South Umpqua Pilot Study 2014-2019

Findings and Recommendations

Oregon Water Quality Pesticide Management Team (7/2/20)

Background

A pesticide water quality pilot study of the South Umpqua subbasin (USGS 8-digit HUC 17100302)[1] was initiated in the fall of 2014. The South Umpqua was selected by the Water Quality Pesticide Management Team (WQPMT) as one of four potential pilot projects after the Pesticide Stewardship Partnership Program received its first funding allocation from the Oregon Legislature. The monitored watersheds were selected because of the multiple types of land uses in the area that use pesticides, the presence of municipal drinking water intakes, as well as existing water quality data collected by DEQ and other entities. Prospective local partners were contacted and they all expressed interest in participating in the pilot effort. Initial reconnaissance monitoring sites were selected by a group comprised of state agencies on the WQPMT, Partners for Umpqua Rivers (PUR), Douglas Soil and Water Conservation District, Oregon State University Extension, and the Cow Creek Band of Umpqua Tribe of Indians and private landowners. The five monitoring locations were intended to capture potential pesticide contributions from various land uses within the four selected watersheds.

Purpose

The purpose of the study was to determine to what extent pesticide applications occurring in the various watersheds were impacting nearby surface waters resulting from various types of land uses. The monitoring locations were chosen to represent the predominant land use types existing within the various watersheds as noted in the United States Geological Survey's (USGS) 2016 National Land Cover Dataset. Initially, five monitoring locations were chosen. At the end of the spring 2015 sampling season two sites (Cow Creek at Mouth and Myrtle Creek at Mouth) were discontinued due to both the limited number of pesticides detected and the low concentrations of those detections during the 2015 sampling period. In 2017 two additional sites were added (Lookingglass Creek at the Happy Valley Bridge and the North Fork of Myrtle Creek downstream of the Bilger Creek confluence) at the suggestion of local partners (Table 1.).

Table 1: Water Quality Monitoring Locations and Accompanying Land Use

Station ID	Monitoring Timeframe	Description	Predominate Land Use			
			F	O	A	U
10997	9/14-6/15	Cow Creek @ Mouth	68%	25.5%	2%	4.5%
11316	9/14-6/15	Myrtle Creek @ Mouth	71%	24%	2.5%	2.5%
12248	9/14-8/19	Lookingglass Ck @ Hwy 42, Winston, OR	55%	25.5%	14.5%	5%
25950	9/14-6/19	Deer Creek @ Fowler Bridge	32%	39%	24.5%	4.5%
30163	9/14-6/19	South Umpqua R. above mouth	64.5%	25%	6.5%	4%
38828	3/17-6/19	Lookingglass Ck @ bridge Happy Valley Rd	56.5%	25.5%	14%	5%
38831	3/17-6/19	NF Myrtle Ck D/S of Bilger Ck Confluence	66%	28.5%	4.5%	1%

F=Forestry, O=Other, A-Agriculture, U=Urban

[1] A HUC is a hydrologic unit code. An eight-digit code represents a subbasin area, generally around 700 mi^2. Monitoring was conducted at the watershed level defined as a ten-digit HUC. These are typically from 62-390 mi^2 in area.

The pilot monitoring results indicated detections of multi-use herbicides at multiple monitoring locations within various subbasins. During the sampling period September 2014 through June 2019 263 pesticide detections were noted out of 3092 sample analysis conducted for pesticides. Concentrations of the 263 detections were all below 50% of the aquatic life benchmarks (254 were below 10% of the aquatic life benchmark and 9 were between 10-50% of the aquatic life benchmark).

Based on these results, the WQPMT approached the local stakeholder group about initiating a second phase of pilot monitoring in the South Umpqua 2017 which extended through the spring of 2019.

Table 2: – USGS Watersheds (10-digit HUCs) in the South Umpqua subbasin and relative location of monitoring stations

USGS HUC_Number	Subbasin_Name	Watershed (10-digit HUC)	Monitoring Site(s) in watershed?	Station ID(s)
1710030213	SOUTH UMPQUA	LOWER S. UMPQUA RIVER	Yes	30163; 25950
1710030212	SOUTH UMPQUA	OLLALA CREEK/LOOKINGGLASS	Yes	12248; 38828
1710030203	SOUTH UMPQUA	MIDDLE S. UMPQUA RIVER	No	-
1710030201	SOUTH UMPQUA	UPPER S. UMPQUA RIVER	No	-
1710030211	SOUTH UMPQUA	MYRTLE CREEK	Yes	11316; 38831
1710030202	SOUTH UMPQUA	JACKSON CREEK	No	-
1710030210	SOUTH UMPQUA	MIDDLE S. UMPQUA RIVER	No	-
1710030205	SOUTH UMPQUA	S. UMPQUA RIVER	No	-
1710030209	SOUTH UMPQUA	LOWER COW CREEK	Yes	10997
1710030204	SOUTH UMPQUA	ELK CREEK/SOUTH UMPQUA	No	-
1710030208	SOUTH UMPQUA	WEST FORK COW CREEK	No	-
1710030206	SOUTH UMPQUA	UPPER COW CREEK	No	-
1710030207	SOUTH UMPQUA	MIDDLE COW CREEK	No	-

How was the Study Designed?

