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Hawaii's Pollution Prevention Information
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HAPPI-Farm 3

Minimizing Pollution Risk from
Land Management

Making a profit and protecting your land can go hand-in-hand. Practices that help to protect your land will help keep your farm profitable for years to come. On the other hand, poor practices can increase water runoff and soil erosion, reduce soil quality, and can introduce sediments, nutrients, chemicals, and pathogens into groundwater and surface waters, decreasing water quality.

This worksheet will help you to assess how your land management practices can impact the quality of both Hawaii's groundwater and surface water bodies. It describes practices that you can use to reduce water runoff and erosion, to improve soil quality, and to minimize nutrient losses from crop fields. It will help you develop an action plan to protect your land. Use this publication's worksheet in conjunction with others in the HAPPI-Farm series, including no. 4, *Nutrient management*, no. 5, *Pest management*, and no. 6, *Irrigation management*.

Conservation planning

Using sound agricultural practices will help you to minimize the risks to water quality from your management activities. You might begin by developing a conservation plan. If you sign up as a cooperator, your local Soil and Water Conservation District (SWCD) will work with you to develop a conservation plan. The plan will help you to stay profitable and productive while minimizing negative environmental impacts, including impacts on water quality. However, the SWCD may not be able to help you complete your plan immediately. In the meantime, you can do many things to identify likely problems and reduce the water pollution risks from your farm.

Signs of soil erosion on your land

Sediment from soil erosion is the most common cause of water quality problems in Hawaii, but it is sometimes difficult to see. Eroded soil and runoff water can carry nutrients and agricultural chemicals that can cause water pollution. Soil erosion occurs when soil is removed from your land by rainwater runoff or wind. It affects the land surface in different ways. If you are growing tree crops like papaya, macadamia, or coffee, one easy way to identify soil erosion is to look for exposed tree roots. Lots of exposed roots probably mean that erosion is a problem. Evidence of water ripples (called rills) or gullies in the soil surface is another erosion indicator.

Climate, soil type, the lay of the land, and nonprotective management practices may combine to promote erosion. Soil erosion is more likely in high-rainfall areas and on steep fields. You can significantly reduce soil erosion by farming across the slope (on the contour) instead of farming up and down the slope. Contour farming, when combined with conservation tillage and crop rotation, can reduce erosion rates even more. When you use these practices, more water goes into the soil and less runs off.

If you are growing crops, the most effective way to decrease soil erosion from both water and wind is to maintain cover over the ground. For example, recent CTAHR research identified several groundcover species that controlled erosion under papaya. Maintaining vegetation under a crop with a thick canopy, such as macadamia, is much more difficult. In these situations, it is important to maintain as much surface cover from fallen

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leaves and other debris as possible. Other practices such as contour strips and windbreaks can also significantly reduce erosion. Minimize traffic in orchard areas to avoid soil compaction that decreases water infiltration and increases runoff. Keep access roads running on the contour whenever possible and avoid constructing roads that go directly up and down the slope, because these are subject to more erosion.

Soil properties

Unique properties make the erosion risks different for different soils. The *Soil Survey of the State of Hawaii* (available at offices of the Cooperative Extension Service, Soil and Water Conservation District, and Natural Resources Conservation Service, as well as at some public libraries) contains specific information on the susceptibility of Hawaii's various soils to erosion. This information will be part of your conservation plan. However, if you do not yet have a plan, you can estimate likely erosion risk from a few basic soil properties.

One of the most important components of your soil is organic matter. It is also one of the first things lost when soil erodes. Organic matter serves to reduce erosion and maintain soil fertility, improve soil structure, and absorb pesticides, preventing their leaching. Although it takes time to build up organic matter in your soil, you can increase organic matter through applications of animal manure or incorporating crop residues or cover crops into the soil.

Another important soil property is soil texture. Water flows more quickly through coarse-textured soils, such as sandy soils, so these soils have a higher risk of nutrient leaching and groundwater pollution. Water flows more slowly through fine-textured soils, such as clay soils, so these soils usually have greater runoff, which can lead to pollution of surface water bodies. In general, silty soils have the highest risk of erosion.

How well soil particles stick together, called soil aggregation, is also very important. Aggregation strongly affects how water moves through the soil. You can get a rough idea of your soil texture and aggregation by picking up some moist soil, rubbing it between your fingers, and evaluating it according to the table below.

Buffer areas and filter strips

There is a high risk of water pollution from fields and orchards that border streams, drainage ditches, or other waters. Pollutants such as sediments, nutrients, and chemicals can flow directly from these fields into water bodies. One way to reduce this risk is to maintain a buffer of vegetation, sometimes called a "filter strip," between cultivated areas and water bodies. The most effective buffer areas have a mixture of vegetation including grasses, trees, and shrubs, but any vegetation is better than none. Refer to HAPPI-Farm 10, *Forest and riparian areas management*, for additional information.

