Photo: USFWS

PESTICIDE IMPACTS TO AQUATIC ECOSYSTEMS

Studies of major rivers and streams in the United States find that 96% of fish, 100% of surface water samples and 33% of major aquifers contain one or more pesticide at detectable levels.[1] Synthetic pesticide use started becoming normalized in the 1950s and the full extent of the negative impacts on ecosystem health are still not universally understood.

This document highlights the detrimental effects of pesticides on water quality, including pollutant loads in urban and suburban stormwater and agricultural runoff. It provides information about alternatives to inspire landscapers, nursery growers and farmers to reduce pesticide use and implement strategies for pesticide residue management.

NCAP has worked for over two decades to ensure endangered Northwest salmon are protected from harmful pesticides—by participating in lawsuits, working with government agencies and legislators and countering industry efforts to thwart protections. But the work isn't over. Salmon need strong advocates in government. Share this resource with your elected officials and ask them to prioritize salmon recovery.

Selected Pesticides Impacting Water Quality

The pesticides listed below are only some of the pesticides that pose a significant risk to endangered salmon. Every pesticide has individual properties that can impact water quality. Warming waters due to climate change induces stress which can make some organisms more susceptible to a specific pesticide's toxicity, so we advocate for increased monitoring of the impacts of individual pesticides on individual species.

Common Name	Pesticide Class	Trade Name Examples	Primary Use	Impact on Aquatic Systems
Chlorpyrifos	Organophosphate	Killmaster II, Brodan, Erade	Control foliage and soil-borne insect pests on a variety of crops	High neurotoxicity on aquatic invertebrates and fish
Malathion	Organophosphate	Cythion	Used to treat head lice	High neurotoxicity on aquatic invertebrates and fish
Diazinon	Organophosphate	Alfatox, Basudin, AG 500, Dazzle, Gardentox, Knoxout	Control cockroaches, silverfish, ants, and fleas in residential, non-food buildings	High neurotoxicity on aquatic invertebrates and fish
Bromoxynil	Nitrile herbicide	Brominal, Bromotril, Bronate, Buctril, Certrol B, Litarol, M&B 10064, Merit, Pardner, Sabre,	Post-emergence to control annual broadleaved weeds	High toxicity on aquatic plants and invertebrates
Metolachlor	Chloroacetanilide herbicide	Dual, Pimagram, Bicep, CGA-24705, Pennant	Grass and broadleaf weed control in corn, soybean, peanuts, sorghum, and cotton	High toxicity on aquatic plants and invertebrates

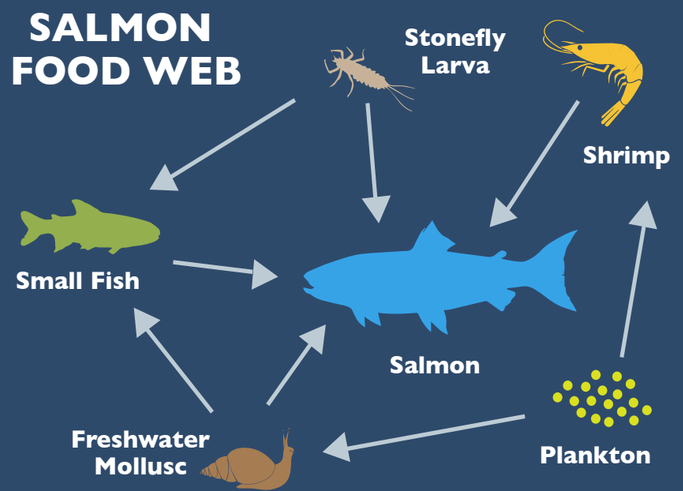
PESTICIDE PATHWAYS

How do pesticides reach rivers?

Climate change induces extreme weather events, which facilitate the spread of pesticides from farmland into surrounding environments. Increasing amounts of precipitation and subsequent flooding increases pesticide runoff into aquatic systems. To make things worse, raising the temperature of water causes pesticides to increase in their acute toxicity.[3]

To the Ocean

SALMON FOOD WEB



Salmon have been federally listed as endangered under the Endangered Species Act since 1996 after Nez Perce Tribes petitioned the EPA. Recovery efforts work to overcome issues such as habitat loss, dam removal, overfishing, inferior genetics from hatcheries, pesticides, and warming water due to climate change.

Pesticides interfere with gill capacity and neurological functions critical to breathing and swimming. Neurotoxins have such an impact on motility in young fish that they have difficulty evading predators, battling currents and migrating.[2] Since some pesticides are fat soluble, the risks of bioaccumulation, or the gathering of a substance inside of an organism, and biomagnification, the increased concentration of a substance higher in the food chain is important to consider.

