

Water and Smart Growth: The Impacts of Sprawl on Aquatic Ecosystems



This paper was commissioned by the Fundersonetwork for Smart Growth and Livable Communities. The collaborating author on this paper was Dana Beach with the South Carolina Coastal Conservation League.** This is the fourteenth in a series of translation papers published by the Fundersonetwork to translate the impact of sprawl and urban disinvestment upon issues of importance to our communities and environment and to suggest opportunities for progress that would be created by smarter growth policies and practices. Other issues addressed in the series of translation papers include community development, arts, health, biodiversity, children and families, education, aging, transportation, agriculture, civic engagement, parks and open space, workforce development, and social equity.*

**The Fundersonetwork works to strengthen fundersonetwork abilities to support organizations working to build more livable communities through smarter growth policies and practices. For more information, visit www.fundersonetwork.org.*

***The South Carolina Coastal Conservation League is a grass-roots nonprofit conservation organization, founded in 1989, that serves more than 4,000 members. Its mission is to protect the threatened resources of the South Carolina coastal plain – its natural landscapes, abundant wildlife, clean water, and traditional communities – by working with citizens and government on pro-active, comprehensive solutions to environmental challenges. For more information, visit www.sccl.org.*

Abstract

Water quality continues to be a primary environmental concern among the American public. Yet many do not realize that the sprawling development patterns that have characterized American growth in recent decades are the second largest and fastest growing source of pollution to our water system. The public's concern for water safety along with evidence that draws a linkage between settlement patterns and water conditions creates a powerful argument for land use reform.

This paper reviews the importance of protecting our watersheds, the effects of pollution on our water systems, and current trends in growth and development.

It makes the case that comprehensive land use reform can become the organizing principle of the nation's water quality agenda, suggesting strategies that can be taken at the regional, neighborhood, and site scales to protect aquatic resources.



Introduction

The second largest, and fastest growing, source of runoff is sprawl – the wasteful and dysfunctional patterns of development that characterize most changes to the American landscape over the past 40 years.

Over the past 30 years, America has achieved spectacular results with new water pollution control technology. Rivers that spontaneously ignited, harbors clogged with raw sewage, streams with the other-worldly hues of industrial chemicals – all of these seem like visions from another era.

But our failures to protect water and aquatic life have been almost as spectacular as our technological successes. Today, vast quantities of pollutants still flow into our nation's waters. Small creeks and streams experience damaging increases in water temperature during summer rains. Critical fish habitat is washed away. Nationwide, hundreds of thousands of miles of rivers are unsafe for swimming or fishing. Millions of acres of bays and sounds that once supported healthy shellfish are off-limits and degraded.

This environmental disgrace is caused by “non-point source” pollution – the toxic soup of contaminants that flows from developed land, roads, and farm fields, ultimately making its way to America's rivers, streams, and estuaries. Failing to act against non-point source pollution will consign waters that are healthy today to severe and irreversible declines in coming decades.

Chemically-assisted agriculture remains the nation's largest source of polluted runoff. Tremendous effort has gone into improving farming

practices around the country. In some areas, water quality has improved significantly. Still, fundamental changes are necessary to address such problems as the Gulf of Mexico's expanding “dead zone,” caused by nitrogen from farming as far inland as Iowa.

The second largest, and fastest growing, source of runoff is sprawl – the wasteful and dysfunctional patterns of development that characterize most changes to the American landscape over the past 40 years. Between 1983 and 1997, the U.S. converted to subdivisions and strip malls one-fourth of all the land that has been used for urban purposes since European settlement. These trends, along with three decades of water quality research, make it clear that comprehensive land use reform is essential to protecting our nation's water resources.

Improving the way our communities grow is a formidable challenge. Water, however, is arguably the most potent symbol of our nation's ecological health. In poll after poll, water ranks as America's top environmental concern. Because we can now draw a hard linkage between settlement patterns and the condition of our lakes, rivers, and streams, we have an enormously forceful argument for land use reform.

Encouragingly, the patterns of growth that will sustain our nation's

waters will also advance other community goals – goals such as affordable housing, social equity, transportation efficiency, and fiscal responsibility. The requisite development patterns are similar to those promoted by smart growth advocates, but they are further shaped by

the needs of watershed protection. It is hard to imagine a more compelling combination of purposes converging on a single goal – the reform of development in the nation’s metropolitan regions and rural landscapes.