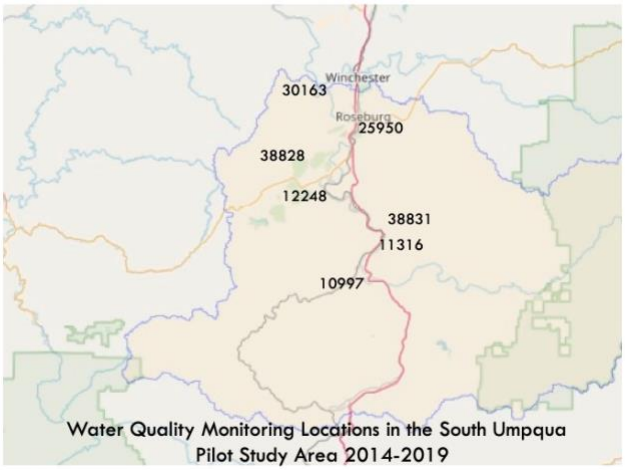
The study was designed in collaboration with local partners with the purpose of addressing as many of the major existing land uses as possible. In developing the monitoring locations, care was taken not to isolate any single land owner unless previous agreements had been made with the potentially effected party or parties. Monitoring locations were distributed in the subbasin at stations including several tributary streams (watersheds) to the Umpqua River.

The main land uses captured during the study were agriculture, commercial forestry, urban and other. Other is defined as either, water, scrubland, wetland, barren, or herbaceous uplands. Monitoring in the agricultural areas was based on crops grown within the watersheds as referenced by the United State Department of Agriculture's 2017 Crop Data Layer and the 2017 USDA Census of Agricultural for Douglas County. It should be noted that pesticides identified in Table 3 are those that are currently registered for use not necessarily what has or is currently in use by agriculture and commercial forestry.

Table 3: Pesticides Registered for Use for Major Land Uses in South Umpqua Subbasin[2]

Crop	Acreage	Pesticides Registered for Use[3]
Hay/Grass Hay/Alfalfa	32,291	2,4-D, Carbaryl, Glyphosate, Hexazinone, Imazapyr, Metsulfuron-methyl, Propiconazole, Tebuthiuron
Grapes (Vineyard)	1787	Glyphosate
Berries	705	2,4-D, Carbaryl, Glyphosate, Hexazinone, Propiconazole, Oxyfluorfen, Simazine
Vegetables	471	2,4-D, Carbaryl, Glyphosate, Propiconazole
Commercial Forestry	–	2,4-D, Atrazine, Carbaryl, Glyphosate, Hexazinone, Imazapyr, Metsufuron-methyl, Oxfluoren, Propiconazole, Simazine, Sulfometuron-methyl

The sampling schedule was based on the best available knowledge of timing of pesticide applications by agriculture and forestry landowners in the area. This timeframe is generally from March through June and again September through October. Grab samples for water were collected by the Partners for Umpqua Rivers approximately every other week during those spring and fall periods. Budget limitations precluded more frequent grab sample monitoring.



Water Quality Monitoring Locations in the South Umpqua Pilot Study Area 2014-2019

Generally, statewide use of the standard spring and fall sampling schedule is adequate for pesticide detection within a two-week window from the majority of applications. In the Willamette Valley PSP areas, there are numerous and frequent agricultural and non-agricultural pesticide applications in the spring and fall within small sub-watersheds. Maintaining a regular bi-weekly sampling schedule is the best way to track changes in trends over time. However, given the unique nature of land use and pesticide applications in the South Umpqua, this sampling schedule may not be adequate to completely characterize pesticide residues in potentially impacted water bodies. For example, pesticide application in commercial forestry occurs on an infrequent basis and is driven by the need to control competitive plants in order to successfully establish seedlings post-harvest. This results in applications occurring within harvest units for 2 or 3 years afterwards and then not again for 3 or more decades depending on specific landowner objectives. Additionally, there are a relatively small number of agricultural commodities in the subbasin that may apply pesticides on a similarly infrequent basis at specific times of the year. These agricultural practices also may not coincide with the standard spring and fall sample collection schedule.

