The Middle Rogue
Pesticide Stewardship Partnership
Strategic Plan

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September 2019

This project was supported by
Oregon Department of Agriculture
Grant Agreement: ODA-4063-GR

Acknowledgements

The Rogue River Watershed Council (RRWC) would like to thank the Middle Rogue Pesticide Stewardship Partnership Coordinating Council, local stakeholders, partner organizations, and others that have contributed to the development of this strategic plan and provided reviews: Kora Mousseaux, Clint Nichols, Jenna Sanford, , and Randy White of the Jackson County Soil and Water Conservation District; Mary Halbleib and Rick Hilton of the OSU Southern Oregon Research and Extension Center; Frances Oyung of Rogue Valley Sewer Services; Craig Harper of the Medford Water Commission; Greg Stabach of the Rogue Valley Council of Governments; Donna Chickering, Alexis Larsen (previously), and Sarah Sauter (previously) of the Rogue River Watershed Council; Eugene Weir of the Freshwater Trust; Frank Baratta of Jackson County; Andy Smith of the Grange Co-Op; Steve Wetmore of the Oregon Department of Forestry; Kevin Masterson of the Oregon Department of Environmental Quality; Kirk Cook of the Oregon Department of Agriculture.

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1. Background and Context

Located in Southern Oregon, the Rogue River Basin has experienced steady growth based upon the development of natural resources since European settlement in the 1850's. Historically, the local economies were based on resource extraction. Mining, agriculture (especially orchards), forest products, and ranching represented the original sources of income in the region. In recent decades, the economy has shifted from natural resource extraction (agriculture, mining, forestry) to manufacturing, processing, and service and tourism industries.

Renowned for its wild salmon and steelhead runs, white water rafting, and rugged scenery, the Rogue River is one of the original eight rivers named in the Wild and Scenic Rivers Act. During part of the year, the Rogue River provides drinking water for over 200,000 residents in Jackson and Josephine Counties. Decades of development in the Rogue Basin have resulted in declining water quality and depressed wild salmon populations. The Southern Oregon/Northern California Coast Coho Salmon was listed as a federally threatened species under the Endangered Species Act in 1997. Achieving high water quality in the Middle Rogue Watershed is vital to recovery of Coho Salmon, important for the local economies, and for the sustainability of the valley's drinking water supply.

Water quality in the Rogue Basin is generally considered fair to good. However, various pollutants of concern are present. High temperature, fine sediment, low dissolved oxygen concentration, and abnormal pH levels have been identified as potential stressors to aquatic life. In tributaries within the Middle Rogue, such as Bear Creek, elevated levels of fecal coliform and *E.coli* are also present.

Due to the importance of water quality, many organizations in the Middle Rogue are currently monitoring the physical, chemical, and biological parameters for water quality in an effort to gauge and meet compliance with state and federal standards. These standards drive the mission of the state's water quality program, which is to protect and improve Oregon's water quality. This is achieved by developing and implementing programs that effectively identify issues and addressing them through collaborative approaches. The Middle Rogue Pesticide Stewardship Partnership (MRPSP) is one of those programs.

1.1. Oregon's Pesticide Stewardship Partnerships Program

The Oregon Department of Environmental Quality (ODEQ) formed the Pesticide Stewardship Partnership (PSP) program in 1999 as a pilot project in Hood River after pesticides were found to exceed water quality standards. Rather than taking a regulatory approach, such as developing a Total Maximum Daily Load (TMDL) to achieve water quality standards, DEQ partnered with local growers to create a voluntary and collaborative approach to reducing pollution from pesticide use. This new approach leveraged tools, resources, and expertise to help landowners and applicators improve pesticide application and pest management practices.

The PSP program is central to achieving the goals of Oregon's Water Quality Pesticide Management Plan (State of Oregon, 2011). The Plan describes the policies, management measures and regulatory approaches that the State of Oregon uses to protect ground and surface water from contamination with pesticides currently registered and used in Oregon. The plan combines local expertise with water quality sampling results to promote practices and actions which protect surface and groundwater resources. The Oregon Water Quality Pesticide Management Team (WQPMT) is responsible for implementing the policies and procedures in the plan.