Protecting Water Means Protecting Watersheds

Life began in the oceans. Over hundreds of millions of years, living things evolved, emerged, and migrated to terrestrial habitats, but nowhere did they venture far from their aquatic origins. Whether along the Mississippi and its tributaries, the Great Lakes, the mountain streams of the Rockies and the Appalachians, or the bays and sounds of the coast, life congregates around water.

The essential relationship between land and water is best expressed by the concept of the watershed, which is defined as all of the land that drains into a river, stream, lake, or estuary. The watershed has become the building block of aquatic ecology, the unit of the living system that cannot be further subdivided. It would be as pointless to consider a river isolated from the surrounding watershed as it would to study the human circulatory system independently of the body. All of the services that the body provides our blood – enrichment, purification, and flow regulation – watersheds provide rivers. Just as our circulatory system

makes the survival of our bodies possible, rivers sustain life on the surrounding land.

What happens underground in a watershed is at least as important as what takes place on the surface. During an afternoon rain, for example, water may be absorbed into the soil, percolate to a shallow layer of groundwater, and flow laterally toward the creek or river into which the watershed drains. In the course of that journey, it is purified by biological, chemical, and physical processes; some is absorbed by plant roots; some penetrates to deeper layers of groundwater; and some is released, over a period of weeks or months, to the receiving stream. These are the mechanisms by which nature, through purification, storage, diversion, and measured release, deals with floods, droughts, and pollution.

But when agriculture or development alters the shape, the soils, and the vegetation of a watershed, the impact on nearby rivers and streams is profound. Regulators and scien-

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tists call the results of these alterations “non-point source” pollution (also called runoff). The term implies that this type of pollution is similar, except in its mode of transport, to “point sources” like factories and wastewater treatment plants. In reality, they have very little in common. Rather than representing a foreign contaminant discreetly dumped into a river through a pipe, non-point source pollution is a fundamental alteration of the system itself. It should be no surprise, then, that dealing with runoff has proven extremely difficult.

How extensive is the damage from urban and suburban runoff? How do we solve the problem? We have known for decades that runoff is responsible for more than half of the water pollution nationwide. In 2000, the U.S. Environmental Protection Agency (EPA) identified more than 200,000 miles of rivers where water quality was not adequate to support a balanced population of aquatic life. Of the rivers surveyed, almost one-third did not meet state standards for swimming.¹ Although at the national scale agriculture produces more runoff than sprawl does, on the coast and in metropolitan regions in the interior – in the places the majority of Americans live – sprawl is the single biggest water pollution problem.

On the coast, the EPA reports that urban runoff nationwide causes one-third of the damage to estuaries that fail to meet water quality standards.

Of the estuaries surveyed by EPA, more than 5,000 square miles, an area almost the size of the state of New Jersey, failed to meet designated uses because of urban runoff.²

Efforts to protect and restore the Chesapeake Bay in Maryland have run headlong into the obstacle of growth, development, and watershed alteration. According to the EPA, over the course of a year, rain flushes more than 442,000 tons of sediment, three million pounds of phosphorous, and 28.2 million pounds of nitrogen into the Bay. This runoff has degraded almost 1,600 miles of streams and thousands of acres of fish and shellfish habitat.³

Surface runoff is not the only form of water pollution that sprawl produces. Automobile exhaust from dramatic increases in driving is a primary source of air-borne nitrogen, one of the most damaging aquatic pollutants. Fully one-quarter of nitrogen pollution in the Chesapeake Bay comes through the air.

Sprawl also places drinking water supplies at risk. When watersheds are covered with roads, parking lots, and other hard surfaces from new development, less water filters through the soil to replenish underground aquifers – the sources of much of our nation’s drinking water. A recent study concludes that major metropolitan areas lose tens of billions of water to runoff annually. Growth in Atlanta during the 1980s and ‘90s, for example, deprived that



metropolitan area of 56 to 132 billion gallons every year, enough to supply the annual water needs of roughly 2.5 million people. As the following sections explain, the damage to water quantity and quality will grow dramatically unless sprawl is brought under control.⁴

Land use reform has two components. First, we must curb the unprecedented and wasteful rate at which our towns, cities, and metropolitan regions are expanding. Growth should be focused in appropriate areas and use land efficiently. Practically, this means identifying watersheds that are undeveloped, evaluating their biological, recreational, and other public values, and maintaining the most important watersheds in an undeveloped state. The companion principle is that the majority of growth over the coming decades should go into watersheds where development is already present and into those that support fewer important public resources.

