DOWNLOAD PDF 3. NONPOINT SOURCE POLLUTION

Chapter 1 : Nonpoint Source Pollution | American Fisheries Society

Nonpoint source (NPS) pollution is a term used to describe pollution resulting from many diffuse sources, in direct contrast to point source pollution which results from a single source.

The contaminants may be spewed into the air, water or soil. They contaminate our natural resources. In this activity, we are concerned with distinguishing between various sources of pollution. Point source pollution results when the contaminants come from a single location. Examples of point source pollution in the air, water and soil are given below. A certain factory is producing chemicals. As part of the manufacturing process, certain poisonous chemicals and toxic gases result, such as benzene. The chemical company permits these toxins to be released from the stack at the factory without treating them. The untreated, toxic chemicals are released directly into the air. A company has a new tank. This tank is being treated with a special chemical. After the tank is treated, the treatment chemicals are drained into a stream that runs hear the building where the company is. The chemicals are released directly into the stream water without being treated or decontaminated to make them safe. A garage does mechanical work on cars. As a result they have accumulated waste oil. The waste oil is supposed to be sent to a treatment company for recycling but, instead, they dump the oil into the ground where it enters the underground water supply and contaminates it. Each of these examples illustrates point source pollution. In each of the examples, the contaminant is introduced directly into the environment at a single location. There are laws to prevent this type of abuse but people do it any because they do not want to spend money, or they do not want to take the time necessary, or both. Environmental authorities are concerned with locating and punishing violations of environmental protection regulations. And, even if laws are followed now, these types of practices occurred in the past before the laws were enacted and the pollutants are still around. Non-point-source pollution results when contaminants are introduced into the environment over a large, widespread area. When a car is running, the engine produces a variety of chemical products including oxides of nitrogen some of which are toxic and molecules of unburned hydrocarbons from gasoline. Similar pollutants and soot result from burning and other combustion processes. Combustion of fuel is used for heating homes and buildings. Large trucks and buses with diesel engines contribute to smoke and hydrocarbons. New federal standards approved in late call for changes in these vehicles over a five-year period. Once the changes are in place, it is expected that emissions from these vehicles will decrease. Burning of fuels with a high sulfur content also produces sulfur dioxide which enters the air. Sulfur dioxide reacts with water in the air to produce sulfurous acid which is a major component of acid rain. Acid rain from the air can enter the water cycle. The result is that it enters the environment. The acid is harmful to fish and other creatures in fresh-water lakes and streams. Whenever there is snow or ice on the roads in winter, the salt trucks come out and spread salt. The salt dissolves the snow and ice and makes the roads safe. But it also washes off the roads into lakes and streams and makes them salty. The salt is also carried down into the ground water where it enters the ground water supply. Harmful pollutants can enter the soil either from the air or from the water. Sometimes these pollutants are absorbed by plants so then the plants become toxic as well. In the middle part of the 20th century they used to add lead to gasoline so that cars would run better. The lead passed out from the cars through the tailpipe and was deposited in the soil along roads and highways. The lead was absorbed by plants making the plants poisonous to any animals that ate them. By this means, the lead entered the food chain. All of these examples illustrate sources of pollution and contamination in the environment. If the origin of the pollution can be traced to a single point, it is called point source pollution. If the pollutants are entering the environment in a widespread fashion, or the pollution is of a general nature and cannot be traced to a single source, it is said to be non-point-source pollution. Materials Students will investigate and do research with a variety of sources, such as the Internet and others, to obtain information necessary to study and write about the topics below. Science Journals Procedure 1. Students brainstorm the different pollutants and different types of pollution that they can think of. They make lists of these pollutants in their Science Journals. After individual lists are prepared, the class prepares a list of all of the pollutants and types of pollution that they have identified. The items in the class list are sorted as to whether they are examples of point source pollution or non-point-source pollution. The list is written in their Science Journals. Students investigate measures taken to prevent or remediate pollution effects. They write about these measures in their Science Journals. Students will have prepared a list of different types of pollution and pollutants and have sorted them according to their nature as point source pollutants and non-point-source pollutants. As a class or individually, students return to this list from time to time to do further investigations or to add new pollutants and sources to the lists. For example, there might be a news item about pollution in New Jersey or in the community. The pollutant can be added to the list. They study what activities these agencies engage in as they attempt to regulate pollution and abate its effects. Students investigate the superfund and the importance of cleaning up superfund sites. Students investigate sources of hazardous materials in the community, county, state or country. Students monitor the activities of the government in their recently announced project where the Hudson River will be dredged in order to remove PCBs poly-chlorinated biphenyls. PCBs are toxins that have been put into the environment. The students investigate what will happen to the material removed from the bottom of the Hudson River and what will happen to the PCBs.

