density decreased by 15.4%. The concern is that the New York region is expanding its urbanized area in *low-density, suburban areas that are on the metropolitan fringe.* It is this trend of suburban sprawl that threatens the East-of-Hudson watershed communities.

More detailed data for the *East-of-Hudson region* can be found in U.S. Census Bureau data. However, in contrast to the NRI survey, the U.S. Census Bureau defines an "urbanized area" as any area with a population density of 1,000 or more persons per square mile (or 1,000 persons per 640 acres). While this definition overlooks land conversion for other urban uses, the following residential statistics help illustrate the rapid rate of consumption that is impacting the East-of-Hudson watershed communities.

RATE OF RESIDENTIAL DEVELOPMENT[6]

County	*Water Area (in sq. mi.)*	*Land Area (in sq. mi.)*	*Housing Units (1990)*	*Housing Units (2000)*	*Population (1990)*	*Population (2000)*	*Housing Increase (1990-2000)*	*Population Increase (1990-2000)*
Dutchess	23.78	801.6	89,567	106,103	259,462	280,150	+16,536	+20,688
Putnam	14.97	231.3	28,094	35,030	83,941	95,745	+6,936	+11,804
Westchester	67.26	432.9	320,030	349,445	874,866	923,459	+29,415	+48,593

What is the current rate of population growth in East-of-Hudson Watershed communities?

From 1990 to 2000, population in Dutchess County grew by 7.97%, Putnam County by 14.06%, and Westchester County by 5.55% – making Putnam the fastest growing suburban county in the State. However, even this large population growth, high in absolute terms, is low relative to the rate of land consumption (illustrated here by

looking at the growth in number of housing units, which is really only a small portion of land actually consumed for human uses). For the same period, the number of housing units, and thus land consumption, grew in Dutchess County by 18.46%, Putnam County by 24.69%, and Westchester County by 9.19%.

HISTORIC POPULATION GROWTH[7]

County	*Aug. 1, 1790*	*Aug. 1, 1800*	*Aug. 1, 1810*	*Aug. 1, 1820*	*June 1, 1830*	*June 1, 1840*	*June 1, 1850*	*June 1, 1860*	*June 1, 1870*	*June 1, 1880*
Dutchess	45,276	47,775	51,363	46,615	50,926	52,398	58,992	64,941	74,041	79,184
Putnam	---	---	---	11,268	12,628	12,825	14,138	14,002	15,420	15,181
Westchester	23,978	27,428	30,272	32,638	36,456	48,686	58,263	99,497	131,348	108,988

County	*June 1, 1890*	*June 1, 1900*	*April 15, 1910*	*Jan. 1, 1920*	*April 1, 1930*	*April 1, 1940*	*April 1, 1950*	*April 1, 1960*	*April 1, 1970*	*April 1, 1980*	*April 1, 1990*
Dutchess	77,879	81,670	87,661	91,747	105,462	120,542	136,781	176,008	222,295	245,055	259,462
Putnam	14,849	13,787	14,665	10,802	13,744	16,555	20,307	31,722	56,696	77,193	83,941
Westchester	146,772	184,257	283,055	344,436	520,947	573,558	625,816	808,891	894,406	866,599	874,866

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[1] *See* WILLIAM FULTON, ET AL., CENTER ON URBAN & METROPOLITAN POLICY, WHO SPRAWLS MOST? HOW GROWTH PATTERNS DIFFER ACROSS THE U.S. (The Brookings Institution Survey Series July 2001), *available at* http://www.solimar.org/pdfs/whosprawlsmost/whosprawlsmost.pdf (last visited Feb. 10, 2005).

[2] *See* DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 7-11 (2002), *available at* http://www.pewoceans.org/reports/water_pollution_sprawl.pdf (last visited Feb. 10, 2005).

[3] *See id.*

[4] *See id.* at 5. For a visual understanding, see Figure Four, which provides images showing the expansion of the New York Metropolitan area in 1930, 1960, and 1990.

[5] While the NRI survey is conducted for each county in the Nation, outside of Alaska, this detailed data is not easily accessible. Thus, the summary information noted here is taken from analysis of the NRI 2001 report published by the Center on Urban & Metropolitan Policy. *See also* FULTON, *supra* note 1.

[6] Compiled from the official U.S. Census Bureau data from the 1990 and 2000 Census of Population and Housing. *See* U.S. CENSUS BUREAU, TABLE 1. LAND AREA, POPULATION, AND DENSITY FOR STATES AND COUNTIES: 1990, *available at* http://www.census.gov/population/censusdata/90den_stco.txt (last revised June 26, 2000); U.S. CENSUS BUREAU, (GCT-PHA) POPULATION, HOUSING UNITS, AREA, AND DENSITY: 2000, *available at* http://factfinder.census.gov/servlet/GCTTable?ds_name=DEC_2000_SF1_U&geo_id=04000US36&_box_head_nbr=GCT-PH1&format=ST-2 (last visited Feb. 10, 2005). Information on 1990 Housing Units was compiled from the 1990 Census by the New York State Data Center. *See* NEW YORK STATE DEP'T OF ECONOMIC DEV., STATE DATA CTR., *Population, Households, Families and Land Area – Governmental Units*, *available at* http://www.nylovesbiz.com/nysdc/censprof/landarea/ctylist.asp (last visited Feb. 10, 2005).

[7] NEW YORK STATE DEP'T OF ECONOMIC DEV., STATE DATA CTR., *Population of New York State by County 1790 to 1990* (July 2000), *available at* http://www.nylovesbiz.com/nysdc/StateCountyPopests/CountyPopHistory.PDF (last visited Feb. 10, 2005).

D.5. Sprawl and Wetlands

What are wetlands?

For regulatory purposes under the federal Clean Water Act (CWA), wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."[1]

The New York State Department of Environmental Conservation (DEC) describes wetlands as "transitional areas between aquatic and upland plant and animal communities, and often have some of the qualities of both. Wetlands also occur where the groundwater occurs near or at the surface, saturating the soil and the root zone of the plants that grow there."[2] More lengthy legal definitions of "tidal" and "freshwater" wetlands are contained in Environmental Conservation Law (ECL) § 24-0107.1 and § 25-0103.1. DEC has paraphrased the definition of freshwater wetlands as "those areas of land and water that support a preponderance of characteristic wetlands plants that out-compete upland plants because of the presence of wetlands hydrology (such as prolonged flooding) or hydric (wet) soils."[3] Similarly, a typical tidal wetland "is the salt marsh which occurs in the near shore areas all around Long Island, the lower Hudson River, and along the entire Atlantic coast of the United States. These areas are dominated by grasses and other marsh plants which are adapted to the rise and fall of the tide and the salty water it brings."[4]

Generally, wetlands are defined by various characteristics – soil type, level and duration of saturation throughout the year, and the types of resident plant and animal communities are dominant factors. Wetland types vary due to regional differences in soil, topography, climate, hydrology, water chemistry, vegetation, and level of human disturbance.[5] Most wetlands fall into four main types – marshes, fens, bogs, and swamps.[6]

Why are wetlands important?

Wetlands are vital for protecting the environment and public health. Wetlands are transitional areas that act as buffers between open waters and uplands and provide functions that:

1) filter pollution, purify our drinking water, and protect rivers, lakes, and coastal waters from sediment, nutrients, chemical contaminants, and bacteria;
2) recharge groundwater aquifers;
3) absorb floodwaters, protecting coasts and homes from floods;
4) provide habitat for plant and animal species, including threatened or endangered species (New York is home to 72 rare wetland-dependent species, 49 rare animal, and 23 rare plant species); and
5) provide local tourism industries with opportunities to engage in activities associated with such wildlife.[7]

In the East-of-Hudson drinking water supply watershed, the pollution filtration and aquifer recharge provided by wetlands is extremely important for protecting the quality of water that serves approximately 9 million people. Wetland environments act as buffers for streams, rivers, lakes, and drinking water reservoirs because they trap, uptake and transform harmful nutrients, heavy metals, pesticides, and organic pollutants before they can flow into downgradient waterbodies. Wetlands have unique features that improve water quality, including: physical configurations that increase water retention time and thus induce pollution settling; hydric soils that bind pollutants and provide a substrate for microbial degradation and transformation; and vegetation that slows water flow, enhancing settling and providing nutrient uptake, and that also provides a substrate for microbial activity.

In addition, it is important that all surface and groundwaters, including wetlands, are inextricably linked by shared hydrological, physical, biological, and chemical properties. Wetlands often are the headwaters that contribute to baseflow of tributaries, streams, rivers, and reservoirs. Groundwater discharges also are cool and clean, compared to surface flows, and thus can combat the thermal stress that could otherwise harm certain biota in warm seasons, such as the cherished native brook trout in New York.

The Great Swamp serves as the headwaters of the Croton watershed. Photo by Marc A. Yaggi.

How does sprawl impact wetlands?

Estimates of wetland losses vary greatly, even among official government agency data sources. U.S. Fish & Wildlife Service research estimates that since the 1800s, the coterminous U.S. has lost approximately 53% of its estimated original 221 million acres of wetlands,[8] and continues to lose almost 60,000 acres each year.[9] However, as recently as 1999, the General Accounting Office estimated that approximately 290,000 acres of wetlands are lost nationally per year.[10] Likewise, in New York, DEC states that as of the mid-1990s, there were approximately 2.4 million acres of wetlands in the State.[11] But detailed reports show quite a different situation. National Research Council data show that since the 1700s, New York has lost over 60% of its estimated original 2.562 million

acres of wetlands, and by the 1980s there were an estimated 1.025 million acres remaining.[12]

In the 387-square-mile East-of-Hudson watershed, there are 15,809 acres of wetlands (which comprise 6.4% of the watershed's land surface area).[13] Vegetated wetlands represent about 85% of the total (the rest being ponds and shallow water zones), and acreage can be broken down by type:[14]

- Emergent = 750 acres
- Scrub-Shrub = 752 acres
- Shrub/Emergent = 812 acres
- Deciduous Forested = 11,036 acres
- Evergreen/Mixed Forested = 158 acres

Sprawl is a significant factor contributing to the rapid loss of critical wetland areas. Wetlands often are ditched and drained in order to accommodate new building, agricultural uses, or to provide alleged mosquito control. Additional pollutants are introduced from vehicles, house and lawn chemicals, factories and power plants. Native wetland vegetation can be replaced by nonnative, invasive plant species that are aesthetically pleasing, but do not provide equivalent wetland functions for water quality. Construction activities significantly increase sedimentation in waterbodies – a construction site can lose up to 1,000 tons of sediment per acre, per year.[15] EPA states that "sediment runoff rates from construction sites are typically 10 to 20 times greater than those of agricultural lands, and 1,000 to 2,000 times greater than those of forest lands. During a short period of time, construction sites can contribute more sediment to streams than can be deposited naturally during several decades."[16] And, creation of more impervious surfaces – such as parking lots, rooftops, and semi-pervious areas like lawns – allows more pollutants to be more quickly carried into wetlands and other waterbodies at volumes and velocities that can rip important vegetation from, and thus destroy, protective wetlands that buffer our drinking water supplies.

Loss of even small wetlands can have irreversible environmental impacts. Sprawling development patterns place wildlife species, particularly amphibians, at risk of extinction.[17] Study of a sample area in South Carolina has shown that eliminating natural wetlands of less than 10 acres would increase the nearest-wetland distance from 1,570 feet to 5,443 feet.[18] This distance would take most amphibian species several generations to travel, and thus increases the probability of extinction of local populations.[19]

Wetland degradation can be as devastating as complete wetland loss because degraded wetlands lose their ability to perform their valuable functions. When development projects disturb wetland areas, they often are required to mitigate losses by creating artificial wetlands in another location. However, successful creation of equivalent wetland functions is rarely accomplished. Wetland vegetation is important to the function of water quality, and hydrology affects the way in which seeds disperse and germinate.[20] Many seeds cannot germinate in standing water and therefore flow is essential.[21] Vegetation, in turn, influences flow rates and thus reciprocally affects hydrology. And wetland plantings require considerable monitoring for several years to

insure they establish. A typical proposed self-monitoring period for wetland plantings in a development project is three to five years, but some wetland vegetation may not mature for many years afterward. Other disturbances occurring after monitoring periods may require plant replacement to ensure successful functioning of wetlands.

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[1] U.S. ENVTL. PROT. AGENCY, Section 404(B)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 C.F.R. § 230.3(t).
[2] NEW YORK STATE DEP'T OF ENVTL. CONSERVATION, FRESHWATER WETLANDS PROGRAM, *available at* http://www.dec.state.ny.us/website/dfwmr/habitat/fwwprog.htm (last revised Mon., Sept. 13, 2004).
[3] *Id.*
[4] NEW YORK STATE DEP'T OF ENVTL. CONSERVATION, Welcome to Marine Habitat Protection, *available at* http://www.dec.state.ny.us/website/dfwmr/marine/mhabitat.htm (last visited Feb. 10, 2005).
[5] *See* U.S. ENVTL. PROT. AGENCY, Wetlands Definitions, *available at* http://www.epa.gov/owow/wetlands/what/definitions.html (last visited Feb. 10, 2005).
[6] *See* U.S. ENVTL. PROT. AGENCY, EPA 843-F-04-011a, WETLANDS OVERVIEW (Dec. 2004), *available at* http://www.epa.gov/owow/wetlands/facts/overview.pdf (last visited Feb. 10, 2005). For a more detailed discussion of wetland classification, see LEWIS M. COWARDIN ET AL, U.S. FISH AND WILDLIFE SERV., CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES (1979), *available at* http://wetlands.fws.gov/Pubs_Reports/Class_Manual/class_titlepg.htm (last visited Feb. 10, 2005).
[7] *See* U.S. ENVTL. PROT. AGENCY, EPA 843-F-01-002c, FUNCTIONS AND VALUES OF WETLANDS (Sept. 2002), *available at* http://www.epa.gov/owow/wetlands/facts/fun_val_pr.pdf (last visited Feb. 10, 2005). *See also* NEW YORK STATE DEP'T ENVTL. CONSERVATION, "Wetland Functions and Values," *available at* http://www.dec.state.ny.us/website/dfwmr/habitat/fwwprog2.htm (last updated Thurs, Apr. 3, 2003).
[8] *See* THOMAS E. DAHL, U.S. FISH & WILDLIFE SERVICE, WETLANDS LOSSES IN THE UNITED STATES: 1780'S TO 1980'S (Version 16 July 97), *available at* http://www.npwrc.usgs.gov/resource/othrdata/wetloss/wetloss.htm (last visited Feb. 10, 2005).
[9] *See* U.S. FISH & WILDLIFE SERVICE, REPORT TO CONGRESS ON THE STATUS AND TRENDS OF WETLANDS IN THE CONTERMINOUS UNITED STATES 1986 TO 1997, SUMMARY FINDINGS, *available at* http://wetlands.fws.gov/bha/SandT/SandTSummaryFindings.html (last visited Feb. 10, 2005).
[10] *See* JAMES M. TIERNEY, NEW YORK CITY WATERSHED INSPECTOR GENERAL, OFFICE OF THE NEW YORK STATE ATTORNEY GENERAL, REGULATION AND PROTECTION OF WETLANDS WITHIN THE NYC WATERSHED: A REPORT OF POLICY-MAKERS AND CONCERNED CITIZENS 9 (July 23, 1999).
[11] *See* NEW YORK STATE DEP'T OF ENVTL. CONSERVATION, *Freshwater Wetlands Status and Trends*, *available at* http://www.dec.state.ny.us/website/dfwmr/habitat/fwwprog3.htm (last visited Feb. 10, 2005).
[12] *See* TIERNEY, *supra* note 10.
[13] *See* RALPH W. TINER, U.S. FISH & WILDLIFE SERV., WETLANDS IN THE WATERSHED OF THE NEW YORK CITY WATER SUPPLY SYSTEM: RESULTS OF THE NATIONAL WETLANDS INVENTORY (1997) (Prepared for the New York City Department of Environmental Protection, Bureau of Water Supply, Quality and Protection).
[14] *See id.*
[15] *See* U.S. ENVTL. PROT. AGENCY, EPA 840-B-92-002, GUIDANCE SPECIFYING MANAGEMENT MEASURES FOR SOURCES OF NONPOINT POLLUTION IN COASTAL WATERS: CHAPTER 4.III CONSTRUCTION SITE MANAGEMENT MEASURE – III. CONSTRUCTION ACTIVITIES (Jan. 1993), *available at* http://www.epa.gov/OWOW/NPS/MMGI/Chapter4/ch4-3a.html (last visited Feb. 10, 2005).
[16] U.S. ENVTL. PROT. AGENCY, *The Mid-Atlantic States*: *Storm Water Pollution Prevention*: *Construction*, *available at* http://www.epa.gov/reg3wapd/stormwater/construction.htm (last visited Feb. 10, 2005).
[17] *See* R. Semlitsch & J.R. Brodie, *Are small, isolated wetlands expendable?,* CONSERVATION BIOLOGY 12: 1129-1133 (1998).
[18] *See id.*
[19] *See id.*
[20] *See* JOY ZEDLER ET AL., NAT'L ACAD. OF SCIENCE, COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT 28 (2001).
[21] *See id.*

D.6. Sprawl and Wetland Buffers

What are wetland buffers?

Wetland buffers (sometimes called "buffer zones" or wetland "adjacent areas") are the upland areas adjacent to wetlands. They can be described generally as "linear bands of permanent vegetation adjacent to an aquatic ecosystem intended to maintain or improve water quality by trapping and removing various nonpoint source pollutants."[1] Like the wetlands themselves, wetland buffers provide numerous environmental benefits and often are protected by regulation. In most East-of-Hudson watershed towns, wetland buffers are 100 feet; however, some towns, recognizing the critical value of buffers, are increasing them to 150 feet or more.

Why are wetland buffers important?

Wetlands perform valuable functions, including water quality protection, aquifer recharge, flood and erosion control, and habitat for fish, plants, and other wildlife. Thus, wetlands "buffer" our water supplies. Wetland buffers are necessary to protect wetlands, and in this sense, provide a second line of defense and help keep human activity from directly impacting our waters.

Buffer lands serve to protect this vernal pool in Yorktown, New York. Photo by Leila Goldmark.

In addition to trapping and removing pollutants, wetland buffers provide other water quality benefits, which include: (1) reducing thermal impacts (shade); (2) providing nutrient uptake; (3) providing infiltration; (4) reducing erosion; and (5) restoring and maintaining the chemical, physical and biological integrity of water resources.[2]

Buffers also filter sediment, pesticides, heavy metals and other pollutants from stormwater, and reduce nutrient loadings to wetlands by uptake in vegetation and denitrification,[3] thereby protecting wetlands from excessive loadings and allowing them to perform similar functions without overloading of contaminants. Buffers function to store water and reduce peak runoff velocities during storm events and provide unique recreation, academic and aesthetic opportunities.[4] Buffers provide habitat for flora and fauna and corridors for wildlife to move between larger sections of habitat.[5]

How does sprawl impact wetland buffers?