Second, we must reorganize development at the neighborhood scale. The goal is to design communities that offer a broad array of transportation and housing choices, that integrate work and shopping into the neighborhood fabric, and that encompass inspiring civic spaces. Besides pro-

ducing substantial saving in land consumption, extensive research concludes that smart urban design can dramatically reduce the number and length of automobile trips. This means less airborne nitrogen, less gas and oil runoff, and less heavy metals from brakes and tires, all of which translates into dramatic benefits for water and air quality.

There are abundant opportunities for funders to advance the land use/water quality agenda. Regional planning efforts that consider watersheds are rare but should be replicated across the country. New mapping technologies now make it possible for advocates and government to analyze and promote favorable growth scenarios. Federal transportation policies are scheduled for renewal. Education and research can help further analyze and convey the important linkage between urban growth and water. Conservation of rural landscapes can help shape regional growth patterns. Finally, at the site scale, more progressive forms of development, such as downtown and brownfield redevelopment in urban areas, conservation development in rural areas, and other more sophisticated development practices can simultaneously promote economic prosperity, social welfare, and efficient use of land.

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Watershed Science and the Ten Percent Rule

The choice for most metropolitan regions is not whether to grow, but how. Where water is concerned, this raises a host of questions. Which settlement patterns can minimize the damage to water quality and protect drinking water supplies? How much development within a watershed is too much? Can general policies be applied nationwide to deal with non-point source pollution, or are specific regional strategies necessary? Fortunately, extensive research on aquatic ecosystems can help answer these questions.

Studies over the past decade converge on a central point: When more than ten percent of the acreage of a watershed is covered in roads, parking lots, roof tops, and other impervious surfaces, the rivers and streams within those watersheds become degraded.

These studies cover a wide range of topics. They examine pollution levels, the physical structure of streams and creeks, and the number of species and abundance of aquatic life. By virtually every measure of ecosystem health, the streams, creeks, marshes, and rivers that are surrounded by hardened watersheds are less diverse, less stable, and less productive than those in natural watersheds.

Habitat Quality

The most obvious change caused by development is that rainwater flows faster across the ground, and more of

it reaches creeks, rivers, and estuaries in the form of runoff. Illustrating this change, a one-acre parking lot produces about 16 times the volume of runoff that comes from a one-acre meadow.⁵

These magnified “pulses” of runoff alter stream flow patterns and eventually even the shape of the stream channel. Streams in watersheds with more than ten percent hard surfaces become physically unstable, causing erosion and sedimentation.⁶ Natural habitats such as pools, woody debris, and the wetted perimeter of the stream bed also decline.⁷ Overall, habitat quality falls below the level necessary to sustain a broad diversity of aquatic life.

Water Temperature

As runoff flows across paved roads and parking lots into creeks and streams, water temperature rises – the more impervious surface area in the watershed, the hotter the water.⁸ Because warm water contains less dissolved oxygen than cold water, fish that are sensitive to oxygen levels like trout and salmon decline or disappear completely. The removal of these top predators can upset the biological balance, particularly in freshwater systems.

Pollutants

When impervious coverage in the watershed reaches ten percent, water chemistry also suffers. Urban runoff transports a vast assemblage of pollu-

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tants into the aquatic environment. These include sediment, nutrients such as nitrogen and phosphorus, organic carbon, trace metals such as copper, zinc, and lead, petroleum hydrocarbons, and pesticides.⁹

The growth of plants and algae in coastal estuaries is generally controlled by the amount of available nitrogen. Consequently, additional nitrogen from development can cause algal blooms. The subsequent decay of these organisms can reduce dissolved oxygen levels below the threshold needed by some species of fish and invertebrates. Additionally, over-fertilization reduces water clarity and allows less light to penetrate below the water's surface. This damages sea grass beds, coral reefs, and other critical aquatic habitats.

Although over-fertilization by phosphorus can be postponed by installing stormwater controls like detention ponds, nitrogen is extremely mobile, and more difficult to contain. This makes land use strategies essential in protecting water bodies from nutrient pollution.

Aquatic Life

Aquatic life is the ultimate measure of ecosystem health. Here, too, the ten percent rule applies. Some of the earliest research on watershed coverage was done on aquatic insects in freshwater streams. This work concluded that the diversity of macroinvertebrates like stoneflies, mayflies,

and caddisflies falls sharply when imperviousness exceeds ten percent.¹⁰ These organisms represent the base of the food chain on which fish and other wildlife depend. Later studies derived similar results.

