

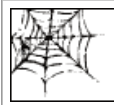


Polluted Runoff (Nonpoint Source Pollution)

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Nonpoint Source Pollution: The Nation's Largest Water Quality Problem

Pointer No. 1
EPA841-F-96-004A



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Why is there still water that's too dirty for swimming, fishing or drinking? Why are native species of plants and animals disappearing from many rivers, lakes, and coastal waters?

The United States has made tremendous advances in the past 25 years to clean up the aquatic environment by controlling pollution from industries and sewage treatment plants. Unfortunately, we did not do enough to control pollution from diffuse, or nonpoint, sources. Today, nonpoint source (NPS) pollution remains the Nation's largest source of water quality problems. It's the main reason that approximately 40 percent of our surveyed rivers, lakes, and estuaries are not clean enough to meet basic uses such as fishing or swimming.

NPS pollution occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water. Imagine the path taken by a drop of rain from the time it hits the ground to when it reaches a river, ground water, or the ocean. Any pollutant it picks up on its journey can become part of the NPS problem. NPS pollution also includes adverse changes to the vegetation, shape, and flow of streams and other aquatic systems.

NPS pollution is widespread because it can occur any time activities disturb the land or water. Agriculture, forestry, grazing, septic systems, recreational boating, urban runoff, construction, physical changes to stream channels, and habitat degradation are potential sources of NPS pollution. Careless or uninformed household management also contributes to NPS pollution problems.

The latest *National Water Quality Inventory* indicates that agriculture is the leading contributor to water quality impairments, degrading 60 percent of the impaired river miles and half of the impaired lake acreage surveyed by states, territories, and tribes. Runoff from urban areas is the largest source of water quality impairments to surveyed estuaries (areas near the coast where seawater mixes with freshwater).

The most common NPS pollutants are sediment and nutrients. These wash into water bodies from agricultural land, small and medium-sized animal feeding operations, construction sites, and other areas of disturbance. Other common NPS pollutants include pesticides, pathogens (bacteria and viruses), salts, oil, grease, toxic chemicals, and heavy metals. Beach closures, destroyed habitat, unsafe drinking water, fish kills, and many other severe environmental and human health problems result from NPS pollutants. The pollutants also ruin the beauty of healthy, clean water habitats. Each year the United States spends millions of dollars to restore and protect the areas damaged by NPS pollutants.

Progress

During the last 10 years, our country has made significant headway in addressing NPS pollution. At the federal level, recent NPS control programs include the Nonpoint Source Management Program established by the 1987 Clean Water Act Amendments, and the Coastal Nonpoint Pollution Program established by the 1990 Coastal Zone Act Reauthorization Amendments. Other recent federal programs, as well as state, territorial, tribal and local programs also tackle NPS problems.

In addition, public and private groups have developed and used pollution prevention and pollution reduction initiatives and NPS pollution controls, known as management measures, to clean up our water efficiently. Water quality monitoring and environmental education activities supported by government agencies, tribes, industry, volunteer groups, and schools have provided information about NPS pollution and have helped to determine the effectiveness of management techniques.

Also, use of the watershed approach has helped communities address water quality problems caused by NPS pollution. The watershed approach looks at not only a water body but also the entire area that drains into it. This allows communities to focus resources on a watershed's most serious environmental problems--which, in many instances, are caused by NPS pollution.

Just as important, more citizens are practicing water conservation and participating in stream walks, beach cleanups, and other environmental activities sponsored by

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community-based organizations. By helping out in such efforts, citizens address the Nation's largest water quality problem, and ensure that even more of our rivers, lakes, and coastal waters become safe for swimming, fishing, drinking, and aquatic life.

RELATED PUBLICATIONS

Additional fact sheets in the Nonpoint Pointers series (EPA-841-F-96-004)

[Watershed Approach Framework](#) (EPA840-S-96-001)

EPA Journal, Vol. 17, No. 5, Nov/Dec 1991, (EPA-22K-1005)

Managing Nonpoint Source Pollution: Final Report to Congress on Section 319 of the Clean Water Act (EPA-506/9-90)

[NPS News-Notes](#) (EPA-841-N-92-003)

Polluted (EPA-841-F-94-005)

[The Quality of Our Nation's Water: 1994 \(EPA-841-S-95-004\)](#)

The Watershed Protection Approach (EPA-503/9-92/002)

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Managing Nonpoint Source Pollution from Agriculture

Pointer No. 6
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The United States has over 330 million acres of agricultural land that produce an abundant supply of low-cost, nutritious food and other products. American agriculture is noted worldwide for its high productivity, quality, and efficiency in delivering goods to the consumer. However, when improperly managed, agricultural activities can affect water quality.