In 2013, the Oregon legislature approved resources needed to formally establish the PSP program. With funding secured, partnerships were established in locations throughout the state.

Key components of the PSP program include:

- Identifying local, pesticide-related water quality issues;
- Sharing water quality monitoring results early and often with local communities and all those who have a direct interest in the state's waters and its quality;
- Explaining data in relation to effects and water quality criteria or benchmarks;
- Engaging pesticide users and technical assistance providers to identify and implement solutions;
- Using long-term monitoring to measure success and provide feedback to support water quality management.

Program success is dependent upon collaboration between regulatory agencies, landowners, other stakeholder organizations and applicator groups. This collaborative process is key to understanding current pesticide application practices that can affect water quality and how to relay best management practices to achieve local objectives. When pesticide detections in local waters exceed established benchmarks, the local PSP evaluates the need for changes in local pesticide selection and application practices. This annual feedback process informs the local PSP on the effectiveness of its program and outreach strategies to employ the following year.

1.2. Middle Rogue Pesticide Stewardship Partnership

The Jackson Soil and Water Conservation District (JSWCD) garnered strong support from a partnership network to initiate a PSP pilot project area and support the necessary monitoring. As a result, the Middle Rogue Pesticide Stewardship Partnership formed in 2014 to identify potential concerns and improve water quality affected by pesticide use in the Middle Rogue area. The MRPSP brings together partner organizations, agricultural producers, drinking water providers, local and state agencies, and Oregon State University technical providers to encourage voluntary changes in pesticide use and management practices, while also promoting best management practices in all users of pesticides from licensed applicators to backyard gardeners.

In 2016 Rick Hilton and Mary Halbleib, of Oregon State University Southern Oregon Research and Extension Center (SOREC), applied for the first MRPSP grant, Pesticide Management Decision Support and Education. The proposal was funded ($40,854) by Oregon Pesticide Stewardship Partnership Technical Assistance Program to support work in 2016-17 by a team of OSU faculty to lead outcome visioning sessions to gather insight into the educational needs, generate locally-relevant decision-support tools, and conduct pesticide applicator and sprayer calibration workshops. In 2018 the Rogue River Watershed Council led the development of a second proposal, Middle Rogue PSP Strategic Communication and Feedback, to broaden the partnership with the Jackson Soil and Water Conservation District. In 2018-19 this support expanded the PSP outreach and resources to new audiences, and provided leadership for the PSP strategic plan.

The MRPSP has no regulatory authority over activities within the Rogue River basin. However, there are multiple federal, state, and local authorities that do have existing and proposed rules, regulations, and programs that address pesticide use. The MRPSP works to provide outreach on and encourage compliance to said rules and regulations (Table 2).

Generally, during the 2015 – 2017 biennium pesticide concentrations within the MRPSP watershed were of low concern with the exception of imidacloprid, diazinon and oxyfluorfen (Table 1). A five-year trend analysis of pesticide concentrations by ODEQ indicated a downward trend for the herbicide diuron. Upward trends were indicated for glyphosate and its metabolite AMPA, oxyfluorfen and sulfometuronmethyl. The data collected during that period provided information allowing for analysis of pesticide applications on a variety of land uses within the MRPSP watershed.

Table 1. Water quality data summary 2015 – 17 biennium (State of Oregon, 2018).