Studies of fish reinforce the proposition that paved watersheds fail to support a natural diversity of species. Particularly affected groups include trout and salmon and other species of anadromous fish. These sensitive species disappeared as impervious surfaces covered ten to 12 percent of the watershed. Impervious watersheds created barriers to migration for anadromous species, illustrated by sharp declines in eggs and larvae in hardened watersheds.¹¹

More driving and more developed land means more damage to our rivers, streams, and estuaries. It's a simple and discouraging equation. The remainder of this paper will reveal just how rapidly these changes are occurring. More importantly, though, it will become clear that these losses are not inevitable. There are distinct choices that communities can make to preserve their water resources and accommodate growth. Further, the same patterns of growth that protect water also serve many other important goals in the fields of transportation, housing, and economic development. But as the next section suggests, current development trends place water resources at great risk.



Trends in Growth and Development

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Population statistics are commonly used as a proxy to describe the magnitude of human impacts to the environment. But the number of people in a region does not, in itself, determine environmental health. What matters is what these people do, where they live, and how they get around. By most measures, human impacts to the environment have grown considerably faster than the rate of population growth. Americans are consuming more land, driving more, boating more, and generally using more resources than they were 30 years ago. Sprawl is at the root of the problem.

Indeed, statistics from the U.S. Department of Agriculture (USDA) suggest that the current rate of urban expansion is unprecedented. If these trends continue over the next 30 years, damage to aquatic resources will occur on a scale beyond any we have yet known. According to the USDA's National Resources Inventory (NRI), between 1982 and 1997, "developed land" in the contiguous U.S. increased by 25 million acres, or 34 percent.¹² This means that more than one-fourth of all of the land that has been converted from rural to urban and suburban uses since European settlement was converted in just 15 years. This 25-million acre expansion represents an area roughly the size of Ohio.

During the same 15-year period (1982-1997), population grew by

about 15 percent.¹³ Thus, land consumption occurred at more than twice the underlying rate of population growth. Further, the mismatch between land development and population growth widened considerably during the 1990s.

Between 2000 and 2025, the U.S. population is projected to grow by 22 percent. If the land use/population relationship in the last decade continues, there will be 68 million more acres of developed land in the contiguous U.S. than there are today. This newly developed acreage, equivalent to the land area of Wyoming, will almost match the amount of land developed from the founding of the country until 1983. The damage to aquatic ecosystems caused by this enormous transformation of watersheds from rural, natural systems to urban and suburban development will be severe and essentially irreversible.

As populations have spread out, driving distances have lengthened. Nationally, the average commuter trip was 20 percent longer in 1995 than in 1983. Further, more driving has produced more traffic congestion and slower average driving speeds in many areas. In the Miami area, for example, interstate highway travel speeds dropped from 53 to 41 miles per hour, a 23 percent decline, between 1983 and 1997.¹⁴ All of this translates into more fuel used for transportation, more air and water

pollution, and more stresses on aquatic ecosystems.

Broward County, in south Florida, illustrates the trend in driving. Between 1983 and 1997, Broward's population grew by 38 percent and the number of licensed drivers grew by 31 percent. However, the number of miles driven on county freeways increased by 177 percent, more than

four times the rate of population increase and five times the increase in the number of drivers.¹⁵ In California, driving increased at four times the rate of population growth between 1970 and 1990.¹⁶ This increase tracks the national trend, with driving, measured in vehicle miles traveled (VMT), increasing at more than three times population growth rates.

Strategies to Protect Aquatic Resources

The question, then, is not whether land use reforms are necessary to preserve aquatic ecosystems. Population and land use data, combined with abundant research on the science of watersheds, make it clear that they are, and that these reforms must begin soon to avert severe and irreversible declines in ecosystem function. The real issue is: which development patterns can sustain aquatic ecosystems? If sprawl will not work, what will? More difficult yet is the question of how to put the necessary land use changes into practice.

It is helpful to group land use reforms by the scale of application. First, there is the issue of **where development will occur** within a metropolitan region. A metropolitan region can encompass dozens of watersheds and cover from 50,000 to more than two million acres of land. This is the regional scale. Second, there is the issue of **how develop-**

ment is organized – what street patterns are laid out, where housing, stores and offices are built, and at what densities. This is the neighborhood scale. Third is the issue of **how development projects are constructed** – what stormwater practices, paving types, riparian buffer widths, will be employed. This is the site scale.