Impacts associated with ever increasing development activities – such as placement of site-design elements, increased use of pesticides, fertilizers and road salt, and increased runoff – encroach upon wetlands and wetland buffers and prevent them from performing their valuable functions. It is not uncommon for developers to create site plans that require wetland permits or wetland buffer encroachment permits. Badly designed site plans place roads, driveways, buildings, recreational facilities such as ball fields, or elements of a project's stormwater pollution prevention plan – culverts, detention basins, stormwater discharge points, etc. – within wetlands and wetland buffers. Siting these impervious surfaces and allowing development activities within buffers can impair buffer function by clearing trees, sacrificing stream channels located above the area of disturbance, altering existing wetland hydrology, and increasing thermal impacts.[6] While such disturbances should not be permitted if communities wish to maintain healthy, functional wetlands and buffer areas, local planning boards often grant wetland and buffer encroachment permits, which largely defeat the purpose of local ordinances that aim to protect these critical areas. In most cases, an alternate site design would avoid wetland and buffer impacts.

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[1] R. FISCHER & J. FISCHENICH, DESIGN RECOMMENDATIONS FOR RIPARIAN CORRIDORS & VEGETATED BUFFER STRIPS 2 (U.S. Army Engineer Research and Development Center 2000).
[2] *See* U.S. ENVTL. PROT. AGENCY, MODEL ORDINANCES TO PROTECT LOCAL RESOURCES, *available at* http://www.epa.gov/owow/nps/ordinance (last updated Sept. 23, 2002).
[3] *See* U.S. ARMY CORPS OF ENG'RS, BUFFER STRIPS FOR RIPARIAN ZONE MANAGEMENT (1991) 2.
[4] *See id.* at 3.
[5] *See* FISCHER, *supra* note 1.
[6] *See id.* at 6.

D.7. Sprawl and Species Habitat

What is habitat?

Habitat is the physical, chemical, and biological environment in which organisms live.[1] Specific types of organisms (species) depend on the soils, water and physical conditions of specific habitats for survival and reproduction. The interactions between a community of species and their habitats may be simple or complex. Species distribution and abundance in any given habitat is related to the ecological processes that influence their ability to survive and reproduce.[2]

Why is habitat important?

Habitat is essential to sustain plant and animal species and to maintain species diversity. The wide array of ecological niches that living organisms occupy when foraging, breeding, roosting, and escaping predators is dependent on the existence of suitable habitat to meet these basic requirements for survival and reproduction. When natural habitat is cleared of vegetation for development, wildlife breeding, nesting and feeding areas are destroyed and the natural corridors on which many species rely for movement between larger tracts become fragmented. In addition, plant species diversity is reduced.

What are the impacts of sprawl on habitat and wildlife?

Vegetation

Sprawl devours forests and other natural habitat and replaces it with building footprints, access roads, parking lots, sidewalks and other impervious surfaces that transport pollutants to surface waters. The loss or alteration of habitat associated with sprawl is responsible for the proliferation of invasive plant species and the near-extinction of hundreds of North American plant species.[3] Worldwide, sprawl has threatened thousands of plants with extinction, including two medically significant species whose natural organic compounds are used to treat childhood leukemia and Hodgkin's disease.[4]

In addition to clearing habitat and exposing natural vegetation to herbicides and excessive nutrient loading, sprawl also leads to the increased use of road salt on impervious surfaces for deicing operations during winter road maintenance. Exposure to chloride road salts inhibits growth of natural soil bacteria, even at low concentrations, and compromises soil structure and erosion control.[5] In turn, elevated salt levels in soils create osmotic imbalances in plants, which inhibit water absorption and reduce root growth. Salt also disrupts the uptake of plant nutrients, inhibits long-term growth, and can damage vegetation up to 200 meters from roadways that are treated with deicing salts.[6]

Buffer zones

Buffers are transitional areas that filter sediment, pesticides, heavy metals and other pollutants from stormwater. As land is cleared of vegetation for development, the vegetated buffers that protect surface waters from polluted stormwater runoff are reduced and degraded. Buffers also reduce nutrient loadings to streams, reservoirs and wetlands by uptake in vegetation and denitrification,[7] thereby protecting aquatic habitat from excessive loadings. Impacting buffer habitat compromises its ability to protect aquatic species.

Wildlife

Removal of, or damage to, vegetation degrades wildlife habitat by destroying food resources, habitat corridors, shelter and breeding or nesting sites. Additionally, connected tracts of similar habitat provide corridors for wildlife to move through when seeking food, shelter or breeding sites.[8] Providing suitable wildlife habitat requires wide buffers in riparian corridors. Most avian populations require a minimum of 300 feet, although the general zoning requirement is only 100 feet.[9] In fact, to provide food and shelter for a wide variety of aquatic wildlife, some aquatic systems require buffers in excess of 1,500 feet.[10]

Birds, like this screech owl, require forested areas for nesting, roosting, and feeding. Photo by William Wegner.

Wildlife populations are stressed not only by the impact of sprawl on their habitat, but also by the pollutants associated with sprawl, which can have direct behavioral and toxicological impacts on wildlife. Pesticides transported to surface waters may kill off aquatic macroinvertebrate populations. The phosphorus contained in fertilizers and transported to streams and reservoirs in stormwater runoff creates algae blooms (eutrophication), which alter aquatic species diversity and abundance. Road salts in water supplies or roadside habitat is toxic to birds, mammals, fish and other aquatic biota.[11] Sprawl's impact on wildlife therefore is not limited to habitat destruction but is in fact exacerbated by direct exposure to the toxic contaminants associated with suburbanization.

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[1] *See* U.S. ENVTL. PROT. AGENCY, TERMINOLOGY REFERENCE SYSTEM: HABITAT, *available at* http://oaspub.epa.gov/trs/trs_proc_qry.navigate_term?p_term_id=7051&p_term_cd=TERM (last visited Feb. 7, 2005).

[2] *See* INST. OF ECOSYSTEM STUDIES, *Defining Ecology*, *available at* http://www.ecostudies.org/definition_ecology.html (last visited Feb. 7, 2005).
[3] *See* NEW YORK BOTANICAL GARDEN, CATALOG OF INVASIVE PLANT SPECIES OF THE UNITED STATES (2000), *available at* http://www.nybg.org/bsci/hcol/inva/ (last visited Feb. 7, 2005).
[4] *See id.*
[5] *See* ENVIRONMENT CANADA, PRIORITY SUBSTANCES ASSESSMENT REPORT: ROAD SALTS 72 (2000).
[6] *See id*. at 75
[7] *See* U.S. ARMY CORPS OF ENG'RS, BUFFER STRIPS FOR RIPARIAN ZONE MANAGEMENT 2 (1991).
[8] *See id.* at 5.
[9] *See* U.S. ARMY CORPS OF ENG'RS, TECHNICAL AND SCIENTIFIC CONSIDERATIONS FOR UPLAND & RIPARIAN BUFFER STRIPS IN THE SECTION 404 PERMIT PROCESS 4 (2002).
[10] *See* U.S. ARMY CORPS OF ENG'RS, *supra* note 7 at 8.
[11] *See* ENVIRONMENT CANADA, *supra* note 5, at 87.

D.8. Sprawl and Forests

How does sprawl impact the variable landscape in a watershed?

The conversion of forests and other open space to development results in a variety of natural resource impacts, including the increase of stormwater runoff, impairment of groundwater recharge, and interference with air pollution control. These impacts are often exacerbated by the presence of steep slopes. Too often the natural landscape is altered to fit development, rather than the other way around.

Because slopes affect so many aspects of land use, they have become "one of the top two or three environmental criteria in regulating development."[1] Slope impact can appear in two forms: placement of structures on potentially unstable land, or disturbance of stable slopes.[2] The causes of disturbance fall into three categories: 1) mechanical cut and fill (i.e. reshaping of slopes); 2) deforestation, reducing stabilization and increasing runoff; and 3) improper siting and construction, leading to alteration of vegetation, slope material, and drainage.[3]

A one-acre parking lot produces 16 times the volume of runoff of a one-acre meadow.[4] Streambanks in watersheds with more than 10% impervious cover become physically unstable, resulting in erosion and sedimentation.[5] These effects are exacerbated by development in steep slope areas.[6] Runoff rates are higher on steep slopes, and in developed areas, stormwater quality declines with higher runoff rates.[7] Steep slopes also hinder the performance of wastewater drainfields.[8]

What are the environmental and economic benefits of forests, and how are these benefits affected by sprawl?

Environmental benefits of trees in the urban landscape include: retention of carbon dioxide, reduction of stormwater flow through increased infiltration and rainfall detention, reduction in erosion and attendant sediment control costs, and providing wildlife habitat.[9] Conserving natural vegetation also results in maintenance cost reduction.[10] Minimizing clearing and/or grading can reduce earth moving and erosion control costs during construction, as well as stormwater management costs from reduced runoff.[11] Vegetation with extensive root systems – such as forests – adds stability to slopes with otherwise fine material.[12] Forests provide significant water storage, aquifer recharge, and flood protection benefits.[13]

Trees themselves can absorb considerable amounts of water, as well as the nitrates, phosphorus, and potassium found in runoff from developed areas.[14] American Forests has developed modeling software to quantify what it contends are significant stormwater control savings from maintenance of healthy tree cover.[15] Using this software, American Forests published a study of the value of tree cover in Garland, Texas.[16] The study revealed savings of $5.3 million per year on residential energy use,

runoff reduction, and air pollution removal.[17] On an individual site scale, lots with trees often have a higher property value than cleared lots.[18]

Forest protection also can produce significant savings on a large, watershed-size scale. A recent study by World Bank – WWF Alliance for Forest Conservation and Sustainable Use shows that more than one-third of the world's largest cities, including New York, rely on protected forest areas for much of their drinking water.[19] The study illustrated that adoption of a forest protection strategy in New York would be seven times less expensive than constructing a water treatment plant for the Catskill/Delaware system.[20]

A tributary entering the West Branch Reservoir. Photo by William Wegner.

Urban sprawl leads to the "parcelization" of land as people buy, subdivide, and sell land. Parcelization often is a precursor to forest fragmentation, the breaking up of large tracts of forest into smaller fragments through land transfers. As a result, many forestlands are converted to long-term or permanent non-forest use. Approximately 2.4 million acres of forestland in the nation is being converted to developed land every 2 years.[21] Ecological impacts of replacing forests with sprawl development include: destruction of wildlife habitat and routes, invasion of non-native animal and plant species, and increased volume and pollution of runoff.[22]

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[1] William M. Marsh, LANDSCAPE PLANNING: ENVIRONMENTAL APPLICATIONS 52 (John Wiley & Sons, Inc. 1991).
[2] *See id.*
[3] *See id.* at 52-53.
[4] *See* DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 9 (2002), *available at* http://www.pewoceans.org/reports/water_pollution_sprawl.pdf (last visited Feb. 9, 2005).
[5] *See id.*
[6] *See* Marsh, *supra* note 1, at 117.
[7] *See id.* at 52.
[8] *See id.*
[9] *See* CTR. FOR WATERSHED PROT., BETTER SITE DESIGN: A HANDBOOK FOR CHANGING DEVELOPMENT RULES IN YOUR COMMUNITY 155 (1998).
[10] *See id.* at 155.

[11] *See id.* at 149.
[12] *See* Marsh, *supra* note 1, at 58.
[13] *See* AMERICAN RIVERS / NATURAL RES. DEF. COUNCIL / SMART GROWTH AMERICA, *Paving Our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought* 18 (2002). For example, study of one site showed conversion of woodlands to development resulted in an 11 to 19-fold increase in runoff, and an 11-100% loss of groundwater recharge. *See id.*
[14] *See* Janis Keating, *Trees: The Oldest New Thing in Stormwater Treatment?*, STORMWATER, Mar/Apr 2002, at 56.
[15] *See id.* at 56-57.
[16] *See id.* at 58.
[17] *See id*. American Forests' study of larger urban areas showed Washington DC's trees have an annual value of over $2 million with respect to air pollution removal, while Atlanta's trees, which remove 19 million pounds of pollutants annually, have a value of $47 million with respect to air pollution savings. *See* AMERICAN FORESTS, Fact Sheet: Trees and Air Quality, *available at* http://www.americanforests.org/graytogreen/air/ (last visited Oct. 21, 2004). Tree coverage in Atlanta also was found to save residents approximately $2.8 million annually in reduced energy costs. *See* AMERICAN FORESTS, Fact Sheet: Trees and Energy Conservation, *available at* http://www.americanforests.org/graytogreen/energy/ (last visited Sept. 3, 2003).
[18] *See* CTR. FOR WATERSHED PROT., *supra* note 9, at 146.
[19] *See* NIGEL DUDLEY & SUE STOLTON, WORLD BANK – WWF ALLIANCE FOR FOREST CONSERVATION AND SUSTAINABLE USE, *Running Pure*, at 4 (Aug. 2003), *available at* http://www.panda.org/downloads/freshwater/runningpurereport.pdf (last visited Feb. 10, 2005).
[20] *See id.* at 89.
[21] *See* U.S. DEP'T OF AGRICULTURE, FOREST SERV., DURHAM FIELD OFFICE, *Fact Sheet: Fragmentation*, *available at* http://www.fs.fed.us/na/durham/coopforest/fragmention/index.shtml (last visited Oct. 21, 2004).
[22] *See* U.S. DEP'T OF AGRICULTURE, FOREST SERV., DURHAM FIELD OFFICE, *Fact Sheet: Impacts of Forest Fragmentation and Urban Sprawl*, *available at* http://www.fs.fed.us/na/durham/coopforest/fragmention/text/impacts.shtml (last modified Sept. 2, 2003).

D.9. Sprawl and Air Quality

How does sprawl increase air pollution?

The effects of sprawl on air quality come primarily in two forms: 1) direct effects on human health and natural resources, primarily due to pollution from vehicle emissions, and 2) indirect effects on natural and physical resources from pollution transformed into acid rain, or conversely, from volatilization of waterborne pollutants.

Direct Effects

Air pollution caused by emissions from vehicles can be attributed to the volume and distance of vehicle travel that, in turn, can be traced to sprawl development. The new suburban model spreads elements of a community apart, resulting in increased vehicle travel as cars become the only transportation option. As driving has increased at three to four times the population growth, traffic has become more congested and air pollution has worsened.[1]

Twenty percent of Americans live in areas where the air is not safe to breathe.[2] According to the U.S. Environmental Protection Agency (EPA), over half the cancers attributed to air toxics can be traced to those released from vehicles.[3] Cars and trucks produce half of all toxic air pollution emitted in the U.S.[4] A typical U.S. car emits enough pollution to create five tons of carbon dioxide a year.[5] Motor vehicles generate more than two-thirds of the carbon monoxide in the atmosphere, a third of the nitrogen oxides, and a quarter of the hydrocarbons.[6]

Sprawling patterns lead to a greater reliance on automobiles, which choke our air with a cocktail of toxic chemicals. Photo by Leila Goldmark.

Indirect Effects

The mercury and sulfur dioxide emitted from fossil-fueled power and manufacturing plants can be transported hundreds of miles by winds. Sulfur dioxide

reacts with other substances to form acid rain, which precipitates from the atmosphere and corrodes automobiles, buildings and historical monuments, and acidifies surface waters in lakes and streams to levels that are toxic to many fish and other aquatic organisms.[7]

Some persistent compounds, such as PCBs, can volitalize from the water column and travel airborne to be redeposited on soils, vegetation, or other surface waters.[8] In fact, recent studies reveal that PCBs are emitted from the Hudson River into the air and deposited in New York City drinking water reservoirs.[9] Some of these same PCBs may then revolitalize and travel airborne to other land and water surfaces.[10]

What are the human health impacts of air pollution?

Vehicle emissions that are known or likely to cause cancer, include toxic substances such as soot (fine particulates), benzene, arsenic compounds, formaldehyde, and lead.[11] EPA estimates that mobile sources such as cars, trucks, and buses release about 3 billion pounds of cancer-causing, hazardous air pollutants each year.[12]

Air pollutants enter the body through inhalation, skin absorption, or consumption of contaminated food or water. Bioaccumulation in the food chain occurs through direct airborne deposition or chronic exposure of plants and animals to air pollution. Air pollutants found in contaminated food and water include pesticides, PCBs, dioxin and heavy metals such as cadmium, lead and mercury. These contaminants have toxic effects on human organ systems and physiological processes, resulting in a variety of direct and indirect health effects:[13]

- Chronic diseases – sinusitis, bronchitis, asthma, allergies, ear infections and hearing loss;
- Circulatory system – anemia, leukemia, and heart disease, including hypertension and cardiac arrhythmias;
- Urogenital system – kidney disease, bladder cancer and reproductive problems;
- Skeletal system – osteoporosis, and calcium deposition during pregnancy;
- Nervous system – psychiatric disorders due to endocrine imbalance; and
- Skin cancer, immune system effects, and eye disorders resulting from UV radiation exposure as chloro-fluorocarbon emissions diminish the ozone layer.

What are the economic and environmental costs of air pollution?