The most recent *National Water Quality Inventory* reports that agricultural nonpoint source (NPS) pollution is the leading source of water quality impacts to surveyed rivers and lakes, the third largest source of impairments to surveyed estuaries, and also a major contributor to ground water contamination and wetlands degradation.

Agricultural activities that cause NPS pollution include confined animal facilities, grazing, plowing, pesticide spraying, irrigation, fertilizing, planting, and harvesting. The major agricultural NPS pollutants that result from these activities are sediment, nutrients, pathogens, pesticides, and salts. Agricultural activities also can damage habitat and stream channels. Agricultural impacts on surface water and ground water can be minimized by properly managing activities that can cause NPS pollution.

Numerous government programs are available to help people design and pay for management approaches to prevent and control NPS pollution. For example, over 40 percent of section 319 Clean Water Act grants were used to control agricultural NPS pollution. Also, several U.S. Department of Agriculture and state-funded programs provide cost-share, technical assistance, and economic incentives to implement NPS pollution management practices. Many people use their own resources to adopt technologies and practices to limit water quality impacts caused by agricultural activities.

Managing Sedimentation. Sedimentation occurs when wind or water runoff carries soil particles from an area, such as a farm field, and transports them to a water body, such as a stream or lake. Excessive sedimentation clouds the water, which reduces the amount of sunlight reaching aquatic plants; covers fish spawning areas and food supplies; and clogs the gills of fish. In addition, other pollutants like phosphorus, pathogens, and heavy metals are often attached to the soil particles and wind up in the water bodies with the sediment. Farmers and ranchers can reduce erosion and sedimentation by 20 to 90 percent by applying management measures to control the volume and flow rate of runoff water, keep the soil in place, and reduce soil transport.

Managing Nutrients. Nutrients such as phosphorus, nitrogen, and potassium in the form of fertilizers, manure, sludge, irrigation water, legumes, and crop residues are applied to enhance production. When they are applied in excess of plant needs, nutrients can wash into aquatic ecosystems where they can cause excessive plant growth, which reduces swimming and boating opportunities, creates a foul taste and odor in drinking water, and kills fish. In drinking water, high concentrations of nitrate can cause methemoglobinemia, a potentially fatal disease in infants also known as blue baby syndrome. Farmers can implement nutrient management plans which help maintain high yields and save money on the use of fertilizers while reducing NPS pollution.

Managing Confined Animal Facilities. By confining animals to areas or lots, farmers and ranchers can efficiently feed and maintain livestock. But these confined areas become major sources of animal waste. Runoff from poorly managed facilities can carry pathogens (bacteria and viruses), nutrients, and oxygen-demanding substances that contaminate shellfishing areas and other major water quality problems. Ground water can also be contaminated by seepage. Discharges can be limited by storing and managing facility wastewater and runoff with an appropriate waste management system.

Managing Irrigation. Irrigation water is applied to supplement natural precipitation or to protect crops against freezing or wilting. Inefficient irrigation can cause water quality problems. In arid areas, for example, where rainwater does not carry residues deep into the soil, excessive irrigation can concentrate pesticides, nutrients, disease-carrying microorganisms, and salts—all of which impact water quality—in the top layer of soil. Farmers can reduce NPS pollution from irrigation by improving water use efficiency. Actual crop needs can be measured with a variety of equipment.

Managing Pesticides. Pesticides, herbicides, and fungicides are used to kill pests and control the growth of weeds and fungus. These chemicals can enter and contaminate water through direct application, runoff, wind transport, and atmospheric deposition. They can kill fish and wildlife, poison food sources, and destroy the habitat that animals use for protective cover. To reduce NPS contamination from pesticides, people can apply Integrated Pest Management (IPM) techniques based on the specific soils, climate, pest history, and crop for a particular field. IPM helps limit pesticide use and manages necessary applications to minimize pesticide movement from the field.

Managing Livestock Grazing. Overgrazing exposes soils, increases erosion, encourages invasion by undesirable plants, destroys fish habitat, and reduces the filtration of sediment necessary for building streambanks, wet meadows, and floodplains. To reduce the impacts of grazing on water quality, farmers and ranchers can adjust grazing intensity, keep livestock out of sensitive areas, provide alternative sources of water and shade, and revegetate rangeland and pastureland.