Ecosystem preservation depends on successfully reforming development at each of these scales. Traditionally, regulatory programs have operated almost exclusively at the site level. Independently, land use reformers have worked at the regional scale promoting strategies such as urban growth boundaries (UGBs) and farmland protection programs. Until recently, the neighborhood scale received very little systematic attention, yet like the regional and site scales, it is profoundly important in the effort to protect aquatic ecosystems.

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The Regional Scale

The central principle of a water resources protection strategy must be to identify watersheds that are less than ten percent impervious and maintain the most valuable of those in an undeveloped state. The companion principle is that watersheds where impervious surfaces exceed ten percent or which harbor fewer significant public resources should absorb the majority of growth over the coming decades.

This does not imply that we must sacrifice developed watersheds. On-site stormwater practices, buffers, new paving techniques, reduced automobile dependency, and other reforms at the neighborhood and site levels can help maintain these systems. However, the current inventory of on-site safeguards does not allow us to ignore the ten percent rule. The only aquatic systems that will retain the full range of species and ecological functions will be those where less than ten percent of the watershed is impervious.¹⁷ The goal, therefore, must be to maintain as many of those systems as possible by promoting efficient development patterns at the regional scale.

Mapping technology and satellite imagery now allow states and metropolitan regions to inventory and evaluate undeveloped watersheds. Important habitats, endangered species, municipal water sources, significant recreational areas and other resources can be mapped using

increasingly affordable geographic information systems (GIS) technology. Further, it is possible to analyze the development potential within watersheds that are already developed. These two elements provide the information necessary to adopt land use policies that steer development into the best locations, thereby protecting rivers, streams and estuaries.

Once regions determine the best locations for new development and the locations in which development should be minimized, localities and the state can adopt policies to carry those plans out. The tools to do this fall into three categories: zoning, infrastructure planning, and land protection programs. These tools can be applied to communities of any size, from small rural towns to multi-state metropolitan areas.

Agricultural Zoning and Urban Growth Boundaries

In the last few decades, some communities have attempted to control the spread of urban areas by regulating development and subdivision densities in rural areas.

Circumstances vary across the country, but certain principles should guide regions as they adopt agricultural zoning codes. The codes should advance the legitimate interests metropolitan regions have in sustaining farming and forest uses, protecting aquatic ecosystems from degradation, minimizing the costs of deliver-

ing urban services, and other regional goals. In areas designated for agriculture, Best Management Practices should be promoted in order to reduce runoff from farms. In most cases, housing densities in undeveloped areas should be less than one unit per 20 acres. Agricultural zoning should be complemented by strategies that insure growth at adequate densities within growth areas. Low density, single family suburban zoning raises housing prices and limits choice at the same time it encourages sprawl in rural areas.

Infrastructure Planning

Public investment in new roads, sewer and water lines, rapid-response fire protection, and other urban services can accelerate development in areas that would otherwise remain rural. With that in mind, some localities have attempted to dampen the spread of development into rural areas by withholding urban infrastructure. Lexington, Ky., adopted one of the nation's first urban service boundaries in 1958.

The state of Maryland recently passed statewide growth management legislation that guides public investment into areas that are already developed or are approved for urban expansion. Public investment from the state is withheld from rural areas that are not judged to be appropriate or necessary for new growth.

Land Conservation Programs

Many states and local governments are attempting to channel urbanization away from important rural areas by using public funds to purchase land development rights (PDR programs). These programs identify important farm and forest parcels and provide public funds to buy the development rights from the owners. Transfer of development rights programs also can work to protect rural land from development without financial harm to rural landowners.

Approximately 1,200 land trusts operate in the U.S. These organizations solicit donated easements on private land holdings and broker conservation purchases of property. As of December 31, 2000, local land trusts had protected a total of 6.4 million acres of land nationwide. National land conservation groups such as The Nature Conservancy, Ducks Unlimited, the Conservation Fund, and the Trust for Public Land have protected more than 15 million acres.¹⁸

Regions must decide how to employ these strategies most effectively to influence the location of new development. The most successful efforts to contain urban growth will almost certainly be in those areas that apply the full assortment of tools available, including zoning, infrastructure planning, and land protection through purchase or easement.

The Neighborhood Scale

Density

The counterpart to maintaining undeveloped watersheds is focusing development into watersheds that are already developed, at densities that are able to meet regional growth needs. In addition to slowing the spread of development, density increases offer dramatic transportation benefits, with consequent reductions in air and water pollution.

