Your Yard and Water Quality

We generally view gardening as a wholesome activity that enhances our environment. But pesticides, fertilizers and erosion from gardens and landscapes can contaminate lakes, streams, rivers, oceans and groundwater. Since the quality of our water resources affects our quality of life, we should learn how gardening practices can contribute to water contamination and how to reduce the threat to water quality.

We have long been aware of contamination from point sources such as factories and municipal sewage systems. Recently, we have become more aware of the threat of nonpoint source contamination from many relatively small, widespread sources. Each source by itself may seem insignificant; however, when added together, they can pose a serious threat.

Thousands of homes in Alaska have gardens. Each garden may contribute a relatively small amount of runoff containing soil, chemicals and fertilizers. This runoff flows into surface water such as lakes, rivers and bays; nitrate (from fertilizers and manure) and some pesticides can leach through the soil to contaminate groundwater (Figure 1).

Added up, these small amounts of contamination form a sizable problem. Only when individuals take responsibility and make wise choices can we control nonpoint contamination.

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Nitrogen Cycle in the Soil

Figure 1—Nitrogen cycle in the soil. All of the arrows represent biological processes in the soil. These steps proceed more rapidly when the soil is warm and there is adequate moisture, but the soil is not saturated. Note that there are three possible fates of nitrate:

(a) It is taken up by plants, if they are present.
(b) It is used by microbes to help break down coarse organic matter such as dry leaves.
(c) Any excess nitrate not used by plants or microbes can be carried to the groundwater by heavy rain or excess irrigation.

(Note: An alternate schematic of the nitrogen cycle is illustrated in Chapter 3, Soils and Fertilizers.)

Why be concerned?

Clean water is essential for human health, wildlife, recreation and industry. Water contamination poses many threats. For example:

- Pesticides and nitrate can contaminate drinking water supplies. Nitrate levels as low as 10 parts per million (ppm) in drinking water can cause blue-baby syndrome. While humans more than 6 months old are not seriously affected by nitrate in drinking water, cattle and sheep are.
- Sediments from erosion can ruin aquatic habitats for species that need clear, oxygen-rich water. Residues from lawn and garden fertilizers can overstimulate aquatic plant growth in shallow lakes and bays, making water unsuitable for fish and wildlife. Contamination of water by toxic chemicals can reduce fish and shellfish populations or make them unfit for human consumption. These problems concern not only those who fish for sport but also the commercial fishing industry and consumers.
- Contamination can make lakes, rivers and beaches unsafe for swimming and other recreational activities.
**Environmentally sound gardening**

Gardens thrive with good water quality practices. The same simple, practical techniques that improve soil, beautify landscapes, reduce maintenance and enhance plant health also can protect water quality.

For gardeners, the keys to protecting water quality are:

- Reducing the amount of potentially dangerous substances introduced to the environment
- Minimizing the amount of water that runs off their property

**Landscape design**

An environmentally sound garden begins with proper planning and design. Properly selected plants and landscape features can reduce runoff and minimize pesticide and fertilizer use. For example, pavement and gravel allow much more runoff than a landscape of trees or grass (Table 1). On the other hand, maintaining a “perfect” lawn often involves more reliance on chemicals than does caring for other types of landscapes.

Spring breakup in Alaska can be fairly sudden. Pet waste and other potential pollutants accumulate during the 3–5 months of winter and then dump into the surface meltwater. If the ground is still frozen, the water and all it carries runs off the landscape into the storm drains, which directly empty into the nearest waterbody, usually a stream.

**What you can do**

- Select plants adapted to the environmental conditions (sun, moisture, soil and temperature) of your site to ensure healthy plants and reduced maintenance.
- Replace turf in inappropriate areas (for example, dense shade, steep slopes, narrow, hard-to-irrigate areas and soil compacted by heavy traffic) with plants, mulches or paving materials that require less irrigation, fertilizer and pesticides.
- Use porous paving materials (for example, wood decking, modular pavers, porous asphalt, gravel or wood chips) instead of impermeable concrete or asphalt.
- Allow roof runoff to spread over well-drained soil or into a water garden, where infiltration can occur.
- Build gravel trenches along paved walkways and driveways to catch runoff.
- Pick up dog waste and other waste regularly during the winter months. Do not let it accumulate and runoff at breakup in the spring.
- Where runoff is a special problem, create gravel seepage pits or a series of infiltration beds underlain by a gravel or tile drainage system. Consult a soils engineer to ensure proper design.