Due to the sporadic nature of applications associated with the predominate lands uses in the subbasin and the broad pesticide application timing information provided, the potential for capturing pesticide residues from non-agricultural land uses in nearby water bodies may require a more tailored sampling approach that in other areas.

[2] Acreage and crops grown are based on 2017 USDA Census of Agriculture – Douglas County, Oregon
[3] Only pesticides detected in water quality sampling are listed.

What Pesticides Were Detected During the Study?

The majority of the pesticides detected during the South Umpqua are classified as herbicides (a substance that is toxic to plants and used to control unwanted vegetation) or herbicide breakdown products. Three pesticides other than herbicides were also detected including: carbaryl (an insecticide with the trade name Sevin), propiconazole (a fungicide common trade name Tilt or Banner) and DEET (an insect repellent). Carbaryl and propiconazole were detected in only 1-2% of all samples collected. The herbicides detected with the greatest frequency generally share a relatively long half- life (the time it takes for the chemical to naturally decrease in concentration by one-half). Therefore, there is a higher probability that these herbicides would be detected in the environment one to three months after initial application occurred, than pesticides with a short half-life. The group of herbicides with a longer half-life includes ones that are commonly used in both agriculture and commercial forestry, such as atrazine[4], hexazinone, glyphosate, 2,4-D, metsulfuron-methyl and simazine. Herbicides used on land in the pilot study area with short half-lives include: imazapyr, and sulfometuron methyl.

Table 4: Pesticides Detected During South Umpqua Pilot Study

Herbicide	Common Name	Detection Frequency	Highest Concentration ug/L	Aquatic Life Ratio	Aquatic Life Benchmark ug/L
Atrazine	AAtrex	47%	.0897	.0897	1
Hexazinone	Velpar	17.5%	.191	.0272	7
Sulfometuron methyl	Oust	16.4%	.174	.3867	.45
DEET		10.3%	1.06	.00003	37500
Metsulfuron-methyl	Escort	9.8%	.07	.1944	.36
Desethylatrazine	N/A	9.79%	.0128		N/A
Imazapyr	Arsenal	7.2%	.175	.0005	24
Acifluorfen	Blazer	1.9%	.2		N/A
2,4-D	Various	1.75%	.3	.001	299.2
Glyphosate	Roundup	1.75%	.0596	.000005	11900
Bromacil	Hyvar	1.57%	.146	.0215	6.8
Tebuthiuron	Spike	1.57%	.365	.0073	50
Carbaryl	Sevin	1.55%	.0121	.0242	.5
Oxyfluorfen	Goal	1.55%	.0275	.0948	.29
Propiconazole	Banner	1.03%	.135	.01667	21
Simazine	Princep	1.03%	.00851	.0014	6

What Do the Pesticide Detections Mean?

Results of pesticide sampling are analyzed using two primary indicators, frequency of detection (the percent of samples in which a pesticide is detected) and concentration of that pesticide in a water quality sample. In order to assess the potential impacts of a given concentration in water, the U.S. Environmental Protection Agency (EPA) has developed Aquatic Life Benchmarks (ALB). Concentrations detected at or

[4] Atrazine is a federally designated restricted use pesticide. Only applicators that have been approved through testing may apply this herbicide.

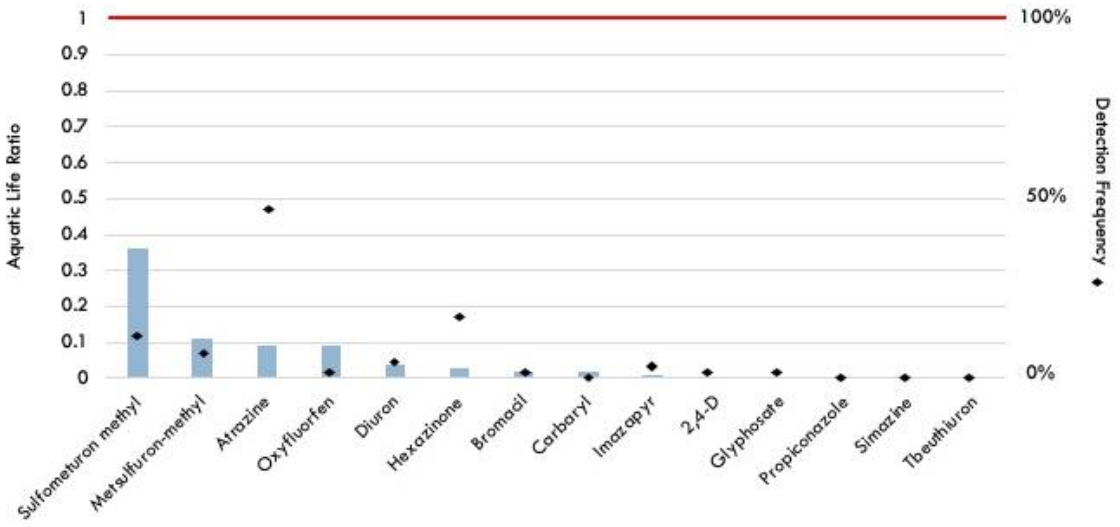
above the EPA (ALB) pose a significant threat to aquatic life (fish, aquatic invertebrates, vascular plants (ferns, grasses, bushes) and non-vascular plants (mosses, algae).