Studies have shown that as housing and employment densities rise, the number and length of automobile trips declines. Further, most research concludes that regions can achieve reductions in driving, transit usage increases, and improvements in air and water pollution with development densities as low as seven to ten residential units per acre. These densities appear to be widely accepted by home buyers looking for single family housing. Indeed, some of the most desirable and sought-after older neighborhoods in the country are “transit-oriented” neighborhoods with roughly ten residential units per net acre. Good design is an essential component of efforts to increase residential density.

Street Network

Another aspect of development that has important implications for water quality is street layout. Until the end of the 19th Century, virtually all cities and towns were built on a rectilinear grid of streets interspersed with parks and other civic spaces. Well-

known examples include Savannah, Ga., Philadelphia, and San Francisco.

This layout provided many routes to travel from one point to another and minimized the length of each trip, increasing transportation options. In one study, people living in communities built after 1977 took less than one-third as many trips on foot or bike as those living in communities built before 1947.¹⁹ Over the past 20 years, the number of trips taken on foot has declined by 42 percent. This, in turn, has caused dramatic increases in traffic congestion and in transportation-related air and water pollution. It has also contributed to the current epidemic of obesity. Many local governments have begun to promote a return to more functional street systems, by increasing block density within new developments and by linking new projects to their neighbors.

Mixed Uses

Conventional zoning separates various land uses from one another. Originally justified by the need to prevent polluting factories from locating next to houses, zoning has reached an unjustified level of complexity. This is especially true in the assignment of suburban housing densities. Some suburban jurisdictions have as many as ten residential zoning categories, distinguished by the size of the lot and the type of housing.



In addition to separating housing types, zoning separates houses from stores, offices, and schools. Daytime activities are usually grouped along the high-volume roads that emerge to accommodate the morning exodus from residential subdivisions. This rigorous division of uses has contributed to the increase in trips taken by car and the reduction in trips taken on foot. One study on the coast of South Carolina concluded that the percentage of students who walk to schools built prior to 1983 is four times that of students who walk to those constructed after 1983.²⁰

Single use zoning, branching, cul-de-sac street systems, and lower housing densities have caused dramatic increases in the length and number of automobile trips. Suburban zoning has now become an engine of pollution rather than a shield against it. Individual neighborhood design reforms – density, street connectivity, and mixed uses – offer significant advantages. But the research suggests that the best results occur when all of these features are combined in new development – that is, when neighborhoods and regions are laid out in traditional patterns.

The Site Scale

Much work has been done to develop Best Management Practices (BMPs) that address the quantity and quality of runoff. These practices are implemented at the site or parcel level, and include detention ponds, swales, constructed wetlands, stream buffers, and other measures to filter runoff and reestablish natural flow rates.

Site level practices are important parts of the overall water protection strategy. However, most regulatory programs focus exclusively on site level practices, ignoring necessary changes that must take place at the neighborhood and regional scales. This overemphasis has two negative

consequences. Abundant research over the past three decades has proven that site level practices, in the absence of land use reforms, cannot protect aquatic ecosystems from decline. The ten percent rule can be bent, but it cannot be broken. Second, regulatory programs have, on occasion, applied regional scale concepts to the site level. For example, some state coastal zone programs limit the amount of impervious surface in new development or offer a regulatory advantage to low density projects. This has the effect of reducing development density in the areas where development is most appropriate, thus exacerbating the problem of sprawl and water pollution.

Opportunities for Funders

- Regional Planning
- Federal and State Transportation Policy Reform
- Education on the Water Quality/Land Use Connection
- Research on the Water Quality/Land Use Connection
- Strategic Land Protection
- Downtown Redevelopment

Technology Advances

The coming decades will undoubtedly produce innovations that will reduce runoff from human settlement and urban activities. More efficient cars and alternative energy sources could reduce the amount of nitrogen and petroleum compounds that flow into the nation's rivers and streams. Restoration of urban wetlands, rooftop gardens, water gardens, systems that use runoff to recharge groundwater, could all help protect water bodies. We should encourage and embrace these advances. They may help stem the decline of the streams and estuaries that exist within urbanized watersheds.

But trends over the past few decades have not been promising. Increased

driving has more than offset increases in fuel efficiency. Urban expansion has overwhelmed improvements in stormwater management practices. The fact remains that the only successful strategy to fully protect aquatic systems is to allow natural watersheds to perform their irreplaceable functions of storage, purification, and measured release. If we delay land use reforms in anticipation of unprecedented, large scale technological advances, we are likely to be sorely disappointed in the outcome. Building great communities and protecting rural landscapes remains the most effective, least expensive approach to preserving water resources.