Chapter 2 : Point Source vs. Nonpoint Source Pollution - Water Education Foundation

We would like to show you a description here but the site won't allow us.

Fill the aquarium half-way with water and place it on an accessible area where it can be easily viewed by the students. Cut a hole in the bottom of the box and place the box on top of the aquarium. The box represents the storm drain and the aquarium represents the waterway that the storm water mixes into after entering the storm drain. Leave the sides of the aquarium uncovered so that the students can view its contents. Introduce this activity with a discussion of storm drains and storm drain systems and their purposes. Discuss where the water and objects that float down into a storm drain go. Have students list all of the things that they can think of that might enter a storm drain during a rain storm. Assign a group of students to each pollutant. Discuss each pollutant, including its use or origin and how it could enter the storm drain. Have each group of students place their pollutant into the storm drain. Use the watering can to create rain to wash the pollutant into the waterway. While washing each pollutant into the waterway, review the pollutant and its use or origin. Discuss the following questions: How does the pollutant damage the environment? Do the people who are responsible for the pollutant want to damage the environment? Why did they do what they did? How can this type of pollution be stopped? After adding all of the pollutants, examine the contents of the waterway. Discuss how the waterway has changed and how viewing this change makes the students feel. What types of the pollution are natural? What types of pollution are added by people living in the local communities? How can we remove the pollution from the water? What could be done to stop pollutants from entering storm drains? Have the groups of students responsible for the pollution think of ways to remove the pollution from the aquarium. Try some of the removal methods. Which pollutants were easy to remove? Which were difficult to remove?

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Chapter 3 : Point and nonpoint sources of water pollution

The U.S. Environmental Protection Agency (EPA) defines point source pollution as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack" (Hill,). Factories and sewage treatment plants are two common types of point.