Air pollution from cars results in 120,000 premature deaths and $40-50 billion in health care costs each year in the U.S.[14] Air pollution costs society a total of 7-11¢ per

mile of solo driving, even if disregarding most forms of damage to crops, plant and animal life, and buildings.[15] In addition to negative impacts on human health, air pollution in the form of smog and acid rain kill or harm agricultural crops and damage buildings at a cost of $2-$3 billion annually.[16] Scientific literature also documents environmental impacts of air pollution to forests,[17] wildlife,[18] aquatic life and water quality.[19]

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[1] *See* DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 3 (2002), *available at* http://www.pewoceans.org/reports/water_pollution_sprawl.pdf) (last visited Feb. 9, 2005).
[2] *See* SIERRA CLUB, SMART CHOICES, LESS TRAFFIC: SIERRA CLUB TAKES A CRITICAL LOOK AT 49 TRANSPORTATION PROJECTS (2002), *available at* http://www.sierraclub.org/sprawl/report02/transportation_choices.asp#highway (last visited Feb. 10, 2005).
[3] *See id*; *see also* ANDRES DUANY, ET AL., SUBURBAN NATION: THE RISE OF SPRAWL AND THE DECLINE OF THE AMERICAN DREAM 95 (North Point Press 2000).
[4] *See* CMTY. & ENVTL. DEF. SERVS., *Fact Sheet: Traffic & Neighborhood Quality of Life*, *available at* http://www.ceds.org/TrafNeig.PDF (last visited Oct. 21, 2004).
[5] *See id.* Of course, more SUVs are on the road today that collectively get worse gas mileage and pollute more than traditional cars. *See* ENVTL. DEF., *Fact Sheet: Cars and the Environment*, *available at* http://www.environmentaldefense.org/system/templates/page/subissue.cfm?subissue=7 (last visited Oct 20, 2004).
[6] *See* SURFACE TRANSP. POLICY PROJECT, *Fact Sheet: Transportation and the Environment*, *available at* http://www.transact.org/library/factsheets/transportation%20and%20the%20environment.doc (last visited Oct. 20, 2004).
[7] *See* U.S. ENVTL. PROT. AGENCY, HEALTH AND ENVIRONMENTAL IMPACTS OF NOX, *available at* http://www.epa.gov/air/urbanair/nox/hlth.html (last updated Feb. 26, 2004).
[8] *See* B. COMMONER, ET AL., THE EXPOSURE OF THE NEW YORK CITY WATERSHED TO PCBS EMITTED FROM THE HUDSON RIVER 5 (Center for the Biology of Natural Systems, Queens College, CUNY (2000)).
[9] *See id.* at 38.
[10] *See id.*
[11] *See id.*
[12] *See* SURFACE TRANSP. POLICY PROJECT, *supra* note 6. Atlanta, one of the modern sprawling cities, has one of the worst ground-level ozone problems in the nation, caused mostly by motor vehicle emissions. *See* Duany, *supra* note 3, at 89, 149, 231.
[13] *See* NAT'L ASSOC. OF PHYSICIANS FOR THE ENVIRONMENT, NATIONAL CONFERENCE ON AIR POLLUTION IMPACTS ON BODY ORGANS AND SYSTEMS (1994), *available at* http://www.easi.org/nape/airexec.html (last visited Feb. 10, 2005).
[14] *See* CMTY. & ENVTL. DEF. SERVS., *supra* note 4.
[15] *See* Burrington, *supra* note 11, at Exec. Summ.
[16] *See* SURFACE TRANSP. POLICY PROJECT, *supra* note 6.
[17] *See* LISA EMBERSON, ET AL., EDS., AIR POLLUTION IMPACTS ON CROPS AND FORESTS (2003), *available at* http://www.wspc.com.sg/books/environsci/p244.html (last visited Sept. 3, 2003).
[18] *See* T. EEVA, AIR POLLUTION IMPACTS ON BIRDS AND INSECTS (1999), *available at* http://users.utu.fi/teeva/Harjavalta_eng.htm (last visited Oct. 17, 2004).
[19] *See* U.S. ENVTL. PROT. AGENCY, *supra* note 7.

II. PAVE IT…OR SAVE IT?
PART E.
The Economic Impacts of Sprawl

E.1. Sprawl and Taxes

The popular myth: increased development brings increased tax revenue into a community.

Simply stated, some citizens and local government officials make the faulty assumption that more money can be brought into a community with increased development. However, study after study shows that sprawl ultimately increases property taxes,[1] and that property tax growth exceeds population growth. While communities may see a short-term increase in revenue, the long-term expenditures necessary to provide increased services overwhelmingly outweigh these short-term benefits. This is because providing services for new homes costs a community more than those homes generate in property tax revenues (or rateables) – services frequently cost 125 to 150% of the tax revenue, and local governments are forced to raise taxes to cover the shortfall.[2]

How does sprawl increase taxes?

Although it often is difficult to calculate the exact cost of sprawl in a community, studies show that increased revenue from property taxes on new development (particularly residential development) does not cover the costs of servicing such new development with roads, sewers, water, schools, libraries, fire and police protection, emergency medical services, garbage collection, buses or other means of public transportation, recreation and government. When services must be spread over larger geographical areas, they function in a less efficient and more costly manner – and costs increase the farther away from existing development the new development is located.[3] Generally speaking, single-family houses on larger lots cost more to service than those on smaller, more centralized lots, and high-density housing is best kept in city/town centers where existing infrastructure can be used. Conversely, smart growth planning that keeps development in community centers can lead to more efficient services and thus, lead to property tax savings.

How does the drive for increased tax revenue promote sprawl?

The converse relationship between taxes and sprawl presents an additional problem. Communities that desire increased revenue from property and sales tax often make land use decisions that compete and conflict with regional planning and economic goals. Thus, municipalities often erroneously favor large, high-end homes on sprawling properties rather than housing in dense urban areas, or favor big box retail stores over less environmentally destructive land uses. In addition, neighboring communities may offer harmful tax breaks, provide cheap services, or allow variances to zoning regulations as they compete to attract new development.

The lack of regional planning is a major contributing factor in spreading sprawl. While commercial and industrial development may sometimes generate more tax revenue than they demand in services, other factors often diminish such gains – they generate

increased traffic and air pollution; they reduce local property values because employees prefer to build new homes in neighboring towns rather than next to the commercial or industrial facilities where they work; and larger companies can often convince a community to widening roads, offering tax breaks, or providing free water and sewage lines.[4]

Examples from Case Studies

Taxes Rise Faster than Population Growth

- A Sierra Club study of Wisconsin from 1990 to 1996 showed that property taxes in Dane County, including the City of Madison, increased 3.46 times faster than the population grew (population grew by 12%; property taxes increased by 43%.[5] In Dane County towns, excluding Madison, taxes grew faster than population by 4.98 times (population grew by 6.77%; taxes increased by 34%).[6] Thus, it is clear that taxes rose faster in sprawling Madison suburbs than in the city.

- The impacts of sprawl on the costs of providing school services present an additional burden. In New York, school districts are authorized to collect school taxes, yet school districts often overlap town and village boundaries. While municipalities may make development decisions based on a desire to raise revenue through property taxes, they often ignore the fiscal impacts on schools districts burdened with new development – new development adds children to already-burdened schools, which leads to significant expansion costs. So, while a rise in property taxes may slow, any potential benefit often is lost to subsequent increases in school district taxes.

    - In the Putnam Valley Central School District in Putnam County, New York, from 1985-1995, student enrollment increased by 24.30%. Taxes per student increased 100.60% (from $4,442 to $8,910 per student), while total school tax collections rose 149.30%.[7] Census data indicates that the population peaked in the mid-1990s and from 1990-2000, enrollment actually dropped from 1,397 to 1,240 students.[8] While Town taxes dropped slightly from $3,677,200 to $3,419,916, school district taxes rose dramatically, from $10,571,489 to $17, 825,937.[9]

    - A study comparing the projected costs of school expansions in a sprawl-style versus smart growth development pattern in Rhode Island suburbs projected that smart growth development would save $31 million in expansion costs over a 20 year period. While a sprawling pattern would increase enrollment by 5,200 student and increase school costs by $52 million, a smart growth pattern limited to revitalizing existing communities would increase enrollment by only 2,000 students and increase costs by $21 million.[10]

EAST-OF-HUDSON WATERSHED COUNTIES:
TAXES vs. POPULATION GROWTH[11]

Government Unit	1990	2000*	% Increase*	Tax/Pop Ratio*
DUTCHESS				
Dutchess County Population	259,462	280,150	7.97%	
All Town, City and Village Property Taxes (including school and special district fees)	265,475,636	395,267,978 (316,214,382)	32.84% (19.11%)	4.12 (2.39)
PUTNAM				
Putnam County Population	83,941	95,745	14.06%	
All Town, City and Village Property Taxes (including school and special district fees)	128,748,143	204,332,545 (163,466,036)	36.99% (26.97%)	2.63 (1.92)
WESTCHESTER				
Westchester County Population	874,866	923,459	5.55%	
All Town, City and Village Property Taxes (including school and special district fees)	1,590,839,864	2,325,097,998 (1,860,078,398)	31.58% (16.92%)	5.69 (3.05)

*The figures in (parenthesis) show the data adjusted for inflation, using a widely accepted inflation deflator.

The three East-of-Hudson watershed counties follow the established trend – as the table shows, local taxes increased two to three times faster than the population grew from 1990 to 2000. Added development, which was predominantly residential, did not generate the revenue required to serve the town, and existing taxpayers were forced to pay higher taxes to make up for this shortfall.

Cost of Providing New Services

- In Loudon County, Virginia, each new house on a quarter-acre lot costs a community $705 per year to provide services, while each new house on a five-acre lot costs $2,232 per year.[12]

- In Redmond Washington, "single-family houses pay 21 percent of property tax but account for 29 percent of the city budget."[13]

Costs of Servicing Different Land Uses

The cost of providing services to different types of land uses varies, but studies show that servicing sprawl communities is more costly than preserving parks and open space.[14]

- Assessments of communities in the Hudson Valley bear similar results. In 1989, Fishkill, New York's revenue to expenditure ratio (in dollars) was 1:1.23 for residential lands, compared with 1:0.74 for farm/forest open land. Residential development in Red Hook was even more costly compared to farm/forest open land, as its residential ratio was 1:1.11 in contrast with 1:0.22 for farm/forest open land.[15]

- The Town of Dunn, Wisconsin, southeast of Madison, estimated that:
  [P]ublic services cost 106% of taxes received from residential building…only costs 29% of taxes received for commercial building and 18% for agricultural, forest, and open space. That means it costs $1060 to service a home that only pays $1000 in taxes each year. Farm and park land only cost $180 to service for the same $1000 in revenue.[16]

- In Michigan, a study conducted by Masters degree students at the University of Michigan School of Natural Resources and Environment found that in Scio Township, agricultural land requires only 62 cents in services for each dollar it pays in taxes; commercial and industrial lands cost only 26 cents; but, residential land required $1.40 in services for each tax dollar raised.[17]

- In 1999, in Ann Arbor, Michigan, the Washtenaw Land Trust conducted a study to assess the economic outcomes of different development scenarios for the Township's remaining developable land (of 4,000 acres of open space, about 2,800 were tillable). It found that:
  - The most likely development pattern of one house per three acres would lead to a $4 million shortfall to provide public services (which translates into a tax increase of 1.35 mills to make up that shortfall), thus requiring a new tax burden of $167 per year for existing households – this was estimated to be a long-term (30+ years) or perpetual cost.
  - Purchasing conservation easements on the tillable land would cost $7.2 million (which translated into 1.16 mills), which would cost existing households $144 per year for 20 years, at which point payment obligations to landowners would end. And the quality of life benefits of preserving open space would remain.[18]

- In Culpepper County, Virginia, a 1988 study published by the Piedmont Environmental Council found that an average residential unit would produce a $1,242 deficit in the county budget, and taxes would have to increase by 80% to cover the costs of new development.[19]

- In Prince William County, Virginia, officials estimated in 1996 that the cost of providing services to new residential homes was $1,600 more per home than what was generated from taxes and other fees.[20]

Costs of Servicing Different Development Patterns

While building high-density units in town centers with existing infrastructure is "smart growth," placing large, high-density developments in rural areas will drain a local

tax base.[21] Thus, in sprawling suburbs, the existing taxpayers end up subsidizing new development rather than benefiting from increased revenue added by new residents and businesses. A study published by the Urban Land Institute in 1987 compared the capital cost of services for single dwelling units for each single dwelling unit for different development patterns and found that compact growth patterns cost $18,000, low density sprawl cost $35,000 and low density sprawl located 10 miles from existing development cost $48,000.[22]

Assessing Fiscal Impacts of New Development

Assessing the fiscal impact of new developments is difficult and must be based on existing local factors. However, several formulas for doing so have been developed by planning organizations, universities and environmental groups. Some sources include:

- Allagash Environmental Institute Center for Research & Advanced Study, *The Comparative Economics of Residential Development & Open Space Conservation;*
- Potawatomi Land Trust, *A Cost of Community Services Study of Scio Township, Michigan;* and
- Natural Resources Defense Council, *Development and Dollars: An Introduction to Fiscal Impact Analysis in Land Use Planning.*

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[1] *See* Brett Hulsey, *Sprawl Costs Us All: How Uncontrolled Sprawl Increases Your Property Taxes and Threatens Your Quality of Life* (Sierra Club Feb. 1996), http://www.sierraclub.org/sprawl/articles/hulsey.asp (last visited Feb. 9, 2005).

[2] *See* Paul Kerlinger, *Economics of Open Space Conservation*, *in* STRATEGIES FOR BIRD CONSERVATION: THE PARTNERS IN FLIGHT PLANNING PROCESS (Rick Bonney et al. eds., Cornell Lab of Ornithology 1999), *available at* http://birds.cornell.edu/pifcapemay/ (last visited Feb. 9, 2005).

[3] *See* Jim Olson et al., *Research Report: The Cost of Sprawl*, (Michigan Land Use Institute July 15, 2000), *available at* http://www.mlui.org/growthmanagement/fullarticle.asp?fileid=3915 (last visited Feb. 9, 2005).

[4] *See* Donella H. Meadows, *If We Don't Like Sprawl, Why Do We Go On Sprawling?,* THE GLOBAL CITIZEN March 4, 1999, *available at* http://www.sierraclub.org/sprawl/articles/meadows2.asp (last visited Feb. 9, 2005)

[5] *See* SIERRA CLUB, *Costs of Sprawl: Tired of Higher Property Taxes? Study Shows We Need to Control Sprawl Development to Control Property Tax Growth*, *available at* http://www.sierraclub.org/sprawl/articles/cost.asp (last visited Feb. 9, 2005).

[6] *See id.*

[7] *See* The Public Policy Institute of New York State, Inc., *Complete List of School Districts* (Jun. 18, 1997), *available at* http://www.bcnys.org/whatsnew/1998/rel_618.htm (last visited Feb. 9, 2005).

[8] *See* National Center for Educational Statistics, *Putnam Valley Central School Census 1990 Top 100 Data, available at* http://nces.ed.gov/surveys/sdds/master90.asp?type=P&fips=36&agid=24000 (last visited Feb. 9, 2005); National Center for Educational Statistics, *School District Demographic System*, *available at* http://nces.ed.gov/surveys/sdds/singledemoprofile.asp?county1=3624000&state1=36 (last visited Feb. 9, 2005) reporting demographic data for 2000.

[9] Statistics compiled from information from the U.S. Census Bureau, and the New York Office of Real Property Services.

[10] *See* Sierra Club, *Sprawl Costs Us All: Schools*, *available at* http://www.sierraclub.org/sprawl/report00/schools.asp (last visited Feb. 9, 2005).

[11] Statistics compiled from information from the U.S. Census Bureau and the New York Office of Real Property Services.

[12] *See* Meadows, *supra* note 4 (*referencing* EBEN FODOR, BIGGER NOT BETTER: HOW TO TAKE CONTROL OF URBAN GROWTH AND IMPROVE YOUR COMMUNITY (New Society Publishers 1999)).
[13] *Id.*
[14] For more detailed discussion, see T. Vance and A. Larson, *Fiscal Impact of Major Land Uses in Culpepper County, Virginia* (Piedmont Environmental Council 1988); American Farmland Trust, *Does Farmland Protection Pay? The Cost of Community Services in Three Massachusetts Towns* (Massachusetts Dept. of Food and Agric. 1992); American Farmland Trust, *Farmland and the Taxbill: the Cost of Community Services in Three Minnesota Cities* (1994).
[15] *See* JULIA FREEDGOOD, COST OF COMMUNITY SERVICES STUDIES: MAKING THE CASE FOR CONSERVATION 57 (2002). Other New York revenue to expenditure ratio (in dollars) studies show the same:

	Residential	Combined Commercial & Industrial	Farm/Forest Open Land
Amenia	1 : 1.23	1 : 0.25	1 : 0.17
Beekman	1 : 1.12	1 : 0.18	1 : 0.48
Dix	1 : 1.51	1 : 0.27	1 : 0.31
Farmington	1 : 1.22	1 : 0.27	1 : 0.72
Hector	1 : 1.30	1 : 0.15	1 : 0.28
Kinderhook	1 : 1.05	1 : 0.21	1 : 0.17
Montour	1 : 1.50	1 : 0.28	1 : 0.29
Northeast	1 : 1.36	1 : 0.29	1 : 0.21
Reading	1 : 1.88	1 : 0.26	1 : 0.32

Id.
[16] *See* Hulsey, *supra* note 1.
[17] *See* WASHTENAW LAND TRUST, *Community Economic Benefits of Land Protection*, (Feb. 9, 2005), *available at* http://www.washtenawlandtrust.org/economic.htm (last visited Feb. 9, 2005) (*summarizing* ANN ARBOR TOWNSHIP COMMUNITY COST COMPARISON (Washtenaw Land Trust 1996)).
[18] *See id.*
[19] *See* J. Palley, *The Economics of Urban Sprawl*, WATERSHED PROTECTION TECHNIQUES at 39 (Vol. 2, No. 4, June 1997) (*citing* T. Vance and A. Larson, *Fiscal Impact of Major Land Uses in Culpepper County, Virginia* (Piedmont Envtl. Council 1988)).
[20] *See id.*
[21] *See* SIERRA CLUB, *supra* note 5.
[22] *See* J. Palley, *The Economics of Urban Sprawl*, 2 WATERSHED PROTECTION TECHNIQUES at 40 (No. 4, June 1997) (*citing* J. FRANK, THE COSTS OF ALTERNATIVE DEVELOPMENT PATTERNS: A REVIEW OF THE LITERATURE 46 (The Urban Land Inst. 1989)). The Palley article discusses several other economic studies that have been conducted to assess the differences between sprawl and compact growth patterns. *Id.* (citing J. Duncan et al., *The Search for Efficient Urban Growth Patterns* (Florida Dept. of Comm. Affairs 1989); R.W. Burchell and D. Listokin, *Land, Infrastructure, Housing Costs and Fiscal Impacts Associates with Growth: The Literature on the Impacts of Sprawl Versus Managed Growth* (Lincoln Inst. of Land Policy 1995)).

E.2. Sprawl and Big Box Stores

"The strip [mall] is a visual expression of bottom-line thinking." – Martha Schwartz[1]

What are Big Box Stores?

Big box stores, such as Wal-Mart, The Home Depot, or K-Mart, are mammoth retail stores that claim "one stop shopping," excellent service, and low prices. Big box stores nearly always are located outside of town centers and often are over 100,000 square feet in size, surrounded by a sea of pavement. They have boundless inventory; one can load T-shirts, house paint, and pineapples into the same cart while under a big box roof. However, big box stores also destroy communities, employ unfair labor practices, take on monopolistic characteristics, and damage the environment.

How are Big Box Stores detrimental to communities?

Environmental Impacts

Big box stores are enormous commercial land uses. In even their smallest form, big box stores are around 80,000 square feet, or the size of two football fields. The largest varieties, at 250,000 square feet, take up almost 6 acres of land.[2] Generally, the parking lots that accompany these stores are 4 to 7 times the size of the store.[3] Simply put, these "superstores" consume large amounts of open space – space that is leveled, paved with impervious surfaces, and developed. Mere construction of the stores often causes severe water quality problems. For example, in May 2004, Wal-Mart agreed to pay a $3.1 million fine for construction-related stormwater violations.[4] The Clean Water Act fine "was the largest ever against a company for storm water runoff violations….The retailer was fined $1 million over similar violations in 2001."[5]

A big box store in Southeast, New York, takes the place of a former mountaintop. Photo by Marc A. Yaggi.

Big box stores clearly increase suburban sprawl by extending retail development outward from community centers. Big box stores increase traffic and air pollution (big box stores generally are accessible only by car), and increase stormwater pollution.