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**Table 1.—Estimated runoff from different surfaces.**

<table>
<thead>
<tr>
<th>Land cover</th>
<th>Runoff (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense forest</td>
<td>10</td>
</tr>
<tr>
<td>Light forest</td>
<td>15</td>
</tr>
<tr>
<td>Lawns</td>
<td>25</td>
</tr>
<tr>
<td>Gravel areas</td>
<td>80</td>
</tr>
<tr>
<td>Pavement and roofs</td>
<td>90</td>
</tr>
</tbody>
</table>

Source: King County, Washington, Surface Water Design Manual (January 1990).

**Soil and fertility management**

Soil is the essential foundation of a garden. Proper soil and fertility management produces a healthier landscape and reduces the potential for water contamination from erosion, fertilizers and pesticides.
**Drainage** refers to the ability of soil to transmit water through the surface and subsoil. Most landscape plants, fruit trees and berry bushes require good soil drainage to a depth of at least 2 feet.

Drainage also affects the potential for water contamination. A coarse-textured mineral soil, such as sand, drains rapidly but also allows dissolved chemicals to leach into the groundwater. Clay particles bind these chemicals and slow their movement through the soil, reducing the likelihood of groundwater contamination. But a dense clay soil drains slowly, thus increasing surface runoff.

**Fertility** refers to the presence of minerals necessary for plant life. Unfortunately, the fertility of garden soils often is less than ideal for plant growth. Gardeners usually compensate by adding fertilizers, either from processed or natural sources. Over-application of any fertilizer or manure can result in excess nutrients being carried into lakes and streams or leaching into groundwater. Overfertilization also wastes money, damages plants and can encourage weeds.

Beating rain and moving water can carry away soil particles, organic matter, plant nutrients and soil contaminants. This water-soil-chemical runoff can cloud natural waters, stimulate unnatural and ecologically disastrous algal bloom, and contaminate fish. Therefore, it is essential to minimize erosion and runoff.

**What you can do**

There are several things you can do to reduce the likelihood of fertilizers contaminating groundwater and surface water. For example:

- Have your soil tested. Testing will detect pH problems that affect nutrient availability to plants. Tests also reveal deficiencies of nutrients such as phosphorus, potassium and calcium. Your local Extension office can provide names of soil testing labs.
- Use only the amount of fertilizer recommended; more is not better.
- Fertilize according to what your plants actually need. Established trees and shrubs do not need annual applications if they are putting on adequate growth and their leaf color is healthy.
- Use slow-release fertilizers (organic or processed) when possible to reduce the loss of excess nitrogen into groundwater or surface water.
- If you use quick-release fertilizers, make several small applications over a period of time instead of a large amount all at once. Split applications reduce the potential for nitrogen leaching.
- Time fertilizer applications correctly. Trees and shrubs make best use of fertilizer just before or as new growth begins in the spring. Fertilize annual and herbaceous perennials when they are actively growing.
- Mulch-mow the lawn to reduce the amount of fertilizer and water used. Grass cycling also builds the organic matter in the soil.

**Conditioning** can greatly enhance soil productivity. Incorporating organic matter such as compost, increases the soil’s ability to store moisture and nutrients. In addition, organic matter can buffer the effects of pesticides in the soil and prevent rapid leaching of many chemicals into groundwater.
Organic matter helps both sandy and heavy clay soils. In sandy soils, it improves moisture retention and reduces leaching of fertilizers and pesticides. In heavy clay soils, it improves water infiltration.

There are several approaches to reducing erosion. For example:

- Slow down runoff. Try terracing slopes, creating grassy swales or building earth, wood or masonry diversions.
- Mulch bare soil. Use straw, grass clippings, wood chips, ground bark or jute mesh erosion control netting.
- Plant vegetation that provides erosion control, especially on sloped and bare soil. Select quick-growing plants, such as rye.
- Protect existing vegetation where high water velocities are expected. For example, use a concrete splashblock at your rain gutter outlet, or place large, rough-edged stones at drainpipe outlets.

**Using garden wastes**

Like many things we do, gardening creates wastes: grass clippings, prunings and leaves. Thrown into the garbage, yard wastes use up scarce landfill space. Landfills themselves can contaminate groundwater. Decaying vegetable matter thrown into a lake or stream can compete with marine animals for the limited oxygen supply. If processed in the garden, however, these wastes can be a valuable resource, contributing to healthy soil and plants.

