

**WATER IS THE CONNECTION:
PESTICIDES AND SALMON RECOVERY IN THE WILLAMETTE BASIN**

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Recovery of severely depleted runs of salmon and steelhead is a national and state priority, including within the Willamette Basin. Clean, cold, abundant water -- vital to salmonids -- is increasingly scarce in the Basin, especially within lower elevation Willamette Valley streams and rivers, which provide spawning and rearing as well as migratory habitat. The 2011 Recovery Plan, required under the Endangered Species Act (ESA), identifies degraded water quality as a significant threat to the Willamette Valley's threatened native salmonid runs. Widespread commitment to improve water quality is critical to recovery.

Oregon's Pesticide Stewardship Partnership program (PSP) tests water samples for dissolved residues of pesticides and works with communities to reduce pesticide residues in waters. Samples are collected biweekly during the growing season in several Oregon subbasins. Water samples (n=872) from streams and rivers collected from 2010-2015 in the Clackamas, Molalla-Pudding, and Greater Yamhill subbasins were analyzed for detectable concentrations of up to 125 different pesticides and their analytes. Not all pesticides were analyzed in all samples, as the analyte list has expanded over time.

The pesticides (or their degradates) diuron, atrazine or simazine, and glyphosate were each present in 50% or more of the samples (Figure 1). Metolachlor, sulfometuron-methyl, DEET, metribuzin, propiconazole, dimethanamid, and imidacloprid were also frequently detected, with detection frequencies between 15 -50%.

EPA Aquatic Life Benchmarks (ALBs) are commonly used to assess whether pesticide concentration levels found in water bodies may indicate a potential hazard to aquatic life. Within the designated PSP areas, many current-use pesticides had occasional detections exceeding the most sensitive ALB. These include chlorpyrifos, bifenthrin, diazinon, atrazine, dimethoate, diuron, simazine, oxyfluorfen, linuron, methomyl, methiocarb, dimethenamid, chlorothalonil, metolachlor, 2,4-D, pendimethalin, ethoprop, and sulfometuron-methyl.

ALBs are based on studies of pesticides in isolation, not in mixture. Mixtures at Willamette Valley sites are the norm, not the exception, with mixtures with four or more pesticides commonly present. Several investigations have demonstrated additive or synergistic effects to salmonids from exposure to mixtures of pesticides at environmentally relevant concentrations. Mixtures remain unregulated, but may pose greater risks to aquatic life that go unaddressed.

Seven of the pesticides detected in the three PSP subbasins have been determined by National Marine Fisheries Service to pose jeopardy and adverse modification to ESA-listed salmonids present in the

Willamette Basin, including spring Chinook, winter steelhead, and/or Lower Columbia coho; an additional four have been determined by EPA as likely to adversely affect listed salmonids.

In general, the pesticides frequently identified or found above ALBs in the Valley are broad-spectrum chemistries with a wide range of use sites. Strategies to reducing pesticide entry into streams include: reducing the amounts of pesticide applied; substituting less toxic, less persistent, or less mobile pesticides; and reducing the transport of pesticides from field sites to streams. Growers stand to benefit because these measures also promote efficiency (saving money), tend to reduce secondary pest outbreaks, and conserve water. As well, proper use and application of all pesticides delays resistance and preserves the ability to judiciously maintain the chemicals in the toolbox.

A new publication and set of pesticide fact sheets sponsored by the PSP program discusses these topics and provides a variety of best management practice recommendations for Willamette Valley growers.