RELATED PUBLICATIONS

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Agriculture and Wetlands: A Compilation of Factsheets (EPA-503/9-92-003)

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Journal of Soil and Water Conservation, Vol. 45, No. 1, Jan/Feb 1990 (EPA-841-N-90-100)

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[The Quality of Our Nation's Water: 1994](#) (EPA-841-S-95-004)

Soil And Water Quality: An Agenda for Agriculture, National Research Council, National Academy Press, Washington, DC, 1993

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Managing Urban Runoff

Pointer No. 7
EPA841-F-96-004G



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The most recent *National Water Quality Inventory* reports that runoff from urban areas is the leading source of impairments to surveyed estuaries and the third largest source of water quality impairments to surveyed lakes. In addition, population and development trends indicate that by 2010 more than half of the Nation will live in coastal towns and cities. Runoff from these rapidly growing urban areas will continue to degrade coastal waters.

To protect surface water and ground water quality, urban development and household activities must be guided by plans that limit runoff and reduce pollutant loadings. To this end, communities can address urban water quality problems on both a local and watershed level and garner the institutional support to help address urban runoff problems.



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How Urban Areas Affect Runoff

Increased Runoff. The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands trap rainwater and snowmelt and allow it to slowly filter into the ground. Runoff tends to reach receiving waters gradually. In contrast, nonporous urban landscapes like roads, bridges, parking lots, and buildings don't let runoff slowly percolate into the ground. Water remains above the surface, accumulates, and runs off in large amounts.

Cities install storm sewer systems that quickly channel this runoff from roads and other impervious surfaces. Runoff gathers speed once it enters the storm sewer system. When it leaves the system and empties into a stream, large volumes of quickly flowing runoff erode streambanks, damage streamside vegetation, and widen stream channels. In turn, this will result in lower water depths during non-storm periods, higher than normal water levels during wet weather periods, increased sediment loads, and higher water temperatures. Native fish and other aquatic life cannot survive in urban streams severely impacted by urban runoff.

Increased Pollutant Loads. Urbanization also increases the variety and amount of pollutants transported to receiving waters. Sediment from development and new construction; oil, grease, and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals are examples of pollutants generated in urban areas. Sediments and solids constitute the largest volume of pollutant loads to receiving waters in urban areas.

When runoff enters storm drains, it carries many of these pollutants with it. In older cities, this polluted runoff is often released directly into the water without any treatment. Increased pollutant loads can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe.

Point and Nonpoint Distinctions

There are two different types of laws that help control urban runoff: one focusing on urban point sources and the other focusing on urban nonpoint sources. Urban point source pollution is addressed by the National Pollution Discharge Elimination System permit program of the Clean Water Act, which regulates stormwater discharges. Urban nonpoint source pollution is covered by nonpoint source management programs developed by states, territories, and tribes under the Clean Water Act. In states and territories with coastal zones, programs to protect coastal waters from nonpoint source pollution also are required by section 6217 of the Coastal Zone Act Reauthorization Amendments.

Measures to Manage Urban Runoff

Plans for New Development. New developments should attempt to maintain the volume of runoff at predevelopment levels by using structural controls and pollution prevention strategies. Plans for the management of runoff, sediment, toxics, and nutrients can establish guidelines to help achieve both goals. Management plans are designed to protect sensitive ecological areas, minimize land disturbances, and retain natural drainage and vegetation.

Plans for Existing Development. Controlling runoff from existing urban areas tends to be relatively expensive compared to managing runoff from new developments. However, existing urban areas can target their urban runoff control projects to make them more economical. Runoff management plans for existing areas can first identify priority pollutant reduction opportunities, then protect natural areas that help control runoff, and finally begin ecological restoration and retrofit activities to clean up degraded water bodies. Citizens can help prioritize the clean-up strategies, volunteer to become involved with restoration efforts, and help protect ecologically valuable areas.

Plans for Onsite Disposal Systems. The control of nutrient and pathogen loadings to surface waters can begin with the proper design, installation, and operation of onsite disposal systems (OSDSs). These septic systems should be situated away from open waters and sensitive resources such as wetlands and floodplains. They should also be inspected, pumped out, and repaired at regular time intervals. Household maintenance of septic systems can play a large role in preventing excessive system discharges.

Public Education. Schools can conduct education projects that teach students how to prevent pollution and keep water clean. In addition, educational outreach can target specific enterprises, such as service stations, that have opportunities to control runoff onsite. Many communities have implemented storm drain stenciling programs that discourage people from dumping trash directly into storm sewer systems.