**What you can do**

- Use leaves and grass clippings as a mulch. This practice reduces erosion, irrigation requirements and weed problems.
- Run prunings and woody brush through a chipper and use the chips as mulch or to cover pathways.
- Compost leaves, needles, grass clippings and annual weeds (before flowering) to create a valuable organic soil amendment.
- Cover compost piles with a tarp during the rainy season to prevent leaching of nutrients.
- Since nutrients are likely to leach from compost piles, locate piles away from bodies of water or where runoff might occur.
- Compost herbicide-treated grass clippings for at least a year to eliminate potential herbicide problems. It’s best to keep these clippings separate from other compost materials.
- Compost diseased plant materials, annual weeds that have flowered or perennial weeds only if your compost pile is “hot.”

**Watering**

The goals of environmentally sound irrigation are to maximize water infiltration and minimize runoff. Reduce the potential for runoff by reducing the need for supplemental irrigation. For example, use mulches to conserve moisture and choose drought-resistant plants.

Overwatering can wash away soil, pesticides and nutrients, which eventually find their way into surface water or groundwater. Overwatering occurs when water is applied faster than the ground can absorb it or when you let the water run too long. By watering efficiently, you will reduce your water bill while protecting water quality.

Hand watering, with either a hose or a watering can, generally is appropriate only for containers or small beds. Hand
watering lawns and planting beds usually does no more than wet the soil surface.

Sprinklers can generate considerable runoff if they apply water too fast or throw water onto paved surfaces. Soaker hoses reduce runoff and evaporation losses because they apply water slowly. Trickle or drip irrigation also is efficient, reducing water use by 50 to 80 percent compared with overhead irrigation.

Do not water according to the calendar since a plant’s water requirement varies depending on weather, soil, species, age and size. Never allow seedlings to dry out. Newly established plants need frequent watering until their root systems become well established. Established trees and shrubs usually do well if you soak them once or twice a month during the summer. Many drought-resistant plants require little or no watering once they are established.

Watch for signs that indicate your lawn needs watering: gray-green grass, turf that does not spring back when walked on and blades of grass rolled lengthwise. Lawns generally need irrigation at least once a week in summer to stay green.

Apply no more than a half inch of water per hour, but adjust this amount according to soil type. Use small cans to measure the amount of water your sprinklers apply. Turn off the water at the first sign of soil saturation or runoff.

What you can do

- Select plants that need minimal water. Many native plants and other species adapted to dry summers require little if any irrigation.
- Decrease the amount of lawn. Turf generally requires more irrigation than a landscape of established trees, shrubs and groundcovers.
- Increase your lawn’s drought tolerance through good cultural practices (soil preparation, dethatching, aeration, fertilization and proper mowing frequency and height).
- Store runoff from your roof in a rain barrel. Mount a hose tap at the bottom so you can use the water in your garden.
- Divide your landscape into irrigation zones, grouping plants that use a lot of water in one zone and those that use less in another. Built-in irrigation systems should have separate circuits for lawns and planting beds.
- Avoid frequent, light irrigations. They tend to encourage shallow rooting and make plants more susceptible to drought.
- Apply water slowly (generally not more than one-half inch per hour).
- Adjust sprinkler patterns and output to avoid runoff.
- Use soaker hoses or drip irrigation rather than sprinklers where possible.
- If you must water by hand, sink perforated cans into the soil by each plant to apply water directly to the roots.
- Water when plants need it, not according to the calendar.
- Apply mulches to conserve soil moisture.
- Mulch-mow the lawn to reduce the amount of fertilizer and water used. Grass cycling also builds the organic matter in the soil.

Pest management

A pest-free garden is expensive, impractical and environmentally undesirable. Attempts to maintain a pest-free garden often result in heavy use of pesticides, which in turn increases the potential for water contamination.
Try to keep pest populations below the level at which they cause unacceptable damage. Allowing low levels of pests to survive helps maintain a population of their natural enemies.

The first step to effective pest management is to inspect your plants often so you can catch problems before they become serious. If you detect and deal with insect and disease problems early, you can reduce or eliminate the need for pesticides. The objective is to make your garden a healthy place for your plants and an inhospitable place for pests.