Pesticide	Type	Benchmark Value µg/L	No. of Analysis	No. of Detections	Max. Conc. µg/L	Average Conc. µg/L	Percent Detections	Percent of Bench-mark (Max. Conc.)
2,4-D	H	299.2	37	4	.3	.0195	10.8	0.1
2,6-dichlorobenzamide	M	NA	151	5	.0367	.00097	3.3	NA
Acetamiprid	I	2.1	151	2	.0104	.00012	1.3	.5
AMPA	M	249500	36	30	.825	.1430	83.3	0
Atrazine	H	1	151	2	.0071	.00059	1.3	.7
Carbaryl	I	.5	151	1	.0073	.00005	.7	84.9
Chlorpyrifos	I	.041	151	1	.034	.00023	.7	19609.8
Deisopropylatrazine	M	NA	151	1	.0049	.00003	.7	NA
Diazinon	I	.05	151	2	.356	.0046	1.3	712
Dichlobenil	H	30	151	6	.0543	.0017	4	.2
Diuron	H	2.4	151	71	.782	.0322	47	32.6
Fluridone	H	480	151	2	.163	.0017	1.3	0
Glyphosate	H	1800	36	19	.49	.0906	52.8	.0
Imazapyr	H	24	151	16	.49	.017	10.6	2
Imidacloprid	I	.01	151	5	.0693	.0014	3.3	693
Oxyfluorfen	H	.33	151	17	.368	.0085	.7	111.5
Pendimethalin	H	5.2	151	1	.0257	.00017	1.3	.5
Prometon	H	98	151	2	.015	.00019	1.3	0
Simazine	H	2.24	151	2	.0454	.00005	1.3	2
Sulfometuron-methyl	H	.45	151	35	.0875	.00369	23.2	19.4
Triclopyr	H	19	37	1	.6	.00002	2.7	3.2

Pesticides highlighted in red are of high concern, pesticides highlighted in yellow are of moderate concern based upon frequency of detection and maximum detected concentration from July 1, 2015 through June 30, 2017 as compared to the EPA aquatic life benchmark.
F = fungicide, H = herbicide, I = insecticide, M = metabolite (breakdown product)

Based on monitoring results, diverse land uses, and a strong local partnership commitment, the WQPMT selected the Middle Rogue as the next long-term PSP project in 2016. The belief is that the MRPSP could play an important role in achieving the goal of continuing to reduce pesticide detection levels in the MRPSP area. As such, in 2017 the MRPSP began the process of developing a Strategic Plan.

The overall purpose of the Strategic Plan is to identify strategies the partnership can take to reduce pesticide contamination in the Middle Rogue as evidenced by reduced detections, including a strategy to communicate best management practices for pesticide use to a wide-range of pesticide users. This strategic plan is intended to be a "living" document and will be evaluated and updated, as necessary, by the MRPSP coordinating group.

Table 2. State Agencies with legal authority over pesticide use in Oregon.

Agency	Description	Legal Authority
Oregon Department of Agriculture (ODA)	Addresses Registration, Distribution and Use of pesticides in Oregon as well as Licensing and Certification for Pesticide Applicators and Operators. Establishes policies, guidelines and specific requirements and restrictions for the implementation of ORS 634. Authorizes ODA to develop and implement an Agricultural Water Quality Management Area plan for agricultural and rural lands where required by state or federal law. The department has developed and adopted agricultural water quality management area plans in the applicable geographic areas. These plans are reviewed periodically. Establishes policies, guidelines and specific requirements for the development and content of plans as allowed in ORS 568. Coordinates program activities of the State's Soil, Water & Conservation Districts (SWCDs).	FIFRA - Oregon Revised Statutes (ORS) 634 Oregon Pesticide Control Act Oregon Administrative Rules (OAR 603-057) Agricultural Water Quality Management Act; (ORS 561.191); Oregon Revised Statutes (ORS 568) Oregon Administrative Rules (OAR 603-090)
Oregon Department of Environmental Quality (ODEQ)	Directs DEQ to cooperate with other agencies of the state to prevent or mitigate pollution of waters of the state.	Clean Water Act; Oregon Revised Statutes (ORS) 468B; OAR 340-012; OAR 340-040; OAR 340-041;OAR 340-042
Oregon Health Authority (OHA)	Administers and enforces drinking water quality standards for public water systems in the state of Oregon. The drinking water program emphasizes prevention of contamination through source water protection, technical assistance to water systems and training of water system operators.	The Safe Drinking Water Act (U.S.C. §300f et seq.); Oregon Revised Statutes (ORS 448)
Oregon Department of Forestry (ODF)	Sets policies, procedures, and standards for forest practice regulation in Oregon. Grants the Oregon Board of Forestry exclusive authority to adopt further procedures and standards in the forest practice rules. Prescribes additional standards beyond those protections provided by the EPA/FIFRA for natural resource protection when chemicals (including pesticides) are used in forest environments.	Forest Practices Act (ORS 527.610 to 527.770, 527.990 & 527.992) Forest practice rules (OAR 629-620)