Opportunities for Funders

Making the water quality/land use connection presents a difficult challenge for funders. There is risk of supporting projects that have unintended and undesirable consequences. For example, a river protection group may seek to reduce development densities in a watershed in order to protect a particular stream, but that watershed may lie within an area where development is appropriate and necessary to meet regional growth needs. Density reductions, in that case, would force growth into other watersheds less appropriate for development. In order to make the correct decision on the grant, the

funder would have to understand the regional growth context. The most promising opportunities to achieve water quality improvement through land use reform involve supporting comprehensive regional planning efforts.

Regional Planning: Challenges and Opportunities

Few metropolitan regions have produced competent regional plans that channel future growth. Virtually none has developed a plan that comprehensively assesses the needs of watersheds and directs growth accordingly. Fortunately, our grow-

ing understanding of aquatic ecology corresponds with the availability of computer technology, such as GIS, that can make regional watershed planning possible.

A number of organizations are working on regional conservation planning. A few examples include: NatureServe, currently developing conservation planning software and working on a pilot project in the Napa Valley; the Sonoran Institute, working on regional planning in the west, and particularly focusing on the greater Yellowstone ecosystem; and the Chesapeake Bay Foundation, developing future growth scenarios for the Chesapeake Bay watershed.

This funding opportunity is probably best accomplished by working with a coalition of established groups with a solid history of regional planning efforts and strong technological capacity. Ideally, the coalition would include participation by local governments and the Council of Governments or Metropolitan Planning Organization within a metropolitan region.

Federal and State Transportation Policy Reform

Sprawl has diverse origins – demographic, economic, cultural, and political. But most observers would agree that the dominant thread in this complex fabric is transportation. More than any other single force, the investment of hundreds of billions of dollars in the nation's road system has shaped America's com-

munities. The transportation system the country is building today will outlast any other decision our metropolitan regions and states make – longer than zoning, longer than civic buildings, longer than wastewater treatment plants. Like Rome's Apian Way, the nation's transportation system – the subway lines, the interstate highways, the cul-de-sacs of residential subdivisions – is the most permanent facet of America's built infrastructure.

Congress is expected to complete its reauthorization of the federal transportation act, the Transportation Equity Act for the 21st Century (TEA-21), in the 2004 session. Nowhere are the stakes higher than in the direction of billions of new dollars for roads, transit, and planning. Previous laws, beginning with the Intermodal Surface Transportation Efficiency Act in 1991, achieved revolutionary reforms in U.S. transportation policy, which for decades had been controlled by road-building interests. It is critical to prevent a reversal of the gains made in the 1990s. Funders can take advantage of this window to promote a federal transportation bill that makes regional watershed planning a prerequisite for the distribution of federal transportation dollars. Even after the bill passes, there will be much work to do in implementation, from federal regulations and guidance to state and regional interpretation, to assure that the nation's complex array of transportation assets is built and managed to promote conservation, not just more sprawl.

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National organizations such as the Surface Transportation Policy Project, Smart Growth America, Environmental Defense, and the Natural Resources Defense Council have built extensive coalitions around transportation reform. Some state organizations, including the Natural Resources Council of Maine, have achieved impressive state policy improvements.

Education on the Water Quality/Land Use Connection

In spite of extensive research affirming the ten percent rule, planners, environmental advocates, and the general public are largely unaware of the importance of watershed protection for water quality. The perception remains, in part perpetuated by environmental agencies and conventional regulatory programs, that watersheds can be developed without inflicting damage on rivers, lakes, and estuaries. This misconception should be dispelled. Just as important is the need to explain the range of community growth choices and how certain choices can protect water resources.

Funders can make an important contribution by supporting education efforts in this field. The focus of education should not be on water quality and supply or growth alone, but on the linkage between these issues. There are few concepts that resonate more deeply with the public imagination than water and community design. An education campaign has the potential to be profoundly

successful if it harnesses those unique strengths.

Here too, the best delivery vehicles for education are likely to be coalitions of various interest groups. Few issues offer the potential to blend diverse advocacy agendas – such as affordable housing, transportation reform, and water quality – as effectively as land use. The leading coalitions working for land use reform are the Congress for the New Urbanism, Smart Growth America, and the Growth Management Leadership Alliance. The member organizations and staffs of these coalitions have extensive resources – research, images, strategies – and tremendous outreach potential to millions of people within their constituencies. Non-traditional messengers – such as fisherman and others that live of the oceans – can also be credible and important educators on this point.

The release of two national reports on ocean policy presents an important opportunity for funders. The Pew Ocean Commission Report and the U.S. Commission on Ocean Policy both call for better management of development in the U.S. coastal zone. It is important that the findings and recommendations of these reports be widely disseminated, discussed, and ultimately implemented. Funders can help facilitate that discussion on the national, state and local levels.

Ultimately, education on the potential of smart growth to protect water



quality is a challenge of making linkages, between causes and effects that appear unrelated, between constituencies that believe they have little in common, and between places that seem to be far apart. Only in the last decade have the tools been widely available to make those links. These new tools offer the prospect to change the way metropolitan regions think about themselves and relate to their environment.

Research on the Water Quality/Land Use Connection

Research on the impacts of development on water quality has been concentrated in a few parts of the country, particularly the Chesapeake Bay region and the Pacific Northwest, with scattered work in the southeast and northeast. Further work is warranted, especially in the more arid regions of the southwest and California and in the growing metropolitan regions in the mid-west.

Very little comprehensive research has been done to explore the relationship between sprawl and water supply. Yet there is no question that development patterns have enormous implications for both the amount of water available for consumption and for patterns of consumption. Sprawl affects both water supply and demand. Particularly in light of the drought that struck much of the U.S. in 2002, work in this arena would receive national attention and could provide strong analytical support for smart growth policies.

Strategic Land Protection

The most straightforward funding opportunities involve initiatives to protect priority watersheds. One example is the Ashepoo, Combahee and Edisto Rivers (ACE) basin initiative in South Carolina. A partnership of land trusts, state and federal agencies, and private landowners has permanently protected more than 150,000 acres of forests and wetlands since the project was founded in 1988. The total project encompasses approximately 350,000 acres.

The mechanisms for protection include outright purchase of property, acquisition of conservation easements, and corporate management agreements. Advocacy for sound public sector decisions on zoning, infrastructure, and conservation funding is essential to the success of priority land protection initiatives.

Effective watershed conservation efforts will reverberate between the public and private sectors. Easement donors, having made substantial personal commitments to the future of their regions, often become powerful advocates for better public decision making. Improved public policies, conversely, provide landowners the confidence to make long-term investments in land management and conservation. This circumstance marks a point of community consensus that is rarely achieved around land use.

Ultimately, education on the potential of smart growth to protect water quality is a challenge of making linkages, between causes and effects that appear unrelated, between constituencies that believe they have little in common, and between places that seem to be far apart. Only in the last decade have the tools been widely available to make those links.

Downtown Redevelopment

The decline of central cities and older suburbs is both a cause and a result of sprawl. Regions that focus their energy and resources in these places, with the intent of rebuilding, diversifying, and intensifying older neighborhoods, will dampen the flow of people to “greenfield” suburban housing. This strategy will deliver important water quality benefits, along with social and economic advantages.

One of the most exciting brownfield redevelopment projects in the nation is Atlanta’s Atlantic Station. This former industrial site will soon become home for thousands of residents, and the site of new offices, stores and beautiful public spaces. The EPA has identified dramatic regional benefits to water and air resulting from this project. Brownfield sites across the country present similar redevelopment opportunities.

Conclusion

The relationship between land use and water quality is the ultimate expression of the interdependency of humans and nature. It is the grand unifying theory of the environment, in which support for affordable housing and equitable transportation options converges with the habitat needs of trout and salmon. The argument is relatively complex, but it has a uniquely powerful capacity to bring varied interests together around an agenda of reform. To date, funders have not widely participated in work that crosses these disciplines but rather have supported

groups in one “silo” or another. We hope this paper contributes by more clearly explaining the reform movement’s goals and convincing potential supporters that success is possible against what appear to be substantial odds.

Failing to act in this arena will condemn our nation’s rivers, lakes, and estuaries to inexorable decline. Now is the time for funders, advocates, business, and public sector leaders to prove that growth that protects the integrity of the nation’s waters is both desirable and achievable.

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Community Development and Smart Growth: Stopping Sprawl at its Source, August 2003.
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Health and Smart Growth: Building Health, Promoting Active Communities, February 2003.
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Published Livable Communities @ Work Papers:

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Strengthening funders' abilities to support organizations working to build more livable communities through smarter growth policies and practices.

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