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[Additional fact sheets in the Nonpoint Pointers series](#) (EPA-841-F-96-004)

[Controlling Nonpoint Source Runoff From Roads, Highways, and Bridges](#) (EPA-841-F-95-008a)

Developing Successful Runoff Control Programs for Urbanized Areas (EPA-841-K-94-003)

[Economic Benefits of Runoff Controls](#) (EPA-S-95-002)

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Storm Water Fact Sheet (EPA-933-F-94-006)

[The Quality of Our Nation's Water: 1994](#) (EPA-841-S-95-004)

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Managing Nonpoint Source Pollution from Forestry

Pointer No. 8
EPA841-F-96-004H



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Nearly 500 million acres of forested lands are managed for the production of timber in the United States. Although only a very small percentage of this land is harvested each year, forestry activities can cause significant water quality problems if improperly managed. The latest *National Water Quality Inventory* reports that forestry activities contribute to approximately 9 percent of the water quality problems in surveyed rivers and streams.

Sources of NPS pollution associated with forestry activities include removal of streamside vegetation, road construction and use, timber harvesting, and mechanical preparation for the planting of trees. Road construction and road use are the primary sources of NPS pollution on forested lands, contributing up to 90 percent of the total sediment from forestry operations. Harvesting trees in the area beside a stream can affect water quality by reducing the streambank shading that regulates water temperature and by removing vegetation that stabilizes the streambanks. These changes can harm aquatic life by limiting sources of food, shade, and shelter.

Preharvest Planning: Opportunities to Prevent NPS Pollution



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To limit water quality impacts caused by forestry, public and private forest managers have developed and followed site-specific forest management plans.

Following properly designed preharvest plans can result in logging activities that are both profitable and highly protective of water quality. Such plans address the full range of forestry activities that can cause NPS pollution. They clearly identify the area to be harvested; locate special areas of protection, such as wetlands and streamside vegetation; plan for the proper timing of forestry activities; describe management measures for road layout, design, construction, and maintenance, as well as for harvesting methods and forest regeneration.

Public meetings held under the authority of federal and state laws provide citizens with a good opportunity to review and comment on the development of forest management plans.

Factors Considered in the Preharvest Plan

Surveying the Site. Preactivity surveys can help identify areas that might need special protection or management during forestry operations. Sensitive landscapes usually have steep slopes, a greater potential for landslides, sensitive rock formations, high precipitation levels, snowpack, or special ecological functions such as those provided by streamside vegetation. Forestry activities occurring in these areas have a high potential of affecting water quality.

Timing. Because most forestry activities disturb soil and contribute to erosion and runoff, timing operations carefully can significantly reduce their impact on water quality and aquatic life. Rainy seasons and fish migration and spawning seasons, for example, should be avoided when conducting forestry activities.

Establishing Streamside Management Areas (SMAs). Plans often restrict forestry activities in vegetated areas near streams (also known as buffer strips or riparian zones), thereby establishing special SMAs. The vegetation in an SMA is highly beneficial to water quality and aquatic habitat. Vegetation in the SMA stabilizes streambanks, reduces runoff and nutrient levels in runoff, and traps sediment generated from upslope activities before it reaches surface waters. SMA vegetation moderates water temperature by shading surface water and provides habitat for aquatic life. For example, large trees provide shade while alive and provide aquatic habitat after they die and fall into the stream as large woody debris.

Managing Road Construction, Layout, Use, and Maintenance. Good road location and design can greatly reduce the transport of sediment to water bodies. Whenever possible, road systems should be designed to minimize road length, road width, and the number of places where water bodies are crossed. Roads should also follow the natural contours of the land and be located away from steep gradients, landslide-prone areas, and areas with poor drainage. Proper road maintenance and closure of unneeded roads can help reduce NPS impacts from erosion over the long term.

Managing Timber Harvesting. Most detrimental effects of harvesting are related to the access and movement of vehicles and machinery, and the dragging and loading of trees or logs. These effects include soil disturbance, soil compaction, and direct disturbance of stream channels. Poor harvesting and transport techniques can increase sediment production by 10 to 20 times and disturb as much as 40 percent of the soil surface. In contrast, careful logging disturbs as little as 8 percent of the soil surface.

Careful selection of equipment and methods for transporting logs from the harvest area to areas where logs are gathered can significantly reduce the amount of soil disturbed and delivered to water bodies. Stream channels should be protected from logging debris at all times during harvesting operations.

Managing Replanting. Forests can be regenerated from either seed or seedlings. Seeding usually requires that the soil surface be prepared before planting. Seedlings can be directly planted with machines after minimal soil preparation. In either case, the use of heavy machinery can result in significant soil disturbance if not performed carefully.