Adapted from the State of Oregon Pesticide Management Plan for Water Quality Protection (2011)

2. Description of the Area

2.1. Middle Rogue PSP Area

The MRPSP area encompasses approximately 360 square miles of primarily agriculture, forested, and urban lands spread across the Bear Creek Watershed in southern Oregon. The headwaters of Bear Creek originate from Emigrant Creek, a reservoir near Ashland and formed by the confluence of Emigrant Creek and Walker Creek.

The southern Oregon metropolitan population is 217,479, the fourth largest in the state. Medford is the population center of the MRPSP area at 82,347 (U.S. Census, 2018). Other communities within the MRPSP are Ashland, Central Point, Jacksonville, Phoenix, and Talent (Figure 2). The climate in the MRPSP area is characterized by mild, wet winters and hot, dry summers. Average annual precipitation in Medford reaches approximately 18 inches. Peak summer temperatures occur in July and August, where on average they reach 90.7 degrees. An extensive network of greater than 700 miles of irrigation infrastructure and perennial streams flow through the watershed (Figure 3). The monthly mean discharge data from the Bear Creek gaging station show the highest average runoff occurring from December (156 ft3/s) through May (140 ft3/s).

Land management is a mixture of public and private lands (Figure 1). More than half of the watershed is privately owned (Table 3). The US Forest Service (USFS) manages lands in the upper watershed and the US Bureau of Land Management (BLM) manages a “checkerboard” pattern with private industrial forestry mixed through the high elevation lands. Agriculture is spread across the MRPSP area and is predominately pear orchards, field and vegetable crops, vineyards, grazing land, forage production, other enterprises, and an emerging agriculture product, cannabis. Hemp production in Jackson County is increasing and leads the other 36 counties in the state in total acres with 8,500 acres.

Within the MRPSP area, several tributaries flow into Bear Creek that travel through a variety of land use types. Specific to the MRPSP, 4 sub-basins, Jackson Creek, Larson Creek, Payne Creek and Wagner Creek, were selected for PSP monitoring. These sub-basins were selected because of the dominant land cover categories in each (Figure 1, Table 4) (USGS, National Land Cover Database, 2016). The headwater areas of the watersheds are comprised of mainly forest interspersed with patches of shrub lands. As the valley floor widens land use transitions to predominantly agricultural land and private ownership, including residential and industrial use.

Table 3. Middle Rogue PSP Area - Land Management

Watershed Name	Land Management (% of Total Watershed Area)			
	Private	BLM	USFS	Other
Middle Rogue PSP	77.2%	12.7%	9.7%	0.4%
Jackson Creek	88.0%	9.0%	2.0%	2.0%
Larson Creek	96.0%	4.0%	NA	NA
Payne Creek	99.0%	1.0%	NA	NA
Wagner Creek	62.0%	21.0%	17.0%	NA

Table 4. Middle Rogue PSP Area - Land Cover

Watershed Name	Land Cover (% of Total Watershed Area)								
	Barren Land	Cultivated Crops	Developed	Forest	Grassland	Open Water	Pasture/Hay	Shrub/Scrub	Wetlands
Middle Rogue PSP	0.38%	3.45%	6.41%	38.60%	6.18%	0.16%	10.53%	39.56%	1.10%
Jackson Creek	0.55%	3.72%	10.42%	37.94%	4.08%	0.04%	18.51%	24.73%	0.01%
Larson Creek	0.01%	7.33%	14.23%	11.78%	7.87%	0.00%	12.90%	45.82%	0.06%
Payne Creek	0.00%	23.74%	1.80%	0.70%	19.20%	0.00%	3.89%	50.67%	0.00%
Wagner Creek	0.11%	3.98%	5.02%	73.04%	2.65%	0.00%	3.64%	11.36%	0.20%

Figure 1. Middle Rogue PSP Area - Land Cover