Impervious surface impacts on runoff volume can be quite dramatic. "For example, a 1-inch rainstorm over 1 acre of open space will typically generate 218 cubic feet of runoff. The same storm over a 1-acre paved parking lot will produce 3,450 cubic feet of runoff, nearly sixteen times more than the natural setting."[6] The sprawl induced by and inherent in the existence of these stores adversely impacts the environmental health of the Hudson Valley.

Economic Impacts

Big box stores not only have high environmental costs, but also place economic burdens on government, and eventually on citizens through increased taxes. As consumer attention shifts towards these huge superstores, so must local governmental attention. Traffic problems must be addressed with the widening of existing streets (often from two-lane to four-lane roadways) and the paving of new roads. Sewer systems and fire hydrants must be installed. This development leads to an increase in local property taxes, as citizens become responsible for the many added costs of big box construction. An investigation in New Paltz, New York found that the widening of streets, at a cost of $2 million per mile, would cost taxpayers $5.1 million dollars.[7] Furthermore, the addition of a Wal-Mart to their town would have a net town tax increase of – $18,940.[8] Further, studies report that Wal-Mart garnered over $1 billion nationwide in state and local subsidies as it expanded over the years.[9]

Big box stores constantly relocate to more effective locations and to bigger buildings. When this happens, giant empty buildings are left behind, creating serious eyesores in suburban and rural areas. As of February 1999, Wal-Mart had 333 empty stores spread across 31 states.[10] Wal-Mart does sometimes put the property up for sale, but only big box retailers seek the property, and Wal-Mart refuses to sell to competitors.[11] Thus, the lots often sit empty and unused. In places like Toledo, Ohio, taxpayers had to pay for the upkeep and maintenance of empty buildings that ended up being owned by the city.[12]

In addition, a recent report found that "Wal-Mart's rock bottom wages and benefits cost taxpayers hundreds of millions of dollars a year in basic housing, medical, childcare, and energy needs that the retailer fails to properly cover for its employees…."[13] The report estimated that "one 200-person Wal-Mart store may result in a cost to federal taxpayers of $420,750 per year," just over $2,000 per employee due to low wages."[14] In addition, the arrival of a Wal-Mart causes a decrease in local retail wages and strains local public services, as well as damaging local small businesses, all of which costs taxpayers. The San Diego Taxpayers Association found that an influx of big box stores in San Diego would "result in an annual decline in wages and benefits [of] between $105 million and $221 million, and [would cause] an increase of $9 million in public health costs."[15]

Taxes are not the only increased monetary burden big box stores force on communities. Big box stores also require the attention of local police forces, which, in turn, leads to an increase in police costs and diverts attention from policing the town

center. One study conducted by newrules.org finds that these increased police costs are not simply a function of lengthened patrolling requirements, but also result from an increase in crime; the infinite provisions of big box stores attract criminals. In Port Richey, Florida, crime committed at the local Wal-Mart accounts for one in four police arrests.[16] These stores attract so many criminals that some of the superstores have small police stations within their store. The increased police presence raises police costs. For example, the Port Richey police force exceeded its 2002 overtime budget by approximately $48,000,[17] while in North Versailles, Pennsylvania, the addition of big box stores has led the police force to increase by 160 percent.[18]

Big Box Store Business Practices

Both nationally and internationally, lawsuits have been filed accusing big box stores of "predatory pricing" – the act of intentionally undercutting prices in order to force local competitors out of business, only to subsequently raise prices back to regular market rates. In the past five years, investigations have taken place in Wisconsin, Oklahoma, Germany, Mexico, and New Zealand to determine whether big box stores utilize this manipulative business tactic. In November 2000, Wal-Mart was forced to battle several anti-trust lawsuits that claimed it was controlling the local Wisconsin marketplace through predatory pricing practices. The company reached a settlement and will be forced pay double or triple fines for future violations.[19] This case, and others of its kind, punctuates the numerous local studies that cite the addition of big box stores as a main cause of local business failure. In a study conducted by *60 Minutes*, in the ten years after Wal-Mart was introduced to Iowa the state lost half of its men's and boy's clothing stores and grocery stores.[20] A study conducted by the International Council of Shopping Centers found that between 1987 and 1992, "the number of discount department stores increased annually by an average of 3%, while men's and women's shoe [stores] dropped an average of 6%; household appliance stores fell by 3%; and grocery stores, radio and television stores, drugstores, building materials stores, apparel stores all were in the negative column."[21] Big box stores manipulate the marketplace in order to drive out competition, and as a result, local business suffers.

In 2004, Wal-Mart raised the bar for corporate audacity. After Inglewood, California indicated that it did not want Wal-Mart to turn 60 acres of land into a megastore along with chain stores and restaurants, the retail giant collected signatures to sponsor a ballot initiative.[22] Wal-Mart has used ballot initiatives before; however, this initiative "would essentially exempt Wal-Mart from all of Inglewood's planning, zoning and environmental regulations, creating a city-within-a-city subject only to its own rules. Wal-Mart [hired] an advertising and public relations firm to market the initiative and [spent] more than $1 million to support the measure, known as initiative 04-A."[23] According to reports, "the company paid signature gatherers more than it pays its average clerk."[24] However, Wal-Mart could not buy the voters; the ballot initiative was defeated on April 6, 2004.

Impacts on Community Centers

Local communities often are defined by the vitality of their town centers. Big box stores blight local towns and eviscerate any sense of community that once existed. The sheer volume of big box stores requires that they be located outside of downtown real estate. Because of their predatory pricing techniques and their ability to be "one stop shopping" centers, this detached location seriously injures local business, removing all patrons from the local business territory. This loss is, quite clearly, crippling to the downtown area, closing independent businesses that often have a long history established in the town. Following the addition of a Wal-Mart in Ticonderoga, New York, sales decreased in a local jewelry store by 20%, a local auto parts store by 25%, and a local crafts store by 50%.[25] One merchant described the main street in downtown Ticonderoga during Christmas shopping season as so empty "'you could've landed a plane on it.'"[26] As patronage is moved outside town centers, these areas become defunct and abandoned. The town loses its character and uniqueness as it becomes reliant on the big box store for its well-being.

Unlike local establishments, big box chains do not recycle much of their profits back into the surrounding community. A recent study conducted by Civic Economics in Austin, Texas found that chain stores rotate significantly less revenue back into the local economy. The study found that where two local stores separately recycled $45 from each $100 in spending back into the local community, the Austin Borders box store only recycled $13 back into the community.[27] Generally, the Borders store adds about $820,000 to the local economy, while the two independent stores generate a combined total of $6.9 million dollars.[28]

Big box stores in Southeast have placed a strain on the Village of Brewster, which has the potential to be a model smart growth community. Photo by Lauren Weiner.

In addition, even when chain stores are experiencing higher than average sales growth, they still produce less revenue than independent counterparts.[29] According to the Civic Economics study there are three main reasons for this discrepancy: 1) local

merchants employ a larger portion of local labor to run their establishment; 2) local merchants recycle their profits into the local economy; and 3) local merchants support local goods and services.[30] A study by Tischler & Associates also found that while big box retail stores produce a *deficit* of $468 per 1,000 square feet of retail space, "specialty retail stores," which include independent businesses, produce a *profit* of $326 per 1,000 square feet of retail space.[31] Community growth is stunted by the addition of a big box retail store, just as community centers are destroyed.

Impacts on Local Workforce

As business is pushed out of local communities, many locals are left with no choice but to work at their town's big box store. Often, this is not a fair alternative. According to reports, Wal-Mart has faced lawsuits in over thirty states regarding their tendency to underpay their workers (full-time employees make an annual salary equal to the poverty level for a family of four),[32] force their employees to work overtime without pay, and make their employees work until certain tasks are completed even after they have clocked out for the day.[33] In 2000, Wal-Mart paid $50 million to "settle a class-action suit that asserted that 69,000 current and former Wal-Mart employees in Colorado had worked off the clock."[34] Aside from being unfair, abusive, and illegal, this practice hurts the quality of life (and even the real estate values) of those working and living in the surrounding region.

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[1] *Can America Go Public? Questions for Martha Schwartz*, N.Y TIMES MAGAZINE, May 16, 2004, at 19.
[2] *See* INST. FOR LOCAL SELF RELIANCE, *How Big is 30,000 Square Feet? Or 100,000 Square Feet?*", *available at* http://www.newrules.org/retail/howbigisbig.html(last visited Oct. 19, 2004).
[3] *See id.*
[4] *See* Deborah Charles, *Wal-Mart to Pay $3.1 Million to Settle Water Pollution Charges,* ENVIRONMENTAL NEWS NETWORK, May 13, 2004, *available at* http://www.planetark.com/dailynewsstory.cfm/newsid/25092/story.htm (last visited Feb. 9, 2005).
[5] *Id.*
[6] GEODIGITAL MAPPING, INC., SIGNIFICANT SOURCES OF URBAN STORM WATER RUNOFF IN UNINCORPORATED AREAS OF THE SOUTH COAST OF SANTA BARBARA COUNTY IDENTIFIED FROM LANDSAT IMAGERY: REPORT TO THE SANTA BARBARA COUNTY WATER AGENCY 2 (2000).
[7] *See* AL NORMAN, SLAM-DUNKING WAL-MART 78 (Raphel Mktg. 1999).
[8] *See id.* at 77.
[9] *See* Barnaby J. Feder, *Wal-Mart's Expansion Aided By Many Taxpayer Subsidies,* N.Y. TIMES, May 24, 2004, at C7.
[10] *See* AL NORMAN, SLAM-DUNKING WAL-MART 26 (Raphel Mktg. 1999).
[11] *See* STOREWARS: WHEN WAL-MART COMES TO TOWN (Indep. Television Source 2001); *see also* http://www.pbs.org/itvs/storewars/stores3_2.html - empty (last visited Oct. 19, 2004). "In one Kentucky town, an empty Wal-Mart was torn down at the taxpayers' expense." *Id.*
[12] *See* NORMAN, *supra* note 7, at 24.
[13] CONGRESSMAN GEORGE MILLER (D-CA), NEW REPORT DETAILS WAL-MART'S LABOR ABUSES AND HIDDEN COSTS (Feb. 16, 2004), *available at* http://edworkforce.house.gov/democrats/releases/rel21604.html (last visited Feb. 9, 2005). *See also* Inst. for Local Self-Reliance, *Report Finds Wal-Mart's Low Wages Cost Taxpayers Millions*, HOME TOWN ADVANTAGE BULLETIN (Apr. 2004).
[14] STAFF OF HOUSE COMM. ON EDUC. & THE WORKFORCE 04D, EVERYDAY LOW WAGES: THE HIDDEN PRICE WE ALL PAY FOR WAL-MART 9 (Feb. 16, 2004). The breakdown is as follows:

$36,000 a year for free and reduced lunches for just 50 qualifying Wal-Mart families. $42,000 a year for Section 8 housing assistance, assuming 3 percent of the store employees qualify for such assistance, at $6,700 per family. $125,000 a year for federal tax credits and deductions for low-income families, assuming 50 employees are heads of household with a child and 50 are married with two children. $100,000 a year for additional Title I expenses, assuming 50 Wal-Mart employees qualify with an average of 2 children. $108,000 a year for additional federal health care costs for moving into state children's health insurance programs (S-CHIP), assuming 30 employees with an average of two children qualify. $9,750 a year for the additional costs for low-income energy assistance.
Id.

[15] *Id.*

[16] *See* Ryan Davis, *Wal-Mart shoplifters strain police services,* ST. PETERSBURGH TIMES, May 20, 2002; *see also* INST. FOR LOCAL SELF-RELIANCE, *Big Box Sprawl Causes Sharp Rise in Police Costs,* NEW RULES NEWSLETTER (Aug. 2002), *available at* http://www.newrules.org/hta/hta0802.htm (last visited Feb. 10, 2005).

[17] *See id.*

[18] *See id.*

[19] *See* INST. FOR LOCAL SELF-RELIANCE, *Wal-Mart Settles Predatory Pricing Charge*, NEW RULES NEWSLETTER (Oct. 2001), *available at* www.newrules.org/hta/hta1001.htm (last visited Feb. 10, 2005).

[20] *See* NORMAN, *supra* note 7, at 20.

[21] *Id.* at 22

[22] *See* John M. Broder, *Stymied by Politicians, Wal-Mart Turns to Voters*, N.Y. TIMES, Apr. 5, 2004, at A14.

[23] *Id.*

[24] *Id.*

[25] *See* NORMAN, *supra* note 7, at 62.

[26] *Id.* at 63.

[27] *See* CIVIC ECON., *A Case Study: Economic Impact Analysis: Local Merchants vs. Chain Retailers* 4 (2002), *available at* http://www.liveablecity.org/lcfullreport.pdf (last visited Feb. 10, 2005). The study found that local merchants generate three times the economic activity of chain retailers.

[28] *See id.* at 7.

[29] *See id.* at 11.

[30] *See id.* at 3.

[31] *See* INST. FOR LOCAL SELF-RELIANCE, *Big Box Stores Drain City Revenue, Study Finds,* NEW RULES NEWSLETTER (Feb. 2003), *available at* http://www.newrules.org/hta/hta0203.htm (last visited Feb. 10, 2005).

[32] *See* NORMAN, *supra* note 7, at 45. According to the *New York Times,* unionized supermarkets pay an average of $13 per hour, while Wal-Mart pays an average wage of about $8.50 an hour. *See* Steven Greenhouse, *Wal-Mart, Driving Workers & Supermarkets Crazy*, NY TIMES, Oct. 19, 2003, at WK 3.

[33] *See* INST. FOR LOCAL SELF-RELIANCE, *Small Businesses Pay Their Employees, Wal-Mart Doesn't,* NEW RULES NEWSLETTER, Feb. 2003, *available at* http://www.newrules.org/hta/hta0203.htm (last visited Feb. 9, 2005).

[34] Steven Greenhouse, *Suit Says Wal-Mart Forces Workers to Toil Off the Clock,* N.Y. TIMES, June 25, 2002, *available at* http://www.walmartwatch.com/ (last visited Feb. 10, 2005).

E.3. Sprawl and Farmland

Why is farmland important?

Sixty-three percent of America's dairy products and 86% of its fruits and vegetables come from domestic farmland.[1] The Nation's food and farming system accounts for approximately $1 trillion toward our national economy (equal to 13% of the G.D.P.), and employs 17% of our workers.[2] The 1997 Census of Agriculture reported that the Nation's agricultural commodities were worth $197 billion.[3] American agriculture's position in global markets, as well as its dietary contribution to the growing national and world populations, thus necessitates sound planning and maintenance.[4]

Cost of Community Services (COCS) studies from 19 states in January 2002 reveal that unlike residential lands, "…revenues from farm, ranch and forest landowners more than covered the public costs these lands incur."[5] These studies have shown over the last fifteen years that agricultural lands balance community budgets by contributing tax revenues to counter the costs of public services required by residential developments.[6] Indeed, farmland spreads commerce, creates jobs, and forms mutually beneficial relationships with nearby support services and businesses, including lumber mills and food processors.[7]

In addition, as visitors flock to farm areas, such as Pennsylvania's Amish and Mennonite communities, in order to enjoy open space or experience farming's rich history, farmland benefits the tourism industry. The influx of these sightseers increases local commerce and often prompts farmers to hire a hospitality staff or concession vendors to greet tourists.[8] Aside from tourism's economic benefits, farmland access promotes recreational opportunities, which combine with this land's beautiful scenery to preserve communities' unique offerings and appearance.[9]

On a biological level, while agriculture contributes nutrient-rich runoff, farmland frequently assists local environments, hindering floods, maintaining air quality that otherwise would be strained by sprawling development, and providing shelter and food for wildlife.[10] Open space also provides wind and noise control, while balancing temperatures.[11] Furthermore, when assessing the ecological contribution of these open spaces, one must anticipate the environmental detriments of farmland's chief replacement – sprawl.

What are the impacts of sprawl to farmland?

Loss of open space

Tragically, several attractive characteristics of farmland often lead to its destruction. As Julia Freedgood reports for the National Resources Conservation Services, "[f]armland is desirable for building because it tends to be flat, well drained and has few physical limitations for development. It also is more affordable to developers than to farmers and ranchers."[12] This shift has become particularly ubiquitous in the

northeastern United States, where communities in and around New York State increasingly lose farmland to residential developments. According to the U.S. Environmental Protection Agency and Massachusetts Audubon Society statistics, for example, "[u]nplanned and unchecked development is eating up more than 1,200 acres of open space, farmland and wetlands each week in New England – including nearly 2 acres an hour in Massachusetts alone."[13] This problem exists at such a high rate that, according to the American Farmland Trust, "[e]very single minute of every day, America loses two acres of farmland."[14] The troublesome movement is only gaining speed, as Americans lost ranch and farmlands 51 percent faster in the 1990s than in the 1980s.[15]

This transfer qualifies as "sprawl" if the conversion of land to non-natural or non-agricultural status increases faster than the population rate.[16] When that pattern occurs, wasteful use practices outpace population growth, meaning that better planning still exists as a potential solution. For instance, from 1982 to 1997, urbanized land grew by 47% whereas America's population only increased 17%.[17] A lack of planning plays a substantial role in this trend considering that new housing acreage per person has nearly doubled over the past two decades.[18]

Across the United States, farmland like this is being subdivided for commercial and residential development, resulting in a loss of open space and American heritage. Photo by William Wegner.