1. Drift & Volatilization

Most pesticides are applied as a liquid and when it lands anywhere other than intended, it is labeled as drift. Drift is not supposed to happen and applicators applying pesticides that drift can be held accountable. Many chemicals can become volatile, which means they can switch from a liquid to a vapor state on their own in the right conditions. For example, certain pesticides can become vapor and drift onto people, animals, insects, and surface water.

2. Chemigation

Sometimes pesticides are added directly into water systems to allow for ease of application. Chemigation is most commonly used to fumigate soil to kill pest insects and microorganisms that cause disease, either indoors or outdoors. In outdoor settings it is common practice for the water used in chemigation to flow untreated through the irrigation system, which then interacts with streams and rivers. In indoor operations the water likely flows to a wastewater treatment plant, which is monitored for safety limits before reintroducing the treated water to the watershed. But it may also flow untreated into storm drains or leach into groundwater.

3. Seed Coating and Treated Plants

Seeds and plants can be pretreated with systemic pesticides that will make them deadly to bugs trying to eat them. This silver bullet technology will kill any bugs that land on the plants, even pollinators and natural predators of pests. Many consumers are choosing to only buy untreated seeds and plants for this reason. Because pesticides don't stay put, pesticides used in this way increase the overall pesticide load in groundwater and subsequently streams and rivers.

4. Runoff

Water flows over impervious surfaces like roads, roofs, and parking lots and ends up in stormwater systems that often flow untreated to rivers and streams. Stormwater or polluted runoff has been identified as one of the major pathways for pesticides into urban and suburban waterways.[4,5] Heavy rain or irrigation events may lead water to flow over non-impervious surfaces like landscaping, gardens, and farms, picking up pollutants along the way.

5. Leaching

When water seeps through the earth it can pick up residues of pesticides which will eventually pollute groundwater. The Environmental Protection Agency (EPA), State and Tribal governments must determine least toxic levels for individual pesticides for groundwater and test public and private wells to measure. Some substrates, like the complex soils layers under forests, promote slow leaching which can allow more pesticides to be filtered out than substrates with a closer connection to groundwater.

NORTHWEST CENTER FOR ALTERNATIVES TO PESTICIDES

Alternative Solutions: Green Stormwater Infrastructure

Rain gardens are small sloped depressions planted with native vegetation designed to work like a native forest, temporarily holding and soaking in polluted urban and suburban runoff.

Stormwater planters are open-bottomed structural containers that capture and filter urban and suburban runoff through layers of gravel, soil, plants and mulch. Planter boxes can either be infiltration style planters designed to filter through soil, or flow-through style planters designed with an impervious liner and overflow pipe.[6]

Filter strips are small strips of land containing permanent vegetation designed to catch pollutants. Normally located aside a stream, river, irrigation channel or wetland, filters can exist in urban, suburban, or agricultural environments to slow runoff and trap sediment, nutrients and pesticides.

Constructed wetlands (CWs) are important forms of green infrastructure that are widely used for stormwater runoff. CWs offer potential habitats for wildlife conservation and biodiversity due to the purification function.[7] As water flows through the wetland it is naturally broken down and taken up by plant roots and bacteria removing pollutants.

Photo: Clean Water Services

Alternative Solutions: Least Toxic Strategies

Less is more: Natural, unmanicured greenspaces including meadows and valleys, benefit communities, plants and wildlife. It is important to leave some spaces unmanicured as they are home to rare plants and beneficial insect species and provide specialized foods and shelter needed for their survival.

Species specific IPM plans: Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests and their damage through a combination of cultural, biological, and chemical methods.[8]

OMRI certified pesticides: Organic Materials Review Institute (OMRI) listed products are allowed for use in organic production and processing under the USDA National Organic Program.

Trap crops: Growers can divert pests by planting more desirable alternate species known as "trap crops."

Healthy predator prey relationships: Natural enemies include predators, parasitoids, or pathogens that are known to prey upon or weaken pest species so pesticides are not needed.

Build soil health: Soil building is a vital step in creating a healthy landscape. A soil test is essential to determine fertility levels and to make nutrient management decisions. Routine soil testing and sampling helps diagnose landscape deficiencies and assure proper planting.[9] Plant care requires healthy, deep soil. Organic amendments such as compost, grass clippings and straw are biodegradable and improve soil aeration, water infiltration, and both water and nutrient holding capacity.[10]

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