**What you can do**

- Plant pest-resistant species and varieties of plants. Check with local nurseries, landscapers, Extension agents or master gardeners to see whether resistance information is available for the plants you are considering.
- Rotate vegetables and annual flowers so that the same plant or plant family does not occupy the same space every year. For example, tomatoes, potatoes and petunias are all in the nightshade (Solanaceae) family. Rotation can reduce insect infestations and the buildup of soilborne diseases.
- Keep your garden clean. Rocks, wood and debris provide great hiding places for slugs and insects.
- Weed your garden. Weeds can harbor insects and diseases that attack your plants.
- Time plantings to avoid peak insect infestations. Often the most destructive phase of an insect’s life is brief and predictable. Check with your Extension office to see whether this information is available for specific insect pests.
- Preserve naturally occurring beneficial organisms by minimizing your use of pesticides.
- Properly identify plant problems. Remember that most problems are cultural or environmental and do not respond to pesticide applications. If your problem is caused by a pest, proper identification is important in selecting the safest and most effective control strategy.
- Determine whether a problem really justifies treatment. Many pests cause only cosmetic damage and are not life-threatening to plants.
- Try the least toxic control strategies first. Cultural methods often are a good place to start.
- Record your observations and the results of your treatments for future reference.
- If you use pesticides, choose those that pose the least threat to water quality. Examples include pyrethrins, insecticidal soaps, horticultural oils and *Bacillus thuringiensis* (Bt).
- If you decide to use pesticides, apply them when the pest is most susceptible, not according to a predetermined calendar schedule.
- If using insecticides, spot treat only those plants or plant parts affected. Compared to cover sprays, spot treatments can drastically reduce insecticide use (by more than 90 percent in some cases) and still achieve good control.
- Apply preventive fungicides only to plants likely to develop disease problems. Better yet, plant disease-resistant species or cultivars.
- If you use pesticides, carefully read the label for directions, usage restrictions and health and environmental precautions.
Nontoxic pest control methods

Insects
- Keep your garden free of weeds and debris that provide a habitat for pests.
- Prune out insect-infested parts of plants and destroy the prunings.
- Cover susceptible crops with floating row covers or nylon screen to exclude certain pests.
- Use insect traps where appropriate. (Research indicates that light traps usually are ineffective.)
- Use a stream of water or a brush to dislodge insects.
- Hand pick insects from plants.
- Encourage beneficial insects by planting flowers that provide nectar and pollen.

Diseases
- Plant disease-resistant cultivars.
- Rotate annual plants (both flowers and vegetables).
- Allow adequate space between plants and prune for good air circulation.
- Time waterings so that foliage dries by nightfall.
- Prune off and destroy diseased plant parts. Do not add them to your compost pile unless you are hot composting.
- Improve soil drainage and aeration.

Slugs
- Place beer in containers to attract and kill slugs.
- Overturn clay pots or place flat boards next to plants to lure slugs. Check frequently and kill collected slugs.

Weeds
- Hand pull weeds or cultivate with a hoe where appropriate.
- Use mulches generously.
For more information

**UAF Cooperative Extension publications**

*Lawn Maintenance and Pesticides*, HGA-00236.
*Protecting Alaska’s Water Resources*, GWQ-00548.
*Tree Maintenance and Pesticides*, HGA-00436.

**WSU Cooperative Extension publications**

*Backyard Composting in the 1990s*, EB1784.
*Cover Crops for Gardens in Western Washington and Oregon*, EB1824.
*Defining Water Quality*, EB1721.
*Role of Soil in Groundwater Protection*, EB1633.
*Safe Disposal of Home Use Pesticides*, EB1386.
*Saving Water: Lawns and Other Turf*, EB0684.
*Watering Home Gardens and Landscape Plants*, EB1090.
*Why the Concern about Agricultural Contamination in Groundwater?*, EB1632.

**OSU Extension publications**

*A List of Analytical Labs Serving Oregon*, EM 8677.
*Cover Crops for Home Gardens*, FS 304.
*Gardening with Composts, Mulches, and Row Covers*, EC 1247.
*How to Take a Soil Sample ... and Why*, EC 628.

**Available from the Web and OSU Cooperative Extension county offices**

*Conserving Water in the Garden: Growing a Vegetable Garden*, EM 8375.
*Conserving Water in the Garden: Landscape and Lawn Care*, EM 8374.

**Websites**

Rain Gardens, Municipality of Anchorage, http://anchorageraingardens.com