Even worse, developers target our best quality farmland first, converting prime land 30% more often than non-prime rural land between 1992 and 1997.[19] Farmers subsequently face increasing responsibilities to irrigate the marginal lands left for them.[20] This problem confronts New York with alarming progress, as the State's increase in Rate of Prime Farmland Loss from 1992 to 1997 was 141%, second only to Arkansas.[21] As Jerry Cosgrove, American Farmland Trust's Northeast regional director laments, "[t]he scary part is that we're losing our best farmland the fastest…. This growing threat extends throughout the state, from the agricultural engine of Western New York to the historic Hudson Valley and Long Island's productive North Fork. We would be foolish not to conserve these rich resources for future generations of New Yorkers."[22]

Economic loss

Along with the abovementioned cultural, recreational, and scenic losses inherent in farmland reductions, the economic impact of replacing farms is staggering. When farmland gives way to residential development, expensive infrastructure must follow. These requirements include increases in sewage and drinking water treatments, as well as stormwater retention, at the edges of developments emerging far from the town's

original, central infrastructure.[23] While agricultural land consistently creates more money through local tax profits than it detracts through such services, COCS studies reveal that residential land's revenues do not exceed expenditures.[24] Several other genres of cost studies similarly uncover the fact that municipal tax bills invariably rise when developments spread.[25] These nationwide trends certainly find no exception in the region around New York City's watershed, according to COCS studies. In 1989, Fishkill, New York's revenue to expenditure ratio (in dollars) was 1: 1.23 for residential lands, compared with 1: 0.74 for farm/forest open land. Red Hook's ratios condemned development even further, as its residential ratio was 1: 1.11 in contrast with 1: 0.22 for farm/forest open land.[26]

Environmental impacts

Moreover, farmland's replacement by residential development may most negatively affect ecology. Because development creates paved roads and roofs, it contributes to increased water pollution as impervious surfaces prevent natural soil filtration.[27] This metamorphosis from soil to concrete may also reduce a community's drinking water supply as paved surfaces block aquifer recharge.[28] In addition, impervious surfaces lead to greater runoff, soil erosion, and flooding as streets and parking lots replace wetlands that were crucial to flood prevention.[29] Sporadically spaced development destroys wetlands and reduces and fragments wildlife habitat.[30] Sprawl further leads to environmental decay when low-density residential septic tanks move unfiltered waste material to ground and surface waters.[31] Moreover, the distance between these widespread houses and town centers necessitates increased reliance on automobiles, leading to heightened traffic, longer commutes, and the concurrent increases of greenhouse gases and smog.[32] New roads for these automobiles bring about rises in oil and road salt leaks, both of which contaminate groundwater.[33] Finally, as these roads move industry farther away from urban centers, businesses progressively abandon and ignore old or empty industrial sites that are suitable for redevelopment.[34]

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[1] *See* Press Release, American Farmland Trust, Study Shows America's Best Farmland Falling Fastest to Development (Oct, 3, 2002), *available at* http://www.farmland.org/news_2002/100302_natl.htm (last visited Feb. 10, 2005).
[2] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 1 (2002) (*citing* Kathryn Lipton, William Edmondson and Alden Manchester, ERS, USDA, *The Food and Fiber System: Contributing to U.S. and World Economies*, 742 AGRICULTURAL INFORMATION BULLETIN 3, July 1998).
[3] *See* JULIA FREEDGOOD, COST OF COMMUNITY SERVICES STUDIES: MAKING THE CASE FOR CONSERVATION 46 (2002).
[4] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 1 (2002).
[5] FREEDGOOD, *supra* note 3, at i.
[6] *See* FREEDGOOD, *supra* note 3, at 7.
[7] *See* American Farmland Trust, *Fact Sheet: Why Save Farmland?* 2 (2002).
[8] *See id.*
[9] *See* FREEDGOOD, *supra* note 3, at 50.
[10] *See id.* at 46.
[11] *See* SMART GROWTH ONLINE, *Principles of Smart Growth: Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas*, *available at* http://www.smartgrowth.org/about/principles/principles.asp?prin=6 (last visited Oct. 19, 2004).

[12] Julia Freedgood, COST OF COMMUNITY SERVICES STUDIES: MAKING THE CASE FOR CONSERVATION 2 (2002).
[13] Press Release, U.S. Envtl. Prot. Agency, EPA Announces Action Plan for Combating "Sprawl" in New England (Feb. 2, 1999), *available at* http://www.epa.gov/region01/pr/1999/020299.html (last visited Feb. 10, 2005).
[14] AMERICAN FARMLAND TRUST, FARMING ON THE EDGE 1 (2002).
[15] *See id.*
[16] U.S. ENVTL. PROT. AGENCY, *Why Should We be Concerned about Sprawl?* 2, *at* http://www.epa.gov/region5/sue/whyconcern.htm (last modified Oct. 12, 2004).
[17] *See* AMERICAN FARMLAND TRUST, FARMING ON THE EDGE 1 (2002).
[18] *See id.*
[19] *See id.*
[20] *See id.*
[21] *See id.* at 2 (*citing* NATIONAL RES. CONSERVATION SERV., *Summary Report, 1997 National Resources Inventory* (2000), *available at* http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/table9.html (last visited Feb. 10, 2005)).
[22] Press Release, American Farmland Trust, Study Shows New York's Best Farmland Falling Fastest to Development (Oct. 9 2002), *available at* http://www.farmland.org/news_2002/100902_ny.htm.
[23] *See* U.S. ENVTL. PROT. AGENCY, *Why Should We Be Concerned about Sprawl?*, *available at* http://www.epa.gov/region5/sue/whyconcern.htm (last visited Oct. 19, 2004).
[24] *See See* FREEDGOOD, *supra* note 3, at 57.
[25] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 2 (2002).
[26] *See* FREEDGOOD, *supra* note 3, at 57.
[27] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 2 (2002).
[28] *See id.*
[29] *See* U.S. ENVTL. PROT. AGENCY, *Why Should We Be Concerned about Sprawl?*, *available at* http://www.epa.gov/region5/sue/whyconcern.htm (last visited Oct. 19, 2004).
[30] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 3 (2002).
[31] *See id.(citing* R. J. Perkins, *Septic Tanks, Lot Size and Pollution of Water Table Aquifers*, 46 J. OF ENVTL. HEALTH 298-304 (1984).
[32] *See* U.S. ENVTL. PROT. AGENCY, *Why Should We Be Concerned about Sprawl?*, *available at* http://www.epa.gov/region5/sue/whyconcern.htm (last visited Oct. 19, 2004).
[33] *See* AMERICAN FARMLAND TRUST, *Fact Sheet: Why Save Farmland?* 3 (2002).
[34] *See* U.S. ENVTL. PROT. AGENCY, *Why Should We Be Concerned about Sprawl?*, *available at* http://www.epa.gov/region5/sue/whyconcern.htm (last visited Oct. 19, 2004).

E.4. Sprawl and Increased Flooding

How does sprawl increase flooding?

Flooding is no longer a problem only in floodplain areas. In some places, destruction of wetlands and unwise development in natural floodplains have increased the economic losses from property damaged by floods. In others, sprawling development is creating new "floodplains" and threatening existing communities that historically faced no significant dangers from floods. Sprawl can induce flooding in several ways:

- *Sprawl increases the total amount of impervious surface on the landscape.* Additional impervious surfaces decrease the land's natural ability to absorb water after storm events, and allow water to travel at higher velocities and in larger volumes across the landscape. As more paved communities develop, homes are subjected to new flooding risks that were not present under previous conditions.

- *Sprawl destroys critical wetlands and buffer areas.* Wetlands and wetland buffer areas provide valuable protection to coastal communities from floods. They provide natural barriers between dry uplands and low-lying waterbodies, and function to trap, absorb, and rechannel floodwaters into contained waterbodies. According to the U.S. Environmental Protection Agency (EPA), "[o]ne reason floods have become more and more costly is that over half the wetlands in the United States have been drained or filled."[1]

Flooding problems in the Croton watershed. Photo by William Wegner.

Wetlands can store more than 1.5 million gallons of water per acre.[2] Sprawling development often trades wetlands for impervious surfaces. Wetlands are frequently filled to build new buildings, roads, parking lots, or to drain land for agricultural uses. As protective wetlands are lost, flooding increases. A study by the Illinois State Water Survey showed that floods increased by 7% for every 1% of wetlands destroyed.[3]

While "mitigation banking" can require developers who destroy wetlands to preserve other wetlands in exchange, "these mitigation schemes put more people at risk from flooding, because the wetlands are destroyed near them and preserved elsewhere, often far away."[4] As EPA states, "[w]etlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface-water runoff from pavement and buildings."[5] One study in Virginia "showed that wetland bankers created flood risks by preserving rural wetlands but destroying urban wetlands… 'Eight out of 11 existing or proposed mitigation banks in Virginia are located in rural communities. Conversely, most wetland loss in Virginia takes place in urban and suburban areas.'"[6]

- *Development in floodplains increases flooding.* Common sense alone makes it apparent that it is unwise to place new development in known floodplain areas. However, communities across the country knowingly continue to build in such flood-prone areas, and even *rebuild* in areas that have already sustained serious damage due to flooding. This additional development only increases the likelihood of flooding. According to the National Science Foundation, "floodplain sprawl and Army Corps projects increase flood damages."[7] From 1988 to 1998, the Federal Emergency Management Agency (FEMA), state emergency management agencies, and county and local governments moved more than 17,000 homes and businesses out of floodplains at a cost of approximately $500 million in local, state, and federal taxes.[8] As of 2000, "state and federal laws allow developers to build in 100 year floodplains if they elevate[d] the home or business one foot above the 100 year level. Many of the [states'] floodplain maps are more than 10 years out of date."[9] Twenty percent of flooding occurs outside the mapped floodplain areas.[10]

- Thus, sprawl development c*hanges weather patterns.* To varying degrees, sprawl contributes to the current global warming trend. Impervious areas absorb and retain heat when exposed to solar radiation; clearing of trees and other vegetation removes the land's natural insulation layer that shields streams and soils from direct sunlight. Global warming has increased the amount and intensity of precipitous events – "[s]ince 1900, the number of extreme rain and snow events has increased by one-fifth or 20%, according to U.S. Department of Commerce studies."[11]

What harm is caused by floods?

As EPA explains:

> Floods have caused a greater loss of life and property and have devastated more communities in the United States than any other natural hazards. Wetlands serve as natural buffers against floods, soaking up and storing a significant amount of flood water, which reduces the frequency and extent of floods. Wetlands slowly release the stored waters after the peak flood flows have passed, reducing property damage downstream.[12]

Along with development, flood damage has soared in recent decades causing damage to homes and personal property, commercial buildings, and crops, as well as roads, bridges, dams, power lines and other structures. In rapidly growing communities, existing stormwater systems are not adequate to capture and transport the ever increasing flows after rain events, and these systems are backing up and overflowing into streets, parking lots, and yards. Similarly, as development grows along the banks of streams and creeks, these waterways cannot handle the increased flows – streambeds are eroded and stream channels shift. In addition, the costs of medical treatment for injuries and loss of human life caused by floods, and the costs of moving people out of floodplains after damage has occurred have been tremendous. From 1989 to 1998, floods killed 957 people and caused $45-90 billion in property damage.[13]

As discussed above, wetland destruction directly relates to increased flooding, and draining wetlands significantly reduce their flood storage capacity. According to the New York State Attorney General's Office, "[t]he top 10 flood damaged states have drained an average of 56% of their wetlands, and account for about 50% of the total US wetland loss."[14]

The New York State Attorney General's Office has presented a clear picture of sprawl, wetlands destruction, and flooding in New York:

> **The Corps, the federal agency responsible for wetland permits, approved 99% of the wetland fill permits in New York between 1988 and 1996, according to its own data.** A total of 2,840 wetland fill permits were issued in New York from 1988-96, and only 7 were denied during that time. Of the permits issued, 92% were granted in flood disaster counties in New York. In that 9-year span New York lost over 1,375 acres of wetlands, which equates to over 4120 acre-feet of flood storage space. From the aforementioned cost estimates for flood control dams [the projected costs for flood control dams can range from around $100 to more than $10,000 per acre-foot of stored water], this loss results in between $412,000 and $41,200,000 in lost flood storage in 9 years alone, under current legislation. New York State has already lost more than 1.5 million acres or 60% of its wetlands, ahead of the 56% average of the Great Lakes Region.
>
> Flooding killed 25 people in New York from 1988-98. The state ranked 25th among states' total flood deaths during this period, and these floods cost over $46 million. New York ranked 12th during this ten year span in total flood damage. New York also led the nation in repeated flood claims ranking 4th with 18 communities in the top 200, and 5th most costly repeated flood damages, with $157 million. Clinton, Essex, Franklin, and Lewis Counties were declared federal flood disasters three times from 1989-98. 49 of 62 New York counties were designated as Disaster Areas at least once during this time.[15]

Economic Costs: Examples

- A Sierra Club report found that in Wisconsin, communities endured 25 times more flood damage in the 1990s than in the 1980s, and that the President declared seven floods to be major disasters in the 1990s, as compared to three in the 1980s and four in the 1970s.[16] After adjusting for inflation using the Consumer Price Index, Sierra Club found that the resulting economic damage totaled $1.3 billion in the 1990s, $56 million in the 1980s (when the State faced a major drought), and $256.8 million in the 1970s.[17]

- Sierra Club reports that "'rubber stamp' wetland permits allow[ed] developers to build on and destroy 78,000 acres of wetlands, enough to store 78 billion gallons of floodwater or about 24,000 flood control dams, between 1988-96. Meanwhile, FEMA and state agencies paid $500 million to move more than 17,000 homes and businesses out of the floodplains after floods from 1988-98."[18]

- "In the Mississippi River basin, Iowa, Missouri, and Illinois have destroyed the most wetlands, 87% on average. These states accounted for $11.8 billion of the total $15.7 billion in 1993 flood damages."[19] EPA reports that "bottomland hardwood-riparian wetlands along the Mississippi River once stored at least 60 days of floodwater. Now they store only 12 days because most have been filled or drained."[20]

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[1] U.S. ENVTL. PROT. AGENCY, *Wetlands: Protecting Life and Property from Flooding; Ten Things You Can Do to Protect Wetlands* (May 20, 2003), *available at* http://env1.kangwon.ac.kr/sdwr%202003/Literature%20Survey/International%20Web%20Sites/EPA-OST/www.epa.gov/newsroom/hi-wetlands.htm (last visited Feb. 9, 2005).
[2] *See* Comment letter from Peter Lehner, Bureau Chief, Environmental Protection Bureau, New York Attorney General's Office, submitted to EPA Water Docket ID No. 02-2002-0050 at 22 (Apr. 16, 2003) (on file in the EPA Water Docket) (referring to a study by North Dakota State Engineer David Spryncznatyk, P.E. and Allyn Sapa of the U.S. Fish and Wildlife Service); *see also* Sierra Club, *Bringing Urban Sprawl into Focus* (October 28, 1999), *available at* http://oklahoma.sierraclub.org/sprawl/sprfocus.html (last visited Feb. 9, 2005).
[3] *See* SIERRA CLUB, *Report: Permitting Disaster in America: Sierra Club and Flood Victims Warn Public About Flooding The Spring – Release Report Showing Flood Damage Made Worse by Weak Wetland Protections* (Mar. 20, 2000).
[4] SIERRA CLUB, *Report: Permitting Disaster in America; Some in Congress Want to Increase Wetland Destruction* (2000).
[5] U.S. ENVTL. PROT. AGENCY, *Flood Protection*, *available at* http://www.epa.gov/owow/wetlands/flood.html (last visited Feb. 9, 2005).
[6] SIERRA CLUB, *supra* note 4.
[7] SIERRA CLUB, *supra* note 3 (referencing DENIS MILETI, DISASTER BY DESIGN: A REASSESSMENT OF NATURAL HAZARDS IN THE UNITED STATES (Joseph Henry Press 1999).
[8] *See* SIERRA CLUB, *Report: Permitting Disaster in America: Summary* (2000).
[9] SIERRA CLUB, *supra* note 3.
[10] *See* SIERRA CLUB, *supra* note 8.
[11] *Id.*
[12] U.S. ENVTL. PROT. AGENCY, *supra* note 1.
[13] *See* SIERRA CLUB, *supra* note 3.

[14] Comment letter from Peter Lehner, Bureau Chief, Environmental Protection Bureau, New York Attorney General's Office, submitted to EPA Water Docket ID No. 02-2002-0050 at 22 (April 16, 2003) (on file in the EPA Water Docket).
[15] *Id.* at 24 (emphasis added).
[16] *See* Jo Sandin. *Flood Damage Soars in State in '90s, Study Says,* MILWAUKEE JOURNAL SENTINEL (September 26, 2000), *available at* http://www.crcwater.org/issues11/20000928flooddamage.html (last visited Feb. 9, 2005).
[17] *See id.* For more detailed information on flood damage costs going back to 1972, see SIERRA CLUB, REPORT: PERMITTING DISASTER IN AMERICA; FLOOD DAMAGE RISING IN WISCONSIN (Sept. 2000).
[18] SIERRA CLUB, *supra* note 3.
[19] *Id.*
[20] SIERRA CLUB, *supra* note 6.

E.5. Sprawl and the U.S. Postal Service

How does sprawl affect the U.S. Postal Service and postage rates?

Common sense suggests that as sprawling development spreads farther away from town centers, the cost of providing postal services will increase and postage rates will go up. As the number of delivery points and the distances between them increase, local post offices increase in number and have to add more delivery routes, vehicles, and personnel. Walking mail carriers cannot make these deliveries. Thus, increased use of vehicles to serve outlying areas will cause increased air and water pollution; as more road miles are traveled this increased use will cause additional wear and tear on roads and add to already problematic East-of-Hudson traffic congestion.

The Postal Service website explains:

> Postal costs go up like those of any other business or household. In fact, increases in costs for fuel and health benefits greatly affect the Postal Service. In addition, we are adding 1.6 million deliveries each year. The Postal Service receives no tax dollars for operations and relies solely on the sale of its products and services to cover its operating costs.[1]

Review of the U.S. Postal Service's (USPS's) 2002 Annual Report shows that on a national level, the organization is growing in rural areas. Generally, over the past five years, the number of career delivery personnel in cities has dropped, but the number of career delivery personnel in rural areas and motor vehicle operators has gone up, as the following table shows:[2]

FIELD EMPLOYEES (In Millions)

	1998	*1999*	*2000*	*2001*	*2002*	*% change 1998-2002*
City Delivery Carriers	240,813	242,300	241,079	240,295	233,639	- 2.98
Rural Delivery Carriers – Full Time	52,241	54,588	57,111	59,790	60,817	+ 14.10
Motor Vehicle Operators	9,026	9,270	9,347	9,325	9,092	+ 0.73

In addition, the number of additional delivery points being added in rural areas is far outpacing the number added in cities.

DELIVERY POINTS

	1998	*1999*	*2000*	*2001*	*2002*	*% change 1998-2002*
RESIDENTIAL DELIVERY POINTS						
City	75,088,866	75,575,844	76,131,249	76,578,169	77,014,294	+ 2.50
Rural	27,683,441	28,753,812	29,915,385	31,004,518	32,141,581	+ 13.87
COMMERCIAL DELIVERY POINTS						
City	7,164,995	7,175,729	7,197,776	7,183,431	7,197,207	+ 0.45
Rural	901,124	956,301	1,013,269	1,071,201	1,132,049	+ 20.40

In the three East-of-Hudson watershed counties, there are 108 post offices: 42 in Dutchess provide service to 802 square miles; 7 in Putnam serve 231 square miles; and 58 in Westchester serve 450 square miles.[3]

How do U.S. Postal Service practices contribute to increasing sprawl?

Post offices, along with other government buildings, provide an essential economic and social hub for downtown areas. Local residents, downtown workers, and business people have walking access to the post office, and thus, nearby businesses and services – banks, restaurants, retail stores, athletic clubs, etc. – receive the economic benefits of the potential customers that the post office attracts. In 1993, a study conducted by the National Trust for Historic Preservation showed that 80% of people who shopped in downtown areas planned their trips around visits to the post office.[4] In small towns, the post office also can often serve as a local meeting place or source of community information.

Sprawl is encouraged and downtown communities undermined when post offices and other government facilities move from downtown areas to outlying suburban locations. When people must make special trips and travel farther distances because they can no longer walk to the post office, there will be a resulting increase in traffic congestion and pollution from vehicle use.

