Vegetative Filter Strips for the Protection of Surface Waters from Pesticide Runoff

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Introduction

Issue: The health of aquatic habitats is declining. Water monitoring data suggests that concentrations of certain pesticides in surface waters present concerns to aquatic organisms.

Risk assessments conducted by Health Canada consider spray drift and runoff as typical routes of entry into surface waters.

Spray buffer zones are a widely used mitigation measure to reduce drift; pesticide labels include few mitigation measures to reduce runoff.

New mitigation measure: Health Canada has implemented mandatory vegetative filter strips (VFS) for pesticides meeting specific criteria in an effort to further protect aquatic habitats from pesticide runoff.

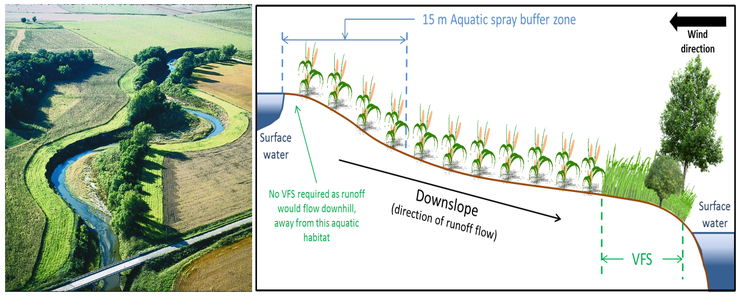
Vegetative Filter Strips

What: Permanent strip of dense perennial vegetation. Grass is required, but the strip may also contain other vegetation, such as shrubs and trees.

Where: Situated on the downslope edge of a field, plantation, woodlot, etc., along a surface water body.

Why: Reduces the amount of pesticide entering surface waters by slowing runoff water to allow suspended soil particles with bound pesticides to settle in the grass before reaching the water body.

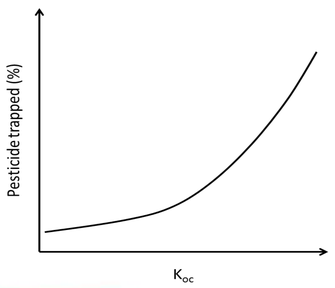
When: A requirement on the label of certain pesticides.



Pesticide Properties

Properties that make a pesticide a suitable candidate for a VFS include:

- High toxicity to aquatic organisms,
- Persistent,
- Low solubility, and
- High binding potential (K_{OC}).



Trapping Mechanisms

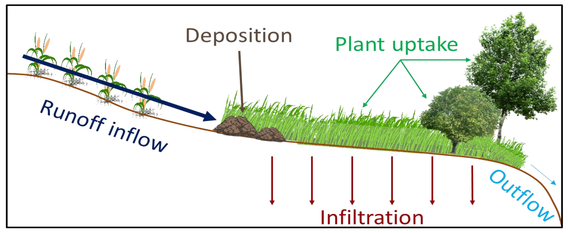
Strongly sorbed pesticides

Adsorption and deposition: Runoff is slowed by dense, mesh-like vegetation. When water travels at lower velocity, soil (and sorbed pesticides) settle out of suspension and are deposited in the VFS (i.e., the strip acts as a "filter").

Weakly sorbed pesticides

Infiltration: Runoff water penetrates and is retained in the soil. Influenced by plant roots and soil texture (coarser textures leads to higher rates of infiltration).

Plant uptake: Runoff water is taken up by plants, where pesticides can accumulate, be converted to volatile forms, or broken down by enzymes.



Design & Construction Considerations

Many factors affect the efficacy of a VFS.

Some site-specific factors cannot be controlled, such as

- Climate (precipitation), size and slope of adjacent area, soil characteristics, distance to groundwater, etc.

Other factors we can control, such as:

- Type of vegetation and width (perpendicular to the bank) of the strip.

Vegetation

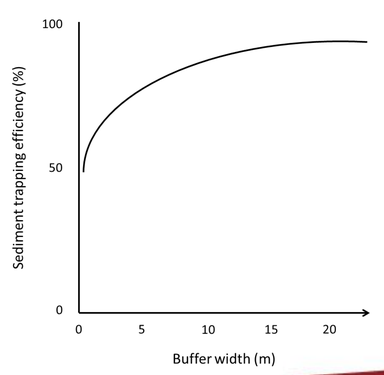
Type: A VFS should predominantly consist of grasses, but may also include other vegetation, such as shrubs and trees. Pre-existing sensitive habitat in the VFS can be preserved (i.e., do not cut down mature trees, incorporate them into the VFS).

Species: Optimal vegetation for a VFS is site-specific. Sturdy, tall, perennial grass with deep roots should be used. Natives should be used, when possible.

Age: Mature vegetation can be more effective.

Width

The wider the VFS, the more effective it will be. There is a trade-off between finding the optimal VFS width that ensures effective protection of aquatic habitats while maximizing arable land.



PMRA Recommendation

The PMRA requires mandatory VFSs for certain pesticides (high K_{OC}, low solubility, persistent) when a risk to aquatic non-target organisms from runoff has been identified and there is supporting information to demonstrate that a VFS would effectively mitigate the risks.

The width of the mandatory VFS is 10 m, perpendicular to the bank of any down-gradient surface water aquatic habitat (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs, wetlands, and estuarine/marine habitats), and extend for the whole length of the water body in the area to which the pesticide is being applied.

Other Jurisdictions

The required use of a VFS for pesticide mitigation is inconsistent around the world. Not all jurisdictions have adopted the use of VFS, the terminology is not always the same, and the recommended width also varies across jurisdictions. The 10 m width currently recommended by PMRA falls within other legislations.

Country	Legislations for pesticide use near surface water	Comments
PMRA, Canada	10 m VFS	Mandatory for certain pesticides only
PEI, Canada	15 m buffer zone (VFS)	Blanket statement for all contaminants
USA	3 m (10 ft) VFS (60 ft proposal)	On pesticide labels
Austria	1 to 3 m VFS	On pesticide labels
Denmark	2 to 10 m crop free zone*	Application restrictions
France	5 to 20 m VFS	On pesticide labels
Holland	0.25 m to 9 m crop free zone*	Application restrictions
Hungary	5 m VFS	Unclear
Italy	5 m VFS/riparian strip along rivers, streams and ditches	Less if water quality is sufficient'(3 m) to high (0 m)
Poland	20 m VFS; 5 m VFS along roads	Unclear
Slovakia	12 m VFS	Unclear
UK	2 m crop free zone*	Application restrictions
Sweden	6 m crop free zone proposal*	Would be on pesticide labels

*Assumed crop-free zone would be vegetated to some degree. Germany legislated 1 to 3 m spray free zone, unclear as to whether crops are allowed.

Future Directions

Work is underway to incorporate VFS modelling into risk assessments using VFSMOD. In the short term, modelling could help support the implementation of a 10 m VFS for highly sorptive pesticides without the need for field trials. The effectiveness of VFS for soluble pesticides could also be further explored with VFS modelling. Longer term directions include finding ways to incorporate site specific considerations to determine optimal VFS width.