Issue Definition Nonpoint source pollution is probably the most pervasive and ubiquitous water quality problem in North America. Nonpoint source pollution results from nearly every type of human activity and land use. In the United States a comprehensive program to control nonpoint sources of water pollution is defined and regulated through the Clean Water Act Amendments of administered by the U. Similar but less comprehensive legislation controlling nonpoint sources of pollution has been promulgated in Canada and Mexico. Impacts on Aquatic Environments The former head of U. Acid precipitation represents a category of atmospheric or airborne nonpoint source pollutants that have adversely affected aquatic ecosystems by lowering the pH of lakes and ponds to levels lethal to fisheries. The magnitude of the discharge of most of these constituents is directly related to the area of lands in North America dedicated to land-use activities identified earlier as nonpoint source categories. Canada Canada Yearbook , and Mexico Wilkie , respectively. In the United States, surface mining and construction together occupy 0. Nonpoint pollution will be the largest problem facing us after the municipal-and industrial -point-source control goals have been met. Effects on Fisheries and Aquatic Resources The foregoing figures suggest that the magnitude and cumulative effects of nonpoint source pollutants impart a profound impact on aquatic resources. Herein lies a paradox that reflects the nature of nonpoint source pollution: Nonpoint sources generally cannot be monitored at their point of origin, and their source is not readily traceable. Furthermore, it is frequently impossible to distinguish man-induced from naturally occurring nonpoint-source pollution. As a consequence, few definitive data exists that quantitatively document the cause -and-effect relationships between nonpoint source pollutants and the degradation of fisheries and other aquatic resources. The effects of individual nonpoint source components-such as nutrients, biocides, and acid mine drainage- on fishery resources are fairly well known and cut across most of the other American Fisheries Society Policy Issues e. A reiteration of those effects will not be presented in detail here. In general sense, however, the effects of nonpoint-source pollutants would include such things as direct and indirect mortality, habitat modification or destruction, stream flow depletion or modification, reproductive and behavioral changes, and many others. The most difficult and perplexing aspects of nonpoint source pollutants deal with effective control. The diffuse, intermittent nature of nonpoint pollutants makes traditional facilities oriented management and control impossible. The regulation of land use and associated land management practices has been identified as the only effective means of controlling nonpoint-source pollutants. In the United States, control of nonpoint-source pollutants occurs pursuant to Sec. Best management practices summarize those land-use operating procedures, technologies, methods, and policies such as land-use control judged to be most effective and practical for reducing nonpoint-source pollutants sufficiently to achieve the national water quality goal. Fisheries experts should play a key role in assessing and defining the magnitude of nonpoint source impacts on aquatic ecosystems and in determining the effectiveness of control strategies and practices. Policy or Position Elements for Nonpoint Sources 1. Emphasis should be placed also on the implementation of existing plans. Fisheries and aquatic scientists should play a key role in the identification and inventory of aquatic habitats or resources particularly sensitive to nonpoint-source pollutants associated with changes in land-use practices. Aquatic resource and fisheries impacts attributable to nonpoint sources need to be quantified and documented. Fisheries and aquatic scientists should focus research and development efforts on innovative land-use management guidelines and control practices designed to maximize aquatic habitat preservation, rehabilitation, or enhancement related to nonpoint source activities. Fisheries and aquatic scientists should actively support and participate in the development of water quality criteria and standards that reflect the diffuse and intermittent nature of nonpoint-source pollutants and that clearly define and differentiate point source from nonpoint-source categories. Fisheries and aquatic scientists should research the direct and indirect impacts of diffuse source atmospheric pollutants-such as acid precipitation, fugitive dust, and heavy metals-on aquatic resources. The effectiveness of various recommended management and land-use practices, strategies, and procedures should be evaluated from the standpoint of their ability to provide for fisheries and aquatic resource protection. Water quality management plans for the control of nonpoint-source pollutants should give ecological values and measures designed to protect them. Specifically, best management practices should be designed to incorporate fisheries restoration and enhancement features in addition to water pollution reduction. Legislative The Society strongly supports and endorses efforts to coordinate and focus federal, state, provincial, and local participation and expertise on wastewater management, land-use planning and plan implementation designed to minimize negative impacts on fisheries resulting from point-and nonpoint-pollution source. Those federal, state, and provincial government agencies responsible for fisheries management should be provided adequate staff, funds, and authority to participate effectively in the planning, inventory, and development of nonpoint-source control issues that affect aquatic resources. Nonpoint-source waste load allocations combined with ecologically sound management practice strategies should be established and enforced on a watershed basis to prevent or minimize localized destruction of aquatic resources. Land application and underground disposal techniques for industrial and municipal wastes should be closely evaluated and regulated to prevent surface and groundwater degradation and to avoid converting tightly regulated point-source pollution problems to nonpoint source problem Land-based and deep-well waste-disposal strategies should recognize the rights of other downstream water users and instream fisheries requirements. The application of chemical fertilizers and biocides should be regulated by guidelines to minimize or reduce nonpoint sources of these substances and the related adverse impact on aquatic resources. The conversion of marginal wildlands in arid areas to irrigated agricultural use should be minimized and undertaken only after full consideration of the impacts of such action on aquatic resources from the standpoints of accelerated instream flow depletions and nonpoint-source pollution. Incentives should be provided for the application of ecologically sound land-use practices in mining, agriculture, silviculture, construction, urban development, and other nonpoint source categories that reduce or minimize nonpoint-drainage, in order to maintain or enhance aquatic resources and provide for maximum water conservation. The use of fisheries technology or aquaculture for the cleansing of waters derived from nonpoint sources, recycling of materials, and the production of beneficial sport and food fisheries should be encouraged as a means of utilizing wastes from nonpoint sources. Enforcement Rigorous enforcement of federal, state, provincial, and local laws, regulations, and standards pertaining to any phase of the nonpoint-source pollution problem-such as a wastewater management planning, coastal zone and wetlands, salinity control, and dredge and fill operationsâ€”should be diligently supported. Education Social, cultural, and institutional traditions often perpetuate outdated agricultural, silvicultural, construction, and mining methods that may contribute significantly to the nonpoint-source pollution problem. Educational programs designed to increase public awareness of the magnitude of nonpoint-source pollution problems and to demonstrate methods by which the general public can contribute to the solution of these problems should be vigorously supported. Studies designed to determine and apply the most effective means of increasing public involvement in wastewater management and land-use planning should be supported. Literature Cited Clean Water Act of Annual review of economic and political development. Ministry of Industry Trade and Commerce. Water pollution from nonpoint sources. Water Research 9 7: An EPA view of area wide water quality management. Statistical abstract of Latin America. University of California, Los Angeles.