As the smart growth movement gains support and communities attempt to create sensible comprehensive/master plans, it is extremely problematic that the USPS is not statutorily bound by the same state and local citizen participation, zoning, land-use, historic preservation and environmental standards that apply to other businesses. Since 1998, the USPS has made attempts to address this problem – Facility Relocation Regulations appear to establish procedures for notification of local and public officials and solicitation of community input when the USPS makes any decision to undertake expansion, relocation, or new construction projects.[5] The regulations also claim to comply with Section 106 of the general provisions of the National Historic Preservation Act, 16 U.S.C. 470 et seq, Executive Order 12702, and Executive Order 13066, which

address projects that will have an effect on cultural resources.[6] However, there are many who feel this policy is not being adhered to in practice because the USPS is a "quasi-public/private monopoly," "is not required to adhere to the same regulations as other government agencies," and receives no congressional oversight of expansions and relocations.[7] Thus, it is all too easy for post offices to be closed, modified, relocated, or constructed without regard to local planning efforts.

In 2000, a voter survey sponsored by the American Planning Association (APA) showed that "an overwhelming 82% of voters support legislation ensuring that federal facilities are located in places that are easily accessible to citizens and are consistent with local growth management plans."[8] Such legislation, the Post Office Community Partnership Act, was introduced to Congress in 1999 (H.R. 670; S. 556), and again in 2001 (H.R. 1861, S. 897).[9] This legislation would amend 39 U.S.C. § 404, which provides minimal procedures only for post office closings or consolidations, to codify the smart growth principles established in the 1998 Facility Relocation Regulations mentioned above. But, despite significant bipartisan support, these bills were never passed.

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[1] U.S. POSTAL SERV., *Why Rates Increase*, *available at* http://www.usps.com/ratecase/why_rates.htm (last visited Feb. 9, 2005).
[2] U.S. POSTAL SERV., ANNUAL REPORT FOR 2002, Operating Statistics (2003), *available at* http://www.usps.com/history/anrpt02/opstats.htm (last visited Feb. 9, 2005).
[3] *See* U.S. POSTAL SERV., Postmaster Finder, *available at* http://www.usps.com/postmasterfinder (last visited Feb. 9, 2005). The PostmasterFinder database provides information by county and zip code, and provides dates of establishment and discontinuance for some locations. *Id.*
[4] *See* Common Dreams Progressive Newswire, *National Coalition Seeks Better Post Office Planning to Fight Sprawl*, Mar. 28, 2000, *available at* http://www.commondreams.org/news2000/0328-02.htm (last visited Feb. 9, 2005).
[5] *See* Expansion, Relocation, Construction of New Post Offices, 63 FED. REG. 170, *available at* http://www.usps.com/news/2000/press/frr_print.htm (last visited Feb. 9, 2005).
[6] *See id*.
[7] Carl Wolf, *quoted in* Willa Reinhard, *Priority Mail: Do Towns Have a Say When the Post Office Declares a Historic Downtown Building an Insufficient Address?*, June 27, 2001, *available at* http://www.nationaltrust.org/magazine/archives/arch_story/062701.htm (last visited Feb. 9, 2005).
[8] Letter from American Planning Assoc. to Rep. Earl Blumenhauer (D-OR) (May 15, 2001), reproduced as part of the Extension of Remarks by Rep. Blumenauer when he introduced the Post Office Community Partnership Act of 2001 before the U.S. House of Representatives, May 17, 2001, *available at* http://blumenauer.house.gov/issues/FloorSpeechSummary.aspx?NewsID=326&IssueID=0 (last visited Feb. 9, 2005). The Senate bill was introduced by Senators Max Bacus (D-MT) and James Jeffords (R-VT). This Act was co-sponsored by NY Representatives Maurice Hinchey (D. 26), Sue Kelly (D. 19), and Carolyn McCarthy (D. 4).
[9] For more information on these legislative efforts, see Press Release, American Planning Association, APA Endorses Bill Addressing Post Offices and Community Planning (May 18, 2001), *available at* http://www.planning.org/newsreleases/2001/ftp051701.htm (last visited Feb. 9, 2005); and American Planning Assoc., *Legislative Priority: Post Office Community Partnership Act*, *available at* http://www.planning.org/priorities/postoffice.htm (last visited Feb. 9, 2005).

II. PAVE IT…OR SAVE IT?
PART F.
The Social Impacts of Sprawl

F.1. Sprawl and Traffic

What is the typical suburban traffic model?

The relationship between traffic and sprawl can be described as a circular one. As sprawl creeps across the landscape and elements of a community are spread farther apart, people become more dependent on cars, traffic increases, and more roads are needed to provide capacity for additional cars. The proliferation of roads then facilitates – in fact, encourages – the propagation of sprawl, and the cycle begins anew.

Indeed, the suburban model results in a variety of cyclical relationships that result in additional road use and traffic. For example, where road design is not pedestrian-friendly, the design itself makes walking less viable; where vast parking lots are needed to house cars, those lots push buildings farther apart, making walking less likely.[1] Thus, even if the suburbs were to generate the same number of trips as urban areas, the sprawl layout of the suburban model – where all the components of a suburban community are typically accessed by a single "collector road" – would nonetheless result in traffic greater than that of a traditional neighborhood.[2]

Morning traffic buildup in the New York City watershed. Photo by Leila Goldmark.

How does sprawl impact traffic flow and impose social and economic costs from the resulting traffic?

"In modern suburbia, where pedestrians, bicycles, and public transportation are rarely an option, the average household generates thirteen car trips a day."[3] A study of one pedestrian-friendly city (Portsmouth, NH) with a core, central plan found it generated half the number of automobile trips of a modern suburb. This translates into less than half the amount of traffic as urban trips are typically shorter than suburban trips.[4]

Americans now drive twice as many miles per year as they did twenty years ago; the number of miles cars travel has grown at four times the population rate since 1969.[5] The average commuter trip was 20 percent longer (in distance) in 1995 than in 1983.[6] The Institute of Transportation Engineers publishes a manual that estimates that the

average single-family home generates 9.55 trips each weekday, of which half – or 4.78 trips – can be allocated to the residence and half to the destination.[7] Coupled with a U.S. Department of Transportation estimate that the average trip length from a residence is 2.25 miles, the total additional miles traveled from each new single-family residence is 10.75 miles.[8] As sprawl development spreads farther, of course, the average trip length increases.

This amount of driving comes at a quantifiable cost to individuals and to natural resources. The average American driver spends 443 hours per year – the equivalent of 55 eight-hour work days – behind the wheel.[9] In a study of 75 U.S. urban areas, the average annual delay per peak road traveler climbed from 16 hours in 1982 to 62 hours in 2000.[10] The congestion "bill" for those areas in 2000 was $67.5 billion, the value of 3.6 billion hours of delay (e.g. lost workplace productivity) and 5.7 billion gallons of excess fuel consumed.[11] This amounted to an average of $1,160 per peak road traveler.[12] Increased traffic also exacerbates impacts on pedestrian safety, property values, air quality, and water quality.[13] It results in 5.7 billion gallons of wasted fuel, or 100 wasted gallons per peak road traveler.[14]

The amount of fuel wasted from sprawling patterns of growth is exacerbated by automobiles with low fuel-efficiency. Photo by Leila Goldmark.

Why does additional road-building worsen, rather than solve, existing traffic problems?

A typical reaction to the traffic epidemic is to build more roads to satisfy demand. Counterintuitively, however, widening roads or building new ones actually makes traffic worse, a phenomenon commonly known as "induced traffic," wherein people are willing to drive more as lanes initially reduce traffic, until those lanes are quickly filled for longer distances.[15] Often, induced traffic eats up 50 to 100% of the roadway's new capacity. After a few years, the new roadway has once again reached full capacity.[16] A recent study of 30 California counties showed that for every 10% increase in roadway capacity, traffic increased 9% within 4 years.[17]

This phenomenon has played out nationwide despite rampant road building. Between 1982 and 2000, the amount of congested roadway expanded from 34 to 58% of

all roadways; during peak periods, the amount of travel that was congested doubled from 33 to 66%; the "penalty" for traveling during peak periods rose from 14 to 39% (i.e. it now takes 39% longer to make the same trip during peak as in off-peak periods).[18] Highway officials predict congestion will quadruple in the next twenty years.[19] A recent poll conducted by the Surface Transportation Policy Project showed that the public recognizes this problem, as 66% of Americans chose transit or walkable communities, rather than new roads, as the best long-term solution to congestion.[20]

How are household transportation costs multiplied by sprawl development?

In addition to the individual economic cost of traffic, sprawl results in increased transportation spending. For most American households, transportation is a cost second only to housing.[21] A 1997-98 study showed that the proportion of household budget spent on transportation was highest in sprawling cities like Houston, Atlanta, and Dallas.[22] In one-third of 28 metro areas found to be the most sprawling, households devoted 20% more to transportation than in the one-third least sprawling areas, amounting to roughly $1,300 more per year per household.[23] Even within metropolitan areas, transportation costs are noticeably higher in outlying neighborhoods with sprawling development.[24]

As seen with traffic, road building only makes the problem of transportation costs worse. Highway mileage construction per person in the most sprawling metro areas grew by more than 21% between 1988 and 1998, while transportation spending grew by almost 18%.[25] Conversely, in the least sprawling metro areas, both transportation spending and highway mileage construction per person dropped.[26]

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[1] *See* ANDRES DUANY, ET AL., SUBURBAN NATION: THE RISE OF SPRAWL AND THE DECLINE OF THE AMERICAN DREAM 23 (North Point Press 2000).
[2] *See id.* at 23.
[3] *Id.* at 22.
[4] *See id.*
[5] *See id.* at 91; *see also* DANA BEACH, SOUTH CAROLINA COASTAL CONSERVATION LEAGUE, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES 2 (Pew Oceans Commission 2002), *available at* http://www.pewoceans.org/reports/water_pollution_sprawl.pdf (last visited Feb. 9, 2005).
[6] *See* COASTAL SPRAWL, *supra* note 5, at 3.
[7] *See* EBEN FODOR, BETTER *NOT* BIGGER 95 (New Society Publishers 1999). The discrepancy between this manual's number and that set forth in SUBURBAN NATION, *supra* note 3, is at least in part due to the latter's focus only on suburban trip generation.
[8] *See id.*
[9] *See* SIERRA CLUB, *Sprawl Report 2002*, *available at* http://www.sierraclub.org/sprawl/report02/transportation_choices.asp#highway(last visited Sept. 3, 2003) [hereinafter *Sprawl Report 2002*] (citing U.S. Dept. of Transp., "Our Nation's Travel" (1997)).
[10] *See* David Schrank and Tim Lomax, Texas Transp. Inst., The Texas A&M Univ. System, *The 2000 Urban Mobility Report* at iii (June 2002).
[11] *See id.* at iii and 20.
[12] *See id.* at 22.
[13] *See* Cmty. & Envtl. Def. Servs., *Fact Sheet: Traffic & Neighborhood Quality of Life*, *at* http://www.ceds.org/TrafNeig.PDF (last visited Sept. 3, 2003); *see also* BEACH, *supra* note 5, at 3.

[14] *See* Schrank & Lomax*, supra* note 10, at 23.
[15] *See* DUANY, *supra* note 1, at 88-89.
[16] *See* SIERRA CLUB*, supra* note 9.
[17] *See* DUANY, *supra* note 1, at 88-89.
[18] *See* Schrank & Lomax*, supra* note 10, at 19.
[19] *See* DUANY*,, supra* note 1 at 91-92.
[20] *See* SURFACE TRANSPORTATION POLICY PROJECT, *Walking in New York:Highlights from STPP's National Poll 2003 available at* http://www.transact.org/library/reports_pdfs/pedpoll/NY.pdf (last visited Feb. 10, 2005).
[21] *See* SURFACE TRANSP. POLICY PROJECT, *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses*, Exec. Summ. (March 2000), *available at* http://www.transact.org/report.asp?id=39 (last visited Feb.10, 2005).
[22] *See id.*
[23] *See id.*
[24] *See id.*
[25] *See id.*
[26] *See id.*

F.2. Sprawl and Transit

What is a transit system?

Simply put, a transit system encompasses all forms of mass transportation, including buses, trains, subways, ferries, etc. that are critical to ensuring an active, mobile citizenry and economy.

What is the relationship between sprawl and transit availability?

Lack of public transit is a problem in any community, but presents even more dire consequences in sprawling areas. The environmental impacts are clear. In spread-out communities with inadequate public transit systems, people are forced to drive more often and for longer distances, leading to increased traffic and resulting in more air pollution from vehicles.

The Village of Brewster has a train station near shopping and housing, making it a viable candidate for revitalization. Photo by Lauren Weiner.

There are social consequences as well. As communities move towards a norm of individual vehicular transportation, people become more isolated from one another – mentally isolated as they drive alone from point A to point B, and physically isolated in car-based, gated "communities."

At the same time, sprawl may also be a *result* of a lack of public transit. As people are forced to drive, development patterns spread farther out – more roads are built to accommodate more vehicles, and larger parking areas are required to store them. In other words, transit impacts, like many other sprawl impacts, become self-perpetuating.

A study of metropolitan areas conducted by the Surface Transportation Policy Project formulated a "Transportation Choice Ratio" to compare the relative supply of public transportation to roads.[1] A low ratio indicated that an area's road network outpaced its public transport system.[2] This study revealed that new sprawling cities like Phoenix, Houston, Atlanta, and Dallas have among the lowest Transportation Choice

Ratios while older, condensed cities like New York, Chicago, San Francisco, and Washington, D.C. have the highest ratios.[3] This is not a surprising result, as transit cannot serve sprawling areas effectively.[4] The problem is that development patterns in the suburbs of older cities often mimic those of the newer sprawling cities. This problem is at hand in suburbs and exurbs of New York City in Westchester and Putnam Counties and throughout the Hudson River Valley.

A similar study compared vehicle pollution per person with transit spending per person, with similarly predictable results. Seven of the twelve cities with the lowest rates of vehicle pollution per person are located in five of the highest graded states for transit spending.[5] The study revealed that only one state – New York – has at least equal spending on transit and highways, while only eight other states spend at least half the amount on transit as spent on highways.[6] Limiting transportation choices while disproportionately funding new highways leads to additional sprawl, more air pollution, and continued natural resource and health impacts.[7] Although New York has had relatively balanced transportation spending, the figure is heavily influenced by transit spending levels in New York City; elsewhere in the state, spending on highways eclipses that on transit.

Why is funding lacking for public transit?

One of the chief reasons we have taken to building roads instead of mass transit to serve the transportation needs of our citizens is the astounding discrepancy between money available for road-building versus that available for transit. This disparity is seemingly justified by commonly characterizing money spent on roads as highway "investment," while that spent on transit is labeled a "subsidy."[8]

Local governments are eager to build every road for which federal and state financing is provided.[9] Of the current federal gasoline tax, 85% is devoted to highways, and only 15% to transit.[10] The current federal transportation bill (TEA-21) appropriates five times as much for highways as for public transportation.[11] The new bill (SAFETEA) for FY 2004-09 perpetuates roughly the same disparity in funding.[12]

Government funding for highways and parking amount to 8-10% of the U.S. Gross National Product, approximately $5,000/car/year.[13] This subsidy, along with the relatively low price of gasoline in the U.S., allows people to drive more than would be logical in true free market conditions.[14] The economic inefficiencies of this subsidization are estimated at $700 billion annually, which encompasses both the direct subsidy costs and additional 'soft' costs, such as pollution cleanup, of using vehicles instead of mass transit.[15] The physical inefficiencies are also apparent: it takes fifteen lanes of roadway to move as many people as one rail track.[16] It is estimated that transit in Washington DC has removed 250,000 cars and eliminated the need for 1,364 lane miles of freeway.[17]

In the last five years, U.S. ridership on public transit has increased by 21%, evincing both a need for, and public interest in, the availability of more public transit.[18]

A recent poll conducted by the Surface Transportation Policy Project similarly revealed that 59% of Americans support investing in transit, even at the expense of funding for highways.[19] Government funding must come in line with current trends and needs.

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[1] *See* SURFACE TRANSP. POLICY PROJECT, *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses*, Chap. 3 at 3 (March 2000), *available at* http://www.transact.org/report.asp?id=43 (last visited Feb. 9, 2005).
[2] The ratio is calculated by dividing the miles of public transportation service per household per hour by the number of lane miles of highways per household. *See id.*
[3] *See id.* at 4.
[4] *See id.*
[5] *See* SIERRA CLUB, *Sprawl Report 2001* at 3, http://www.sierraclub.org/sprawl/report01/transitvshighways.asp (last visited Feb. 9, 2005).
[6] *See id.*
[7] *See id.* at 2. *See also* Barbara A McCann & Reid Ewing, *Measuring the Health Effects of Sprawl: A National Analysis of Physical Activity, Obesity, and Chronic Disease* (Sept 2003), *available at* http://www.smartgrowth.umd.edu/pdf/HealthSprawl8.03.pdf (last visited Feb. 9, 2005). A recent report published by Smart Growth America and Surface Transportation Policy Project revealed that people in sprawling neighborhoods, where vehicle travel is the only real option, weighed six pounds more on average than those in compact areas, and were more likely to suffer from obesity and risk of high blood pressure, cancer, diabetes, and other diseases.
[8] *See* ANDRES DUANY, ET AL., SUBURBAN NATION: THE RISE OF SPRAWL AND THE DECLINE OF THE AMERICAN DREAM 96 (North Point Press 2000).
[9] *See id.* at 87, 231.
[10] *See id.* at 234.
[11] *See* SIERRA CLUB, *Sprawl Report 2002*, 3-4, http://www.sierraclub.org/sprawl/report02/transportation_choices.asp#highway (last visited Feb. 9, 2005) [hereinafter *Sprawl Report 2002*].
[12] *See* U.S. DEP'T. OF TRANSP., *Authorizations - Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003*, http://www.fhwa.dot.gov/reauthorization/authorizations.htm (last visited Feb. 9, 2005). Note that the existing transportation funding has been extended six times, most recently through May 2005, while Congress considers passage of SAFETEA.
[13] *See* DUANY, *supra* note 8, at 94.
[14] *See id.* at 95.
[15] *See id.* at 96-97. *See also,* STANLEY HART & ALVIN SPIVAK, THE ELEPHANT IN THE BEDROOM: AUTOMOBILE DEPENDENCE & DENIAL 166 (Hope Publishing House 1993).
[16] *See id.* at 96. In a staggering example of the economic inefficiency of highway versus transit spending, the Wisconsin DOT spent half a billion dollars on renovating a single existing interchange in downtown Milwaukee. For that same amount of money, the city could have built an entire light rail system fanning out twenty miles. *See* James Howard Kunstler, HOME FROM NOWHERE: REMAKING OUR EVERYDAY WORLD FOR THE 21ST CENTURY 76-77 (Simon & Schuster 1996). At the same time, most of the available highway funding is allocated to new construction of sprawling roadways, and not to repairing decaying urban road systems. For example, even though 84% of Virginia's urban highways are in disrepair, most of the State's road budget goes to new construction. *See* SOUTHERN ENVIRONMENTAL LAW CENTER / ENVIRONMENTAL LAW INSTITUTE, *Smart Growth in the Southeast: New Approaches for Guiding Development* 21 (1999), *available at* http://www.eli.org/ [hereinafter *Smart Growth in the Southeast*]. In Virginia, federal and state funds cover all road construction costs but only 75% of transit capital costs and 25% of transit operating costs, giving municipalities a strong incentive to build roads in place of transit. *See id.* at 22.
[17] *See Smart Growth in the Southeast, supra* note 16, at 23.
[18] *See* SIERRA CLUB, *supra* note 11.