Leaching

Adequate soil drainage is important for crop cultivation, particularly in irrigated situations. However, water that is not used by the crop can move down through the soil and enter the groundwater. If good management practices are not followed, this water can carry pollutants like nutrients and pesticides. This process is called leaching. Water pollution from leaching is more likely on sandy soils and on soils where the water table (also called the groundwater or aquifer) is close to the surface. Leaching can also be increased by cultivation practices such as deep tillage. Leaching is usually not a major problem in orchard systems except on very sandy soils or on soils that are very thin. You can reduce leaching by adopting practices that increase the ability of your soil to hold water, such as increasing soil organic matter.

Soil texture and aggregation affect water pollution risk

How the soil feels	Type of soil	Risks to water quality
Sandy or gritty	Coarse texture or highly aggregated	Higher risk of leaching, lower risk of erosion and runoff
Slippery like chalk dust or flour	Silty texture or moderate aggregation	Moderate risk of leaching, moderate risk of runoff, higher risk of erosion
Sticky	Fine texture and low aggregation	Lower risk of leaching, higher risk of runoff, moderate risk of erosion

Assessing your risks

Complete the risk assessment table below to determine your farm's water pollution risks. For each category, choose the set of practices that best fits your situation. Then, go to page 4 and develop an action plan to minimize water pollution on your land.

Risk assessment table for land and soil management

	Low risk	Moderate risk	High risk	Your risk
Conservation planning	Have an up-to-date conservation plan	Have a conservation plan that doesn't fully reflect your current practices	No conservation plan	❑ low ❑ moderate ❑ high
Conservation structures (if applicable)	All conservation structures are in place and well maintained	Most structures are in place and some are maintained	Structures are not constructed or maintained	❑ low ❑ moderate ❑ high
Soil erosion and water runoff (evidence)	No evidence or very little evidence of soil and water runoff from fields	Some evidence of runoff (muddy water) only during and immediately after big storms; few roots visible	Muddy water flows during and after most rains; many roots visible; other evidence of erosion (gullies, rills)	❑ low ❑ moderate ❑ high
Soil erosion and water runoff (slope)	Fields are flat to very gently sloping; any cultivation is done across the slope; all roads run across slope	Fields are moderate to steeply sloped but all cultivation is done across slope and barriers are installed where appropriate	Fields are moderate to steeply sloped; cultivation is done and roads constructed up and down slope; barriers are not installed.	❑ low ❑ moderate ❑ high
Soil erosion and water runoff (ground cover)	Well maintained ground cover present	Ground cover present but has incomplete coverage	No or very little ground cover present	❑ low ❑ moderate ❑ high
Soil organic matter (OM)	Soil is high in OM; many roots and earthworms are present	Soil has moderate OM levels; some roots and earthworms present	Soil has low OM levels; few roots and earthworms are present; soil may be light in color	❑ low ❑ moderate ❑ high
Soil erosion and water runoff (soil texture, aggregation)	Soil has a course texture (sand, loamy sand) or is well aggregated; soil is well drained	Soil has an in-between, silty texture (loam or clay-loam) or moderate aggregation; soil is well to moderately well drained	Soil has a fine (clay or clay-loam) texture or poor aggregation; soil is moderately or poorly drained	❑ low ❑ moderate ❑ high
Buffer areas	Well maintained buffer areas between fields and all water bodies; buffers contain a diverse mixture of vegetation	Buffers along most water bodies with few gaps; buffers have only a few plant species (e.g., grass strips)	Few or no buffers between fields and water bodies; buffers are poorly maintained and have many gaps	❑ low ❑ moderate ❑ high
Leaching	Soil has a fine (clay or clay-loam) texture or poor aggregation; good ground cover is maintained	Soil has an in-between (loam) texture or moderate aggregation; between-row cultivation is sometimes used for weed control	Soil has a course (sandy or sandy-loam) texture or good aggregation; between-row cultivation is regularly used for weed control	❑ low ❑ moderate ❑ high

Your action plan

Now that you have assessed your management practices, you can take action to change practices that may be causing water pollution. For areas that you identified as high or moderate risk, decide what action you need to take and fill out the Action Plan below.

Write down all your moderate-risk and high-risk activities below	What can you do to reduce the potential risk for water pollution?	Set a target date for action
Samples of action items:		
Conservation plan doesn't reflect current management practices.	*Call local SWCD office to schedule appointment to update plan.*	*By the end of next week*

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