Chapter 4 : Drinking Water & Ground Water Kids' Stuff

In the federal Clean Water Act amendments created a national program to control nonpoint source pollution, established under Section of the Clean Water Act (33 U.S.C). Ohio EPA is the designated water quality agency responsible for administering the Ohio program.

Runoff Management What you can do The best way for you to become a solution to NPS pollution is to make your home a pollutionâ€"free zone. To start, try some of these helpful hints. Reduce the quantity and toxicity of what you buy. Try using less toxic alternatives. Read labels and use recommended amounts. More is not necessarily better and can lead to serious problems. Keep products in their original containers with warning labels and directions. Be sure to recycle used motor oil, antiâ€"freeze and used batteries. Never dump anything into the storm sewer! It goes directly to a nearby lake, river, stream or wetland. Try to protect and enhance wetlands on your property. Wetlands act as a filter to trap sediment, nutrients and toxics running off the land. Contact the DNR about managing your wetland. Plant a rain garden. When caring for your lawn, apply fertilizer at the proper time and rate so that you use the smallest amount necessary. Avoid getting pesticides and fertilizer on sidewalks and driveways, where they can easily be washed into storm drains. Mow your grass with a sharp blade set at the correct height. Keep litter, pet wastes, leaves and debris out of street gutters and storm drainsâ€"these outlets drain directly to lake, streams, rivers and wetlands. Leave your grass clippings on the lawn. It will act as a natural fertilizer and save you money. Learn more about what you can do to help reduce runoff pollution.

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Chapter 5 : Nonpoint Source Fact Sheets | Polluted Runoff: Nonpoint Source Pollution | US EPA

State and local governments, volunteer groups, water quality professionals, and ordinary people are working together to clean up our lakes, rivers, streams, and wetlands. You can help! Whether you live in a big city or in the country, you can prevent nonpoint source pollution by taking simple.

Nonpoint Source Pollution Categories of Pollution: Nonpoint Source Nonpoint source pollution is difficult to control because it comes from many different sources and locations. Motor oil and other oil-based chemicals can be recognized by a characteristic rainbow-colored sheen. Click on image for larger view. Most nonpoint source pollution occurs as a result of runoff. When rain or melted snow moves over and through the ground, the water absorbs and assimilates any pollutants it comes into contact with USEPA, b. Following a heavy rainstorm, for example, water will flow across a parking lot and pick up oil left by cars driving and parking on the asphalt. When you see a rainbow-colored sheen on water flowing across the surface of a road or parking lot, you are actually looking at nonpoint source pollution. This runoff then runs over the edge of the parking lot, and most likely, it eventually empties into a stream. The water flows downstream into a larger stream, and then to a lake, river, or ocean. The pollutants in this runoff can be quite harmful, and their sources numerous. Click on image for further details and larger view. Nonpoint source pollution not only affects ecosystems; it can also have harmful effects on the economy. Coastal and marine waters support If pollution leads to mass die-offs of fish and dirty-looking water, this area and others like it will experience deep financial losses. Nonpoint source pollution affects the beauty and health of coastal lands and waters. If the physical and environmental well-being of these areas is diminished, people will naturally find it less appealing to visit the coast. Beaches will not provide the tranquility and leisure activities many people expect to experience. High densities of population along coastal regions can place great stress upon the environment, particularly through the effects of nonpoint source pollution. The population in many coastal communities is also increasing at a rapid rate, and the value of waterfront property often relies on environmental and aquatic conditions. Excess nonpoint source pollution impacts the overall quality of life, and subsequently can drive property values down. If nonpoint source pollution continues to plague the waters surrounding coastal communities, their economies and social conditions may rapidly deteriorate. Although the concentration of some pollutants from runoff may be lower than the concentration from a point source, the total amount of a pollutant delivered from nonpoint sources may be higher because the pollutants come from many places. With increased control over point source pollution, scientists have begun to focus on nonpoint source pollution, how it affects the quality of the environment, and, even more importantly, how it can be controlled. Nonpoint source pollution is difficult to control because it comes from multiple locations. It also varies over time in terms of the flow and the types of pollutants it contains.