[19] *See* SURFACE TRANSPORTATION POLICY PROJECT, *Walking in New York: Highlights from STPP's National Poll 2003*, *available at* http://www.transact.org/library/reports_pdfs/pedpoll/NY.pdf (last visited Feb. 10, 2005).

F.3. Sprawl and Race

The fall of American cities

In 1980, British Geographer Brian J. L. Berry observed an alarming American trend that has only worsened in subsequent years. As he wrote, "…what are being abandoned are those environments that were crucial in the traditional metropolis-driven growth process: the high-density, congested, face-to-face city centre settings that are now perceived as ageing, polluted, and crime-ridden, with declining services and employment bases, and escalating taxes. Such is the New American Dilemma."[1] Indeed, with white Americans moving to the suburbs to "escape" the cities' crime and poverty, these urban centers simply fall farther into despair. This exodus perpetuates inner-city problems, as sprawl expert John A. Powell argues, "[u]rban residents were left behind with a declining tax base, shrinking employment opportunities, a failing educational system, and a shortage of decent, affordable housing. There is an economic incentive for middle-class suburban residents to keep out those with high needs and few resources."[2]

Negatively affecting both whites and African Americans – though certainly harder on the minorities – sprawl should alarm even the most comfortable and content Americans. As Berry noted,

> …although their populations are decreasing, central cities still hold a very large number of people whose lives and fortunes are unfavourably affected by physical and social environments. Even assuming that suburbanites and exurbanites entirely escape these adversities, over one-fourth of the nation's people live in central cities and contend with these daily stresses. The welfare of these people is surely a matter of national interest.[3]

In fact, even when removing the substantial environmental and scenic problems of sprawl from the analysis, it *still* remains clear that sprawl has become a multifaceted dilemma for Americans of any ethnicity or neighborhood.

Disappointing retreat for whites

Fleeing the cities and moving to cookie-cutter suburban developments, American whites have increased problems not only for the "abandoned" inner-cities, but also for themselves. The niche they have progressively carved out of the shrinking countryside bears several headaches for these suburban pioneers. For example, a powerful automobile subsidy,[4] bearing the appearance of "free goods," leads middle and upper-middle class whites into an alluring suburban trap of sorts. "The cost of these subsidies – approximately $5,000 per car per year – is passed directly onto the American citizen in the form of increased prices and sales taxes. This means that the hidden costs of driving are paid by everyone: not just drivers, but also to those too old or too poor to drive a car."[5] Those without cars have no practical way of traveling throughout suburbia, especially considering the scarcity of pleasant, safe walkways on the automobile-friendly suburban streets.

Even if these car-free citizens had a means of walking or busing out of their immediate neighborhoods, they would find few of the social, community-building centers and features of cities and towns predating the postwar sprawl explosion. Those suburbanites with cars, on the other hand, still maintain the dubious luxury of navigating through growing traffic – past endless rows of identical houses towards their next sterile suburban destination – while enduring the increasing price of gas and automobile maintenance. Simultaneously, their quest for a uniform community means that these suburbanites' children will grow up without much contact with minorities. Such a lack of diversity in these neighborhoods may hinder a person's ability to later function in America's diverse society.[6] This isolation also inevitably produces people who have little comprehension or empathy for increasingly faraway urbanites and their problems.[7] This growing separation, and the indifference it breeds, may only exacerbate the following difficulties faced by those most negatively affected by sprawl – minorities.

Inescapable, urban "reservations" for minorities

It might seem inevitable that minority groups, especially African Americans, would find substantially improved opportunities and living standards following desegregation and the civil rights movement. "However," writes John Powell,

> the dynamics of sprawl and jurisdictional fragmentation largely blunted the civil rights movement. While the civil rights movement was concerned with ending segregation, the court and policy makers adopted a different approach that distinguished intra-jurisdictional segregation from inter-jurisdictional segregation, thus limiting desegregation efforts and remedies to segregation within local political boundaries…. This move towards greater fragmentation in the wake of the civil rights movement was not just a coincidence, but part of a deliberate move to compromise the idea of integration while responding to the growing demands for racial justice by blacks.[8]

Regardless of who is to blame for our new form of fragmented and segregated society, certain facts now face the nation.

For starters, many African American neighborhoods simply ceased to exist once sprawl began growing after World War II. New highways cut through the middle of cities, most commonly disemboweling entire African American neighborhoods.[9] As many of these communities were thriving symbols of black ascension in the past, such as in downtown Detroit, the automobile-related destruction not only hurt neighborhoods, but planted an understandable seed of mistrust towards land-planners in the minds of urban African Americans nationwide.[10]

In those non-white urban neighborhoods that avoided highway intrusions, the situation remains similarly bleak. Minorities looking for improved living conditions find themselves blocked out of many more attractive neighborhoods because, as Powell points out, …many developing suburban communities limit or prohibit multifamily housing and

have minimum lot sizes and other restrictions that push up the cost of housing. Racial steering and redlining have also played roles in limiting housing choices for many people of color; isolating them in central city neighborhoods and declining suburbs while denying them the opportunity to develop wealth through home ownership."[11]

Stuck on their urban "reservations," minorities also must face the heightening, sprawl-related trend of businesses moving to the suburbs to follow the whites. Powell notes that over 60% of the Nation's offices are now found in suburbs, as opposed to only 25% in 1970.[12] Political Economy Professor Paul A. Jargowsky finds at least four issues related to these suburban office locations that hinder minority advancement, stating,

> …it may be difficult for the poor to get jobs because of the lack of public transportation or the difficulty and expense of reverse commuting by car. Long commuting time and high commuting costs both reduce the effective wage rate, especially if the base pay rate is low to begin with. Second, information about jobs may not reach into inner-city neighborhoods that have few social, political, or economic ties to the suburbs. Third, employers in the suburbs may exercise more racial discrimination in hiring because they operate in the virtually all white environment of the suburbs. Even if the employer would not mind hiring minority workers, the employer may wish to indulge customers who are not comfortable dealing with minorities or poor whites from the central city. Fourth, the central city workers may fear they will be treated unfairly in the largely white suburban labor market.[13]

Locked into living and (hopefully) finding jobs in their urban neighborhoods, minorities remain surrounded by obstacles between them and the American Dream. Jargowsky notes, "[a] concentration of poor neighbors might lead people, especially teens, to emulate negative behaviors, resulting in worse outcomes even after controlling for the influence of a person's immediate family and personal characteristics."[14] Along with bad role models in the communities, these minorities typically face poor instruction in the classroom as well. Jargowsky laments this trend, stating,

> [w]hen poor families are clustered geographically, and then a grid of school districts and school attendance zones is also imposed geographically, poor children will also be clustered in school. Schools in poor neighborhoods have greater needs and a lower tax base than suburban schools. It is harder to hire and retain high quality teachers in the inner city when pay and working conditions are better in suburban districts. In some cases, teachers who continually deal with children from troubled families develop low expectations for students.[15]

With the growth of sprawl, the troubled urban present, and the inadequate schooling of young minorities all in mind, the standing of non-white American urbanites could become even worse than its already deplorable state.

Crumbling urban economy and infrastructure: problematic for everybody

Though generally proud of their nation's history, success, and resilience over the years, Americans often ignore the embarrassment that their once great cities have become. As Geographer Brian Berry argued, "…it is socially wasteful to under-utilize, abandon, or destroy capital investments made by preceding generations in urban infrastructure, housing, places of business, and public buildings. The national product is diminished by our present course of reproducing these facilities elsewhere rather than using what already exists."[16] Powell notes that this problem, which has only worsened since Berry's 1980 report, affects everyone because the welfare of cities and suburbs are often mutually-dependent. Despite many whites' belief that fleeing the city means completely disassociating themselves with its troubles, their flight only exacerbates regional difficulties. As Powell explains,

> [s]tudies indicate that the better the central city does, the better the suburb does; and during the last recession, the metropolitan areas with the greatest income differential between central city and suburbs suffered the most. Inner ring suburbs are now suffering many of the same problems central cities faced a generation ago. In today's global economy, regions compete with each other for capital and jobs. Crippled central cities and declining suburbs can serve as a drag on the whole regional economy.[17]

To further illustrate this point, Sandra Newman of the Institute for Policy Studies in Minnesota notes at least four interdependencies between cities and their suburbs: writing, "a. The image of the region is affected by the image of the city. b. The city's amenities are of value. c. Fiscal problems of cities might increase the suburbs' tax burden. d. Increased coordination between cities and suburbs may provide unique agglomeration economies that cannot be achieved elsewhere through the region."[18] Proponents of suburban growth might counter such facts with the notion that sprawl is the only economically feasible development option today. Nevertheless, Metro Portland, Oregon, representative Ed Washington notes that, "to those who say that building on the fringes of what currently exists is the only way to guarantee property values will increase, I would point out that the values of homes in [increasingly redeveloped] Portland [Oregon] have risen 302 percent in the past five years."[19] In any case, considering the scant attention paid to urban-suburban relationships, Americans seem to have forgotten the crucial philosophy that created and preserved our vast and diverse nation: "United We Stand, Divided We Fall."

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[1] Brian J.L. Berry, *Inner City Futures: An American Dilemma Revisited*, 5 TRANSACTIONS OF THE INSTITUTE OF BRITISH GEOGRAPHERS, New Series, Issue 1, 18 (1980).
[2] John A. Powell, *Race, Poverty and Urban Sprawl: Access to Opportunities through Regional Strategies*, *available at* www1.umn.edu/irp/publications/racepovertyandurbansprawl.html (last visited Oct. 19. 2004).
[3] Berry, *supra* note 1.
[4] "According to Hart and Spivak, government subsidies for highways and parking alone amount to between 8 and 10 percent of our gross national product, the equivalent of a fuel tax of approximately $3.50 per gallon. If this tax were to account for 'soft' costs such as pollution cleanup and emergency medical treatment, it would be as high as $9.00 per gallon." ANDRES DUANY, ET AL., SUBURBAN NATION: THE

RISE OF SPRAWL AND THE DECLINE OF THE AMERICAN DREAM 94 (North Point Press 2000) (*citing* STANLEY HART & ALVIN SPIVAK, THE ELEPHANT IN THE BEDROOM: AUTOMOBILE DEPENDENCE & DENIAL; IMPACTS ON THE ECONOMY & THE ENVIRONMENT (Hope Publishing House 1993)).
[5] *See* DUANY, *supra* note 4.
[6] *See id.* at 45.
[7] *See id.*
[8] Powell, *supra* note 2, at 3.
[9] *See* DUANY, *supra* note 4, at 87.
[10] *See* SPRAWLING OF AMERICA: INNER CITY BLUES (Great Lakes Television Consortium), *available at* http://www.gltv.org/ (last visited Feb. 10, 2005).
[11] *See id*.
[12] *See id.*
[13] Paul A. Jargowsky, *Sprawl, Concentration of Poverty, and Urban Inequality*, 26, June 30, 2001, forthcoming in GREGORY SQUIRES, ED., URBAN SPRAWL: CAUSES, CONSEQUENCES AND POLICY RESPONSES (URBAN INST. 2001)*, available at* http://urbanpolicy.berkeley.edu/pdf/census2000/jargowsky.pdf (last visited Feb. 10, 2005).
[14] *Id.*
[15] *Id.*
[16] Berry*, supra* note 1, at 19.
[17] Powell, *supra* note 2, at 2.
[18] Statement of Sandra Newman, *A Regional Perspective,* April 11, 1996, *available at* http://www1.umn.edu/irp/april1296/regionalperspective.htm (last visited Feb. 10, 2005).
[19] Statement of Ed Washington, *A Regional Perspective*, April 11, 1996, *available at* http://www1.umn.edu/irp/april1296/regionalperspective.htm (last visited Feb. 10, 2005).

F.4. Sprawl: Its Pattern and Impacts on Public Health, Children, the Elderly, and Low-Income Workers

How does sprawl fracture the social fabric and health of a community?

Sprawl brings negative consequences that reach far beyond the more obvious impacts on local economies, property taxes, and the environment. Ideally, compact development keeps complementary uses close to one another, and thus easily accessible to all members of a community.[1] In contrast, the pattern of sprawl – the unplanned, uncoordinated, and fractured growth of a community away from its core – can tear the social fabric that binds a society and directly affect peoples' quality of life and public health. The typical cul-de-sac structure of suburban towns, designed to keep out "undesirable" people and through-traffic, also limits the mobility of people who live there, particularly children, the elderly, and the poor (who are predominantly of minority ethnic groups). This lack of mobility, in turn, negatively impacts public health.

Characteristic patterns of sprawl include:

1) widely dispersed population residing in low-density residential development;
2) a rigid separation of homes, shops, and workplaces;
3) a lack of distinct activity centers, found in strong downtown or suburban town centers; and
4) a road network distinguished by large block size, and few intersections or crosswalks, which creates poor access from one place to another.[2]

What dangers are caused by the pattern of sprawl?

Driving is an essential part of life when sprawl becomes more pronounced in any community. Sprawling suburban communities are designed to accommodate autos and SUVs; walkers and cyclists become stranded, as "shops are miles away, often in strip malls accessible only by high-speed roadways."[3] Bigger houses on larger lots take the walkable errand out of the neighborhood.[4] Residential neighborhoods are farther away from jobs and shopping centers.[5] Our national priorities have been skewed by sprawl as roadway development sits atop the public funding hierarchy.[6] Such sprawling design, coupled with a lack of public transportation, creates a car-dependant culture that discourages walking or biking as a realistic means of transportation. People must drive to shop, get to work or attend social gatherings. Based on Federal Highway Administration surveys, researchers estimate that Americans rely upon a vehicle to make over 33% of all trips under a half mile, 75% of trips under one mile, and make fewer than 6% of their daily trips on foot.[7] And, vehicle dependence brings negative health impacts. For example, recent research by the University of British Columbia to assess health impacts of development planning patterns at the neighborhood level shows that, "[e]ach hour spent in a car was associated with a 6 percent increase in the likelihood of obesity and each half-mile walked per day reduced those odds by nearly 5 percent."[8]

Public Health Impacts

> I know that when you talk about smart growth and sprawl, most people tend to focus on one of two things: either the conservation impact in terms of loss of open space, or the huge cost on the tax bill to subsidize sprawl. The most fundamental impact is health. Sprawl is hazardous for your health. . .Unfortunately, with sprawl, we are designing obesity and high blood pressure and heart attacks and asthma right into our lives.[9] ~ Parris N. Glendening, former Maryland Governor

Because of the pattern of sprawl, people are missing out on the significant health benefits that are available simply by walking, bicycling, climbing stairs, and getting physical activity as part of everyday life. Compared to people living in areas with higher density development, people living in sprawling places are likely to walk less and become physically inactive and overweight, which contributes to increased risk of many chronic diseases and conditions, non-insulin-dependent diabetes, colon cancer, osteoarthritis, osteoporosis, coronary heart disease, hypertension, and other mental health problems, like anxiety and depression.[10]

Public health researchers have examined community design and determined that urban residents living in older neighborhoods (those built pre-1946 where there are more sidewalks, interconnected roads, and a mix of residential and commercial land uses) were "more likely to walk greater distances with some frequency than those living in newer homes."[11] Distinct from recreational walking, "utilitarian travel on foot" to engage in work, shopping, or school, is more prevalent in dense, mixed-use neighborhoods as compared to lower density residential neighborhoods.[12] Walking trips to commercial areas occur more frequently in older neighborhoods with nearby stores and grid-like street networks than in the newly developed sprawling neighborhoods.[13] Poor accessibility underlies a sprawling community as nothing is near or within easy walking distance.[14]

Studies show that "[d]espite the health benefits of physical activity, 74% of U.S. adults do not get enough physical activity to meet public health recommendations and about one in four U.S. adults remains completely inactive during their leisure time."[15] While diet contributes to this obesity problem, the physical sprawl of a neighborhood fails to enable physical activity that could assist in the maintenance of a healthy weight, and obesity "has reached epidemic proportions across age, race, ethnic, and socioeconomic groups."[16] The National Health and Nutrition Examination Survey (NHANES) found that 64.5% of adults in the United States are overweight and 30.5% are obese, conditions that are reported to account for over 300,000 premature deaths each year.[17] The incidence of diabetes rose to 12 million cases, doubling from 1980 to 2000.[18]

The specific relationship between sprawl and leisure time physical activity levels, body mass index (BMI) and obesity, hypertension, diabetes, and coronary heart disease

(CHD) was documented by Reid Ewing who studied data from the Behavioral Risk Factor Surveillance System (BRFSS) from 1998 to 2000; the survey included over 200,000 respondents from 448 counties and over 175,000 respondents from 83 metropolitan areas for which urban sprawl indices were available.[19] In short, statistical relationships were found between sprawling community form (as measured by the sprawl index) and hypertension, BMI, and obesity at the more sprawling county level, but found a statistically significant relationship only with minutes walked as a leisure time activity at less sprawling metropolitan level (no statistically significant link was found between community design and diabetes or CHD).[20] On average, when other variables are held constant, "adults living in the most sprawling counties weigh 6 pounds more than those living in the most compact, densest jurisdictions."[21] "For every 50-point increase in sprawl as measured by the sprawl index, the BMI of residents would be expected to rise by .17 points…an increase in weight of just over one pound for the average person."[22] Thus, sprawling patterns that inhibit walkability for exercise or daily errands contributes to obesity.