In evaluating frequency of detection, the Water Quality Pesticide Management Team considers a detection frequency above 36% as an indication that the detected pesticide would be considered a moderate level of concern.

The aquatic life ratio is the highest concentration detected for a specific timeframe, divided by the lowest EPA aquatic life benchmark for that pesticide. For example, if the highest concentration detected for the herbicide atrazine during the time frame evaluated was 0.025 ug/L the aquatic life ratio would be: 0.025/1 = 0.025. An aquatic life ratio of 1.0 would indicate that the aquatic life benchmark was met, an aquatic life ratio above 1.0 would indicate that the benchmark had been exceeded. The WQPMT has determined that concentrations that are over 50% of a benchmark value (aquatic life ratio greater than 0.5) are of high concern based on the WQPMT's *Designation Matrix Based on Water Monitoring Data (2019)* for determining pesticides of high and moderate concern. The 50% threshold provides a safety factor for grab sample results that may miss peak concentrations of pesticides, and is an approach used by other state and federal agencies.

The results of the South Umpqua Pilot Study indicated that there were no aquatic life ratios above 0.35. This means that the highest concentration detected (sulfometuron methyl) was approximately one third of the EPA aquatic life benchmark and therefore posed a low threat to aquatic life species[5]. The highest concentration detected for the herbicide atrazine was less than a tenth of the EPA aquatic life benchmark and thus, by itself, posed minimal threat to aquatic life. The frequency of detection was the highest for the herbicide atrazine. In some sub-watersheds the detection rate approached or exceeded 60% (Lookingglass Creek @ Hwy 42, Winston, OR and Lookingglass Creek @ bridge Happy Valley Rd).

Figure Two: Aquatic Life Ratio for Detected Pesticides South Umpqua Pilot Study 2014-2018



[5] Desethylatrazine is a degradate of atrazine and simazine. It currently does not have an aquatic life benchmark and therefore it is impossible at this time to calculate an aquatic life ratio. DEET is an insect repellant its appearance in water quality samples in many watersheds is still being investigated.

In all cases pesticide concentrations fell below 50% of the aquatic life benchmarks, and therefore by themselves likely pose low risk to aquatic species. The high frequency of detection for the herbicide atrazine raises it to a moderate level concern due to its continuous presence and continuous exposure to aquatic species coupled with the atrazine breakdown product desethlyatrazine and the herbicide simazine. Atrazine and simazine are both of triazines and can be evaluated together along with their breakdown products to assess total aquatic life exposure.

What are the Next Steps?

The results of the pilot study indicate that no pesticide has been detected approaching an aquatic life benchmark. One pesticide (atrazine) has been consistently detected at frequencies that raise it to a moderate level of concern based on the WQPMT's *Designation Matrix Based on Water Monitoring Data (2019)* for determining pesticides of high and moderate concern.

To address this concern the Water Quality Pesticide Management Team (WQPMT) suggests several actions be considered in the South Umpqua. These suggestions are:

- Consider additional evaluation or assessment into the types of registered uses of atrazine in the subbasin and specific watersheds.

- Based on the results of the evaluation, education and outreach strategies should be developed for user groups in the South Umpqua pilot area and coordinated with local partners. The education would focus on ways of reducing off-target movement of atrazine and other herbicides. This program would also provide information on newly adopted statute(s) regrading buffers for aerial application of forest herbicides.

- In concert with state agencies and the WQPMT, Partners for Umpqua Rivers (PUR), Douglas Soil and Water Conservation District, Oregon State University Extension, and the Cow Creek Band of Umpqua Tribe of Indians and private landowners evaluate the utility of alternative monitoring techniques that could provide additional information on the link between pesticide use and occurrence in waterbodies. This group would also provide guidance regarding the necessity for any future monitoring within the South Umpqua watershed.