Chapter 6 : Nonpoint Source Success Stories | Polluted Runoff: Nonpoint Source Pollution | US EPA

Nonpoint source pollution not only affects ecosystems; it can also have harmful effects on the economy. U.S. Coastal and marine waters support million jobs, generate $54 billion in goods and services through activities like shipping, boating, and tourism, and contribute $30 billion to the U.S. economy through recreational fishing alone (Leeworthy,).

Nonpoint Source Pollution Categories of Pollution: Point Source This image shows a point source of industrial pollution along the Calumet River. Click on image for larger view. Factories and sewage treatment plants are two common types of point sources. Factories, including oil refineries, pulp and paper mills, and chemical, electronics and automobile manufacturers, typically discharge one or more pollutants in their discharged waters called effluents. Some factories discharge their effluents directly into a waterbody. Others treat it themselves before it is released, and still others send their wastes to sewage treatment plants for treatment. Sewage treatment plants treat human wastes and send the treated effluent to a stream or river. Another way that some factories and sewage treatment plants handle waste material is by mixing it with urban runoff in a combined sewer system. Runoff refers to stormwater that flows over surfaces like driveways and lawns. As the water crosses these surfaces, it picks up chemicals and pollutants. This untreated, polluted water then runs directly into a sewer system. These images show the difference between a combined sewer overflow system found in many older cities, and a sewer system where sanitary and stormwater are completely separated. When it rains excessively, a combined sewer system may not be able handle the volume of water, and some of the combined runoff and raw sewage will overflow from the system, discharging directly into the nearest waterbody without being treated. This combined sewer overflow CSO is considered point source pollution, and can cause severe damage to human health and the environment. Large farms that raise livestock are often considered potential point sources of pollution because untreated animal waste may enter nearby waterbodies as untreated sewage. Unregulated discharges from point sources can result in water pollution and unsafe drinking water, and can restrict activities like fishing and swimming. Some of the chemicals discharged by point sources are harmless, but others are toxic to people and wildlife. Whether a discharged chemical is harmful to the aquatic environment depends on a number of factors, including the type of chemical, its concentration, the timing of its release, weather conditions, and the organisms living in the area. Large farms that raise livestock, such as cows, pigs and chickens, are other sources of point source pollution. These types of farms are known as concentrated animal feeding operations CAFOs. Under the NPDES program, factories, sewage treatment plants, and other point sources must obtain a permit from the state and EPA before they can discharge their waste or effluents into any body of water. Prior to discharge, the point source must use the latest technologies available to treat its effluents and reduce the level of pollutants. If necessary, a second, more stringent set of controls can be placed on a point source to protect a specific waterbody.

Chapter 7 : What you can do - Nonpoint source pollution - Wisconsin DNR

Nonpoint source pollution results from nearly every type of human activity and land use. In the United States a comprehensive program to control nonpoint sources of water pollution is defined and regulated through the Clean Water Act Amendments of administered by the U.S. Environmental Protection Agency.