Ewing found that a direct relationship also existed between living in sprawl and the existence of chronic disease hypertension, also known as high blood pressure.[23] Physical inactivity contributes to chronic health conditions, and combined with obesity, are risk factors for hypertension. Using the same sprawl index that was used to assess obesity, researchers found that "the odds of having high blood pressure, are six percent higher for every 50-point increase in the degree of sprawl."[24]

In addition to health problems caused or exacerbated by lack of exercise, sprawl also contributes to increased air pollution, and thus an increase in deaths from heart and lung disease, and asthma.[25] The volatile organic compounds and nitrogen oxides from cars, diesel-trucks, and power plants combine to form ozone, which along with other microscopic particulate matter irritates lung tissue causing "shortness of breath, coughing, choking, wheezing, chest pains, headaches, and eye irritation."[26] Although these conditions may effect everyone, it is children and the elderly, and those with chronic respiratory illnesses that are most affected by diminished air quality.[27]

The Risks of Walking

The pattern of sprawl, dominated by the automobile, creates an additional risk as roads have become more dangerous for pedestrians and cyclists.[28] Those who do try to walk, and receive the health benefits therefrom, face significant safety risks – "about 6,000 pedestrians are killed and 10,000 injured in the United States every year."[29] These numbers are growing quickly in sprawling communities – for example, a 1999 study by the Center for Disease Control and Prevention found that from 1994 to 1998 the pedestrian fatality rate in Atlanta increased by 13% while the national rate dropped by 9.6%.[30]

Particular groups face higher risks when walking in sprawl. Recent studies show that compared to Germans or Dutch, American pedestrians and bicyclists are two to six

times more likely to be killed or severely injured in auto accidents, and attribute this increased risk to residential neighborhood and street design.[31] American minorities often face increased risks compared to the general population. "In metro Atlanta, the pedestrian fatality rate is 4 per 100,000 people for African Americans, 10 for Hispanics, and less than 2 for Caucasians."[32] A 1993 study reportedly found that "suburban children were at greater risk from traffic than urban children were at risk from gun violence."[33]

In New York, from 1986 to 1996, approximately 510 pedestrians were killed, and 10,200 injured by automobiles each year.[34] Seniors make up 13% of the population, but account for 33% of the pedestrian fatalities, a rate 2.5 times higher than the general population.[35]

Who is most affected by the pattern of sprawl?

The health impacts discussed above may affect the general public. But, some physical and social impacts may be felt more acutely by certain groups of people, particularly senior citizens, children, and low-income workers. As noted by journalist Thomas Hylton in his book "Save our Land, Save Our Towns":

> Today, children rarely walk anywhere on their own. We don't want them to! They might get run over. So they ride to school on busses, and must be chauffeured everywhere else by their parents. Meanwhile, the elderly dread the loss of their driving privileges, because when that happens, they lose their independence.[36]

Senior Citizens

Although many seniors lead active and fulfilling lives, those who are no longer able to drive can become trapped in their residences or retirement communities. Due to sprawl, basic shopping and social or recreational needs are not within walking distances, and adequate public transit often is lacking. Thus, the pattern of sprawl that significantly limits a community's walkability causes particular problems for seniors. They must rely on others for transportation or have items delivered to their homes. Some must decide either to remain immobile and trapped at home or to drive when it may no longer be a safe choice. They fear loss of their drivers' licenses and subsequently being forced to revert to a form of childhood, despite the fact that they are not senile and otherwise healthy.[37] When seniors are trapped at home, the social isolation and lack of exercise contributes to declining mental and physical health.

The Brookings Institution documents that "[i]n 2002, 35 million Americans, or 12.5 percent of the total U.S. population, were over age 65, and almost 4.5 million (or 1.6 percent of the total population) were over age 85. By 2003, the number of older Americans [will] more than double; 9 million alone will be over 85."[38] Although the disability rate for seniors has been decreasing in recent years, in 1997, nearly 35 percent

over 80 years old reported needing assistance due to disability.[39] Women and people of color are significantly more likely to have serious health problems or disabilities since women tend to live longer than men and have been found to have less family assistance available than men. People of color, particularly women, "are less likely to have the resources to buy assistance or the services and goods they need as they face mobility problems."[40] More and more, seniors prefer to stay in their family homes than move to retirement communities – in the 1990s, the suburbs "greyed" more rapidly than the overall population, with approximately 79% living in metropolitan areas (23 % rural, 56% suburb, 21% center city).[41] And the percentage of trips made by driving has risen while use of alternative modes of transit has dropped rapidly.[42]

Children

Children, who like some seniors, cannot drive, also face social and health impacts created the pattern of sprawl and the subsequent lack of mobility. Social opportunities become limited and children socially isolated when they cannot walk to and from neighborhood schools. If parents are not available to drive and children must rely on school bus systems, they often will not be able to partake in after-school sports or outdoor recreational activities, or have social time with friends. The National Trust for Historic Preservation puts partial blame on construction policies and regulations for schools that tend to favor large sites, at a community's edge, which are out of walking distance for most children – less than 13% walk to school.[43] For example, federal guidelines, which are often used by local school boards, recommend building new, larger facilities over remodeling old ones, and using 30 acres as a base plus one more acre per student.[44]

The "cul-de-sac kids", isolated in their suburban communities, are completely dependent upon their parents' driving, and thus suffer from a loss of autonomy and become "frozen in a form of infancy."[45] When asked, children express this feeling of social isolation; when asked about what they would like to see developed in their communities, the answer is not often a mall, but rather places to "hang out" such as parks with "people" in them.[46] In suburban California, children watched four times as much television as those in rural Vermont who had access to recreational opportunities that did not require parental driving. And, sociologists identify "teen isolation and boredom" as a contributing factor to the high national rate of teenage suicides – nearly nonexistent in before 1950 and the advent of the "suburbs," by 2000 suicide accounted for more than 12% of youth mortalities, and the suicide rate is much higher in suburbs than in cities.[47]

The fact that children no longer walk to school each day contributes to health problems, particularly childhood obesity. Dru Schmidt-Perkins, executive director of 1000 Friends of Maryland explains that "[k]ids have lost out on that basic, fifteen-minute walk twice a day."[48] The inaccessibility of neighborhood parks or ball fields adds to a child's inactivity, and less active children are prone to the effects of obesity. According to the CDC, "22 percent of American children are obese, twice the level of ten years ago."[49] In addition, asthma has become the leading pediatric illness in recent years,

particularly for African American children, and asthma attacks have been clearly linked to increased ozone levels.[50]

Low-Income Workers

Sprawling suburban development in the last fifty years has been fueled by the flight of inner city residents, relatively cheap (highly subsidized) gasoline, and the American Dream of independent land ownership.[51] Sprawl concentrates poverty when it creates a landscape where people cannot walk to work. Poor people who cannot afford to purchase and maintain a vehicle are severely limited in where they can find jobs and are forced to remain in decaying inner cities with few job prospects. This situation has been duly noted by Valerie Gregg, who explains that as wealthier people leave cities and spread out into sprawling suburbs, "the economic boom times that drive urban sprawl create unequal opportunities. Suburban business and retail development often mean empty storefronts in the urban core. Without public transportation to the suburbs, new jobs created by suburban business development are out of reach to city residents without cars."[52] And, Robert Bullard, a Sociologist at Clark Atlanta University, warns that "[s]prawl concentrates poverty and poverty exacerbates many public health problems."[53]

Socioeconomic separation can be seen in the pattern of sprawl. The Metropolitan Area Research Corporation explains that poor neighborhoods in core city areas spread out into older working-class, inner-ring and middle-income satellite suburbs, where the demand for social services is highest, but government resources and income tax bases are lowest.[54] Moving out from the core, middle-income suburbs are dominated by single-family housing developed on inadequate septic systems, inadequate roads and infrastructure, and under-funded-over-crowded schools.[55] The core and ring-communities suffer further impacts from highway-building and road widening to allow fast access from the wealthier outer suburbs to downtown areas – such road projects remove on-street parking, hurting pedestrian access and street side businesses, and reducing the ability of residents to store a car if they have one.[56] Moving farther, the upper-income suburbs, often considered the "favored quarter" grow into "edge cities" and become the urban environments that community members originally sought to avoid.[57] It is only in these upper-income communities that people have the relative power and wealth to begin to fight urban sprawl by fighting for local development laws that promote preservation of open space and funding open space purchases. However, even as the upper-income suburbs urbanize, the socioeconomic separation remains because these communities offer little or no affordable housing, and poverty remains concentrated in the core urban communities.

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[1] *See* Reid Ewing, et al, *Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity*, 18 AM. J. HEALTH PROMOTION 1, 48 (2003).
[2] *See id.*

[3] Thomas Turney, *Driving Everywhere Adds Up on American's Waistline,* CAROLINA MORNING NEWS VIA ASSOCIATED PRESS, August 28, 2003 (*quoting* Richard Jackson of the Centers for Disease Control and Prevention).
[4] Martha T. Moore, *The Way Cities and Suburbs are Developed Could be Bad for Your Health*, USA TODAY, April 25, 2003, at A1.
[5] *Id*.
[6] ANDRES DUANY, ET AL., SUBURBAN NATION 121-22 (North Point Press 2000).
[7] *See* Moore, *supra* note 4; The Robert Woods Johnson Foundation, *The Shape We're In: Statistics: America's growing numbers: Inactivity and Obesity* (2003), *available at* http://www.rwjf.org/news/special/shape/planning_4.jhtml?liquid&pff. (last visited Feb. 9, 2005).
[8] Rob Stein, *Car Use Drives Up Weight, Study Finds: Obesity Called More Likely in Sprawling Areas Than Mixed-Use Neighborhoods*, WASH. POST, May 31, 2004, at A02, *available at* http://www.washingtonpost.com/ac2/wp-dyn/A3062-2004May30?language=printer (last visited Feb. 9, 2005). The findings of the study will be published in the August 2004 issue of the American Journal of Preventive Medicine.
[9] Howard Libit, *Study Links Community Sprawl to Fat*, BALT. SUN, August 29, 2003, *available at* http://www.healthycarroll.org/whatsnew-sprawl.htm (last visited Feb. 9, 2005) (*quoting* Parris N. Glendening).
[10] *See* Ewing, *supra* note 1, at 47; BARBARA A. MCCANN AND REID EWING, MEASURING THE HEALTH EFFECTS OF SPRAWL: A NATIONAL ANALYSIS OF PHYSICAL ACTIVITY, OBESITY, AND CHRONIC DISEASE 1, 5-6 (Smart Growth America and Surface Transp. Policy Project, Sept. 2003), *available at* http://www.smartgrowthamerica.org/healthreport.html (last visited Feb. 9, 2005); Bradford McKeem, *As Suburbs Grow, So do Waistlines*, NY TIMES, Sept. 4, 2003, F13.
[11] Ewing, *supra* note 1, at 47 (*citing* Berrigan and Troiano, *The Association Between Urban Form and Physical Activity in U.S. Adults,* 23 AM. J. PREVENTIVE MED. 36-43 (2003).
[12] *See id.* (*citing* Saelens, et al., *Environmental Correlates of Walking and Cycling: Findings from the Transportation, Urban Design, and Planning Literatures,* 25 ANN. BEHAV. MED., 80-91 (2003).
[13] *See* Susan L. Handy, *Understanding the Link Between Urban Form and Nonwork Travel Behavior*, 15 J. OF PLANNING EDUCATION AND RESEARCH 183 (1996).
[14] Ewing, *supra* note 1, at 48 (*citing* Reid Ewing, *Is Los Angeles Style Sprawl Desirable?*, 63 J. AM. PLAN. ASS'N, 107-126(1997).
[15] Ewing, *supra* note 1, at 47.
[16] *Id.*
[17] *See id.*
[18] *See* McKeem *supra* note 10.
[19] *See* Ewing, *supra* note 1, at 49-51. For an explanation of the BMI, see MCCANN, *supra* note 10 at 13.
[20] *See* Ewing, *supra* note 1, at 52-54; MCCANN *supra* note 10 at 3.
[21] Libit, s*upra* note 9.
[22] MCCANN, *supra* note 10, at 13 (A more detailed explanation of how the sprawl index was created can be found at pages 9-11 and throughout Ewing, *supra* note 1).
[23] *Id*. at 20.
[24] MCCANN, *supra* note 10, at 2.
[25] *See* Valerie Gregg, *Taming Urban Sprawl*, PUBLIC HEALTH (Spring 2001), *available at* http://www.whsc.emory.edu/_pubs/ph/spring01/sprawl.html (last visited Feb. 9, 2005).
[26] *Id.*
[27] *See id.*
[28] *See* Turney, *supra* note 3 (*citing* John Pucher's study at Rutgers University where "American cyclists and pedestrians were two to six times more likely to be killed on the road than their German or Dutch counterparts.").
[29] Gregg, *supra* note 25.
[30] *Id.*
[31] *See* Libit, *supra* note 9.
[32] Gregg, *supra* note 25.
[33] JAMES CORLESS AND GLORIA OHLAND, CAUGHT IN THE CROSSWALK: PEDESTRIAN SAFETY IN CALIFORNIA (Surface Transportation Policy Project 1999), *available at*

http://www.transact.org/ca/caught99/caught.htm (last visited Feb. 9, 2005) (*citing* ALAN DURNING, THE CAR AND THE CITY (Northwest Environment Watch 1993).
[34] *See* ENVIRONMENTAL WORKING GROUP, MEAN STREETS: PEDESTRIAN SAFETY AND REFORM OF THE NATION'S TRANSPORTATION LAW, NEW YORK (Surface Transportation Policy Project April 1997) 1, *available at* http://www.ewg.org/pub/home/reports/meanstreets/states/NY.pdf (last visited Feb. 9, 2005).
[35] *See id.* at 2.
[36] Liz Conroy, *Conroy: Sprawl Hurts Children, Senior Citizens Most*, ATHENS BANNER-HERALD, June 29, 2002, *available at* http://www.onlineathens.com/stories/062902/opi_20020629010.shtml (last visited Feb. 9, 2005) (*quoting* SAVE OUR LAND, SAVE OUR TOWNS (Bullfrog Films 1995)).
[37] *See* DUANY, *supra* note 6 at 122-23.
[38] SANDRA ROSENBLOOM, THE MOBILITY NEEDS OF OLDER AMERICANS: IMPLICATIONS FOR TRANSPORTATION REAUTHORIZATION 1 (The Brookings Inst. July 2003), *available at* http://www.brookings.edu/es/urban/publications/20030807_Rosenbloom.pdf (last visited Feb. 9, 2005).
[39] *See id.* at 2.
[40] *Id.* at 3.
[41] *See id.* at 3-4 (*citing* Lavada E. DeSalles, *Testimony to U.S. Senate Committee on Banking, Housing and Urban Affairs,* July 17, 2002).
[42] *See id.* at 4-5.
[43] *See* Moore, *supra* note 4.
[44] *See* Johanna Miller, *Hey Kid, Try Walking! Communities Win When Schools are Close to Home*, Michigan Land Use Inst. (Oct. 2, 2001), *available at* http://www.mlui.org/growthmanagement/fullarticle.asp?fileid=11895 (last visited Feb. 9, 2005).
[45] DUANY, *supra* note 6 at 116-17.
[46] *See* Dan Burden, *Walkable Communities*, *available at* http://www.sierraclub.org/sprawl/community/walkable.asp (last visited Feb. 9, 2005).
[47] *See* DUANY, *supra* note 6, at 120.
[48] Libit, *supra* note 9.
[49] *See* DUANY, *supra* note 6 at 126 (*citing* Kilborn, *Most Americans Are Overweight*, NY TIMES, Oct. 16, 1996 at A21.
[50] *See* Gregg, *supra* note 25.
[51] *See id.*
[52] *Id.*
[53] *Id.*; *see also* JP, *The Economics of Urban Sprawl*, 4 WATERSHED PROTECTION TECHNIQUES 461, 465 (1997).
[54] *See* METROPOLITAN AREA RESEARCH CORPORATION, THE PATTERN OF SOCIAL SEPARATION AND SPRAWL (2002), *available at* http://www.metroresearch.org/misc/pattern.asp (last visited Feb. 9, 2005).
[55] *See id.*
[56] *See* DUANY, *supra* note 6, at 130-31.
[57] *See* METROPOLITAN AREA RESEARCH CORPORATION, *supra* note 54.

Useful Sprawl & Smart Growth Resources

The following publications and websites contain information about sprawl and smart growth. By listing resources below, Riverkeeper does not necessarily endorse the views expressed in any particular publication or website. The publications and websites below include some, but not all, resources cited in the body of this report. They also include additional resources not used or cited in the body of this report.

Publications:

DANA BEACH, PEW OCEANS COMMISSION, COASTAL SPRAWL: THE EFFECTS OF URBAN DESIGN ON AQUATIC ECOSYSTEMS IN THE UNITED STATES (2002).

F. KAID BENFIELD ET AL., NRDC, ONCE THERE WERE GREENFIELDS: HOW URBAN SPRAWL IS UNDERMINING AMERICA'S ENVIRONMENT, ECONOMY, AND SOCIAL FABRIC (1999).

F. KAID BENFIELD ET AL., NRDC, SOLVING SPRAWL:MODELS OF SMART GROWTH IN COMMUNITIES ACROSS AMERICA (2001).

ANDRES DUANY ET AL., SUBURBAN NATION: THE RISE & THE DECLINE OF THE AMERICAN DREAM (2000).

REID EWING ET AL., ENDANGERED BY SPRAWL: HOW RUNAWAY DEVELOPMENT THREATENS AMERICA'S WILDLIFE (NATIONAL WILDLIFE FEDERATION, SMART GROWTH AMERICA, AND NATURESERVE (JAN. 2005).

JULIA FREEDGOOD, COST OF COMMUNITY SERVICES STUDIES: MAKING THE CASE FOR CONSERVATION (2002).

JAMES HOWARD KUNSTLER, THE GEOGRAPHY OF NOWHERE (1995).

JAMES HOWARD KUNSTLER, HOME FROM NOWHERE (1996).

The Next American City – www.americancity.org (Journal).

AL NORMAN, SLAM-DUNKING WAL-MART! HOW YOU CAN STOP SUPERSTORE SPRAWL IN YOUR HOMETOWN (1999).

ROBERT D. PUTNAM, BOWLING ALONE (2000).

MICHAEL L. SIEGEL ET AL., NRDC, DEVELOPMENTS AND DOLLARS: AN INTRODUCTION TO FISCAL IMPACT ANALYSIS IN LAND USE PLANNING (2000).

Websites:

American Planning Association – www.planning.org/growingsmart/

The Center for Watershed Protection – www.cwp.org

Community & Environmental Defense Services - www.ceds.org

The Congress for the New Urbanism – www.cnu.org

EPA - http://www.epa.gov/smartgrowth

Funders Network for Smart Growth & Sustainability, Biodiversity and Smart Growth paper - http://www.fundersnetwork.org/info-url_nocat2778/info-url_nocat_show.htm?doc_id=126645

Michigan Land Use Institute - www.mlui.org

National Trust for Historic Preservation – www.nthp.org

Pace Land Use Law Center - http://www.law.pace.edu/landuse/index.html

Planner's Web Sprawl Articles - www.plannersweb.com/sprawl/home.html

The Preservation Institute - www.preservenet.com/index.html

Smart Growth America – www.smartgrowthamerica.org

Smart Growth Network – www.smartgrowth.org

Sprawlwatch Clearinghouse – www.sprawlwatch.org

Sierra Club - www.sierraclub.org/sprawl

Surface Transportation Policy Project - www.transact.org

Trust for Public Land – www.tpl.org