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[Additional fact sheets in the Nonpoint Pointers series](#) (EPA-841-F-96-004)

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Managing Nonpoint Source Pollution from Households

Pointer No. 10
EPA841-F-96-004J



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The well-known stories about environmental problems tend to focus on big, recognizable targets such as smoking industrial facilities, leaking toxic waste dumps, and messy oil spills. As a result, people often forget about water pollution caused by smaller nonpoint sources--especially pollution at the household level.

However, nonpoint source (NPS) pollution is the Nation's leading source of water quality degradation. Although individual homes might contribute only minor amounts of NPS pollution, the combined effect of an entire neighborhood can be serious. These include eutrophication, sedimentation, and contamination with unwanted pollutants.

To prevent and control NPS pollution, households can learn about the causes of such pollution and take the appropriate (and often money-saving) steps to limit runoff and make sure runoff stays clean.

NPS pollution is widespread because it can occur any time activities disturb the land or water. Agriculture, forestry, grazing, septic systems, recreational boating, urban runoff, construction, physical changes to stream channels, and habitat degradation are potential sources of NPS pollution. Careless or uninformed household management also contributes to NPS pollution problems.

Limit Paved Surfaces

Urban and suburban landscapes are covered by paved surfaces like sidewalks, parking lots, roads, and driveways. They prevent water from percolating down into the ground, cause runoff to accumulate, and funnel into storm drains at high speeds. When quickly flowing runoff empties into receiving waters, it can severely erode streambanks. Paved surfaces also transfer heat to runoff, thereby increasing the temperature of receiving waters. Native species of fish and other aquatic life cannot survive in these warmer waters.

To limit NPS pollution from paved surfaces households can substitute alternatives to areas traditionally covered by nonporous surfaces. Grasses and natural ground cover, for example, can be attractive and practical substitutes for asphalt driveways, walkways, and patios. Some homes effectively incorporate a system of natural



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grasses, trees, and mulch to limit continuous impervious surface area. Wooden decks, gravel or brick paths, and rock gardens keep the natural ground cover intact and allow rainwater to slowly seep into the ground.

Landscape With Nature

Altering the natural contours of yards during landscaping and planting with non-native plants that need fertilizer and extra water can increase the potential for higher runoff volumes, increase erosion, and introduce chemicals into the path of runoff. In contrast, xeriscape landscaping provides households with a framework that can dramatically reduce the potential for NPS pollution.

Xeriscape incorporates many environmental factors into landscape design--soil type, use of native plants, practical turf areas, proper irrigation, mulches, and appropriate maintenance schedules. By using native plants that are well-suited to a regions climate and pests, xeriscape drastically reduces the need for irrigation and chemical applications. Less irrigation results in less runoff, while less chemical application keeps runoff clean.

Proper Septic System Management

Malfunctioning or overflowing septic systems release bacteria and nutrients into the water cycle, contaminating nearby lakes, streams, and estuaries, and ground water. Septic systems must be built in the right place. Trampling ground above the system compacts soil and can cause the systems pipes to collapse. Also, septic systems should be located away from trees because tree roots can crack pipes or obstruct the flow of wastewater through drain lines. Proper septic system management is also important, and a system should be inspected and emptied every 3 to 5 years.

y maintaining water fixtures and by purchasing water-efficient showerheads, faucets, and toilets, households can limit wastewater levels, reducing the likelihood of septic system overflow. Most water conservation technologies provide long-term economic and environmental benefits.

Proper Chemical Use, Storage, and Disposal

Household cleaners, grease, oil, plastics, and some food or paper products should not be flushed down drains or washed down the street. Over time chemicals can corrode septic system pipes and might not be completely removed during the filtration process. Chemicals poured down the drain can also interfere with the chemical and biological breakdown of the wastes in the septic tank.

On household lawns and gardens, homeowners can try natural alternatives to chemical fertilizers and pesticides and apply no more than the recommended amounts. Natural predators like insects and bats, composting, and use of native plants can reduce or entirely negate the need for chemicals. Xeriscape can limit chemical applications to lawns and gardens.

If chemicals are needed around the home, they should be stored properly to prevent leaks and access by children. Most cities have designated sites for the proper disposal of used chemicals.

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[Cleaner Water Through Conservation \(EPA-841-B-95-002\)](#)

Handle With Care, Terrene Institute, Washington, DC, 1991

[The Quality of Our Nation's Water: 1994 \(EPA-841-S-95-004\)](#)

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This page last updated October 4, 1999