MIP focused on control of dissolved phosphorus from animal wastes particularly barnyard runoff , manure-spreading schedules, and conservation practices including waste storage, stripcropping, conservation tillage, conservation cropping, cover cropping, critical area planting, woodland improvement and harvest, and tree planting. As part of the MIP, barnyards on farms were prioritized for treatment based on their distance from defined watercourses. Out of high-priority barnyards, 91 were treated with BMPs. The practices applied included diversions, open drains, water-control structures, roof gutters, grading, fencing, livestock exclusion from streams, and pavement of heavily used areas. Treatment of some cropland with phosphorus and with erosion-control measures was accomplished, and an educational and advisory program for silviculture was established. As a result, a great deal was known about the potential sources of phosphorus, the appropriate analysis methods for phosphorus, and phosphorus transport mechanisms in agricultural watersheds. The MIP first focused on changing the size and management of dairy barnyards. Detailed monitoring data showed that barnyards can be treated to achieve a high level of phosphorus control 50â€”90 percent load reduction. Diversion of water flow from areas above the barnyard was found to be a critical factor in controlling runoff from barnyards. However, even though dairy barnyards were a significant source of phosphorus, the studies concluded that the Developing Phosphorus Reduction Goals. Two components are needed to assess the impact of farm activities on nearby water quality: Watershed Management for Potable Water Supply: Assessing the New York City Strategy. The National Academies Press. MIP-related studies also modeled the effects of manure-spreading schedules, which indicated that manure scheduling could lead to an average reduction of total phosphorus loading of 35 percent. A watershed-based model was used to show that direct runoff both surface and subsurface , WWTPs, and baseflow accounted for 38, 23 and 33 percent, respectively, of dissolved phosphorus loadings and 70, 10, and 16 percent, respectively, of total phosphorus loadings to the Cannonsville Reservoir Brown et al. The month record developed for this study showed that more than 85 percent of dissolved phosphorus, total phosphorus, and sediment loadings occurred during periods of snowmelt and rainfall in January to March. The model illuminated the most relevant parameters for assessment of BMPs. Average concentration of dissolved phosphorus in direct runoff both surface and subsurface estimated from load vs. Interestingly, a substantial portion of the dissolved phosphorus budget 39 percent for the entire WBDR was due to groundwater inputs to streamflow, considered at the time "to be largely uncontrollable" Brown et al. Another major phosphorus source identified in this work was flooded cropland along the WBDR itself. Recommendations were that 1 efforts should focus on cropland and manure-management practices in the watershed, 2 field-scale investigations were needed to understand phosphorus losses from upland farming in the watershed, and 3 barring changes in land use or agricultural practices, a concentration of 0. This estimate for dissolved phosphorus in surface runoff was used in some of the modeling studies undertaken in NYC DEP, a. Several issues regarding reservoir water quality modeling must be addressed. First, as suggested by others CTIC, , monitoring and modeling must take both dissolved and particulate phosphorus into account. The WAP and New York City should consider using the existing information developed from both the phosphorus cycling models and the TMDL process to develop specific phosphorus load reduction targets for the Cannonsville watershed. Scientifically based load reduction targets would 1 provide an endpoint to be reached in the planning and implementation process of the WAP, 2 be a quantifiable measure of success, and 3 provide feedback to the process of BMP application during whole farm planning. If loads were unequally distributed among subwatersheds, the monitoring of subwatersheds could be related to specific load reduction goals and the effectiveness of specific agricultural BMPs. Monitoring to Document Success. The second goal mentioned above was to determine phosphorus loadings from adjacent agricultural areas, considering both surface and subsurface contributions. This task requires that individual BMPs or systems of BMPs be monitored for their effectiveness in reducing pollutant loadings. Because of technical limitations, such an approach has not traditionally been taken in farm management. As suggested by others CTIC, , new techniques will be needed in order to demonstrate that agricultural BMPs can meet load reduction goals. Although a large number of BMPs have already been installed and Whole Farm Plans have been implemented on farms, there is very little known about the net result. At both locations, stream discharge and precipitation are monitored continuously, and concentrations of pollutants in stream discharge are regularly monitored, including three forms of phosphorus, three forms of nitrogen, organic carbon, suspended solids, Giardia, and Cryptosporidium. As expected, loading rates of most pollutants are higher at the farm WAP, ; Longabucco et al. Practices implemented on Robertson Farm include manure storage, spreading schedules based on hydrologic sensitivity, tile drainage of wet fields, and diversion of milkhouse waste discharge away from streams. Page Share Cite Suggested Citation: According to the first year of monitoring results after the implementation period, the Whole Farm Plan has reduced certain loadings, especially soluble reactive phosphorus loading. However, as noted by the authors Longabucco et al. It should be noted that monitoring was suspended from May until fall during the implementation of BMPs. Future monitoring efforts should include the implementation period because the first year of postimplementation data show increases in total suspended solids and particulate phosphorus, attributed to construction activities. Understanding the impact of these construction activities should be part of evaluating Whole Farm Plan implementation. Although this type of paired-watershed monitoring activity is expensive, more of it is essential for both documentation of the effects of Whole Farm Plans and for determining whether load reduction goals are being met. The paired-watershed monitoring will not yield information on individual BMPs, but it provides the best approach to understanding the aggregate effects of Whole Farm Plans. More watershed sites should be established, with the goal being to compare loads from reference areas and farms before and after implementation of Whole Farm Plans. Such data can later be used to test models of loadings from farm-scale watersheds. The primary determinants of research cost are the number of samples analyzed and the numbers and types of constituents. Flow proportional sampling on more sites would yield more useful information with a lower marginal cost. The WAP should consider contracting with appropriate agencies to set up a monitoring system with the following attributes: Thus, the sample load per sampling station can be reduced to 50â€” per year, rather that â€” per year. Although the monitoring system would involve a substantial commitment of resources, without it there will be no way to quantify the water quality effects of Whole Farm Plans. Integration of Modeling and Monitoring. The overall goal of modeling is to estimate the effects of Whole Farm Plans on nonpoint source pollution. Models should be clear and explicit in the approaches taken to simulate the effects of BMPs, the generation of nutrient budgets for farms, and the simulation of water- Page Share Cite Suggested Citation: They must also be tested and validated using monitoring data taken at the field, farm, and watershed scale. Unfortunately, a major limitation to current efforts is the lack of monitoring data from specific BMPs that can be used for model development. The needed integration of monitoring and modeling can be accomplished using the expanded paired-watershed approach described above. Although a single demonstration farm could not provide monitoring data for all BMPs, particular high-priority BMPs as identified by modeling could be targeted. For example, preliminary modeling efforts indicate that changes in manure-spreading schedules based on manure storage may provide the largest decrease in phosphorus transport NYC DEP, a. Testing these model simulations might be a priority for a demonstration farm. Although the effectiveness of particular BMP types may change from farm to farm because of site-specific conditions, performance data for specific BMPs would be very useful to the WAP in validating models and formulating future Whole Farm Plans. Modeling has already played a prominent role in the preliminary evaluation of the farm-scale impacts of WAP. For example, NYC DEP has recently modeled the effects of source barriers and landscape barriers on the transport of pollutants, primarily phosphorus, and has compared model results to field observations at a demonstration farm NYC DEP, a. The source barriers involved changes in the size and structure of the barnyard, while the landscape barriers included changes in the schedule of manure applications to fields. Modeling results showed that installing barnyard gutters and pads and decreasing the size of the barnyard decreased barnyard runoff by 47 percent and phosphorus export by approximately 30 percent. In addition, variable manure-spreading schedules resulted in 2 percent to 50 percent reduction in phosphorus export. Field observations of barnyard runoff at the demonstration farm, however, did not always corroborate model results. This shows why better integration of modeling and monitoring is needed. For example, monitoring how changes in barnyard runoff routing affect filter areas and adjacent fields could inform the modeling effort. This type of model-based evaluation must be reinforced by efforts to generate phosphorus load reduction goals, as recommended above. However, these estimates are not particularly useful unless there is an overall phosphorus load reduction goal at the watershed scale. In fact, Robillard and Walter b indicates that changes in manure-spreading schedules may allow a maximum 35 percent phosphorus load reduction if they are combined with effective manure-storage facilities. There is contradictory evidence about the efficacy of barnyard treatment. Monitoring studies Robillard and Walter, a and model estimates NYC DEP, a indicate significant nutrient load reductions from barnyard treatments, while estimates of nutrient runoff from watershed studies indicated little effect on overall watershed loading from barnyard treatments Brown et al. What is clear from earlier studies is that phosphorus loadings from barnyards are primarily dependent on the amount of runoff rather than on the amount of manure phosphorus in contact with the runoff. This implies that marginal changes in manure phosphorus concentrations would have little or no effect on phosphorus transport from barnyards. Transport of pathogens is a relatively new concern in agricultural watersheds. Hence, there is much less known about the transport and fate of pathogens. The pathogen-related research undertaken by Cornell to support the WAP was, by necessity, oriented toward developing methods for oo cyst detection, determining oo cyst viability, and determining the sources of oo cysts. Although a clear picture has begun to emerge concerning sources, risk factors associated with these sources, and factors affecting the viability of parasites in the environment, little is known about the actual transport of parasites from farms or the importance of agricultural areas as a source of parasites at the reservoir watershed scale NYS WRI, A recent modeling study by Walker and Stedinger suggests that agricultural loading of pathogens to reservoirs is largely dependent on the ability of BMPs to enhance degradation of pathogens before they enter nearby streams. Preliminary analysis of these data indicates sites influenced by agriculture have a lower incidence of detection of Giardia and Cryptosporidium than do urban watersheds or WWTP effluent, although the differences are not large NYC DEP, b. Undisturbed watersheds have the lowest incidence of both protozoans. More specific studies have investigated farm animal sources of these pathogens, as described in Chapter 5. Because calves were identified as a major source of parasites, procedures were recommended to segregate calves from cows to prevent cross-infection. Other research has focused on the prevalence and incidence of protozoan infection in entire dairy herds and on management practices that contribute to development and perpetuation of protozoans in dairy herds NYS WRI, Cornell research has also made contributions to understanding the viability of Cryptosporidium oocysts in various farm environments. Laboratory studies show that free ammonia in manure causes significant inactivation of oocysts. The viability of oocysts in calf manure piles was reduced by more than 90 percent in days during late fall and early winter, clearly suggesting that calf manure should be stored prior to spreading NYS WRI, The implications of this research are that winter spreading of manure may require bare soil without snow cover, limiting the time periods when winter spreading can occur.

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Chapter 8 : Nonpoint Source Pollution

Nonpoint source (NPS) pollution is widely dispersed in the environment and is associated with a variety of human activities. These activities produce pollutants such as nutrients, toxic substances, sediment, and microorganisms that may be delivered to nearby waterbodies following rainfall or.

Sediment[edit] Sediment loose soil includes silt fine particles and suspended solids larger particles. Sediment may enter surface waters from eroding stream banks, and from surface runoff due to improper plant cover on urban and rural land. Sediment can also be discharged from multiple different sources. Sources include construction sites although these are point sources, which can be managed with erosion controls and sediment controls , agricultural fields, stream banks, and highly disturbed areas. These nutrients can cause eutrophication 4. Nutrients mainly refers to inorganic matter from runoff, landfills , livestock operations and crop lands. The two primary nutrients of concern are phosphorus and nitrogen. It is notoriously over-abundant in human sewage sludge. It is a main ingredient in many fertilizers used for agriculture as well as on residential and commercial properties, and may become a limiting nutrient in freshwater systems and some estuaries. Phosphorus is most often transported to water bodies via soil erosion because many forms of phosphorus tend to be adsorbed on to soil particles. Excess amounts of phosphorus in aquatic systems particularly freshwater lakes, reservoirs, and ponds leads to proliferation of microscopic algae called phytoplankton. The increase of organic matter supply due to the excessive growth of the phytoplankton is called eutrophication. A common symptom of eutrophication is algae blooms that can produce unsightly surface scums, shade out beneficial types of plants, produce taste-and-odor-causing compounds, and poison the water due to toxins produced by the algae. These toxins are a particular problem in systems used for drinking water because some toxins can cause human illness and removal of the toxins is difficult and expensive. Bacterial decomposition of algal blooms consumes dissolved oxygen in the water, generating hypoxia with detrimental consequences for fish and aquatic invertebrates. Nitrogen is the other key ingredient in fertilizers, and it generally becomes a pollutant in saltwater or brackish estuarine systems where nitrogen is a limiting nutrient. Similar to phosphorus in fresh-waters, excess amounts of bioavailable nitrogen in marine systems lead to eutrophication and algae blooms. Hypoxia is an increasingly common result of eutrophication in marine systems and can impact large areas of estuaries, bays, and near shore coastal waters. Each summer, hypoxic conditions form in bottom waters where the Mississippi River enters the Gulf of Mexico. During recent summers, the aereal extent of this "dead zone" is comparable to the area of New Jersey and has major detrimental consequences for fisheries in the region. Nitrogen is most often transported by water as nitrate NO3. The nitrogen is usually added to a watershed as organic-N or ammonia NH3 , so nitrogen stays attached to the soil until oxidation converts it into nitrate. Since the nitrate is generally already incorporated into the soil, the water traveling through the soil i. Toxic contaminants and chemicals[edit] Compounds including heavy metals like lead , mercury , zinc , and cadmium , organics like polychlorinated biphenyls PCBs and polycyclic aromatic hydrocarbons PAHs , fire retardants, and other substances are resistant to breakdown. These compounds include pesticides like DDT , acids, and salts that have severe effects to the ecosystem and water-bodies. These compounds can threaten the health of both humans and aquatic species while being resistant to environmental breakdown, thus allowing them to persist in the environment. Pathogens found in contaminated runoff may include:

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A point source is a single, identifiable source of pollution, such as a pipe or a drain. Industrial wastes are commonly discharged to rivers and the sea in this way. High risk point source waste discharges are regulated by EPA through the works approval and licensing system, and associated compliance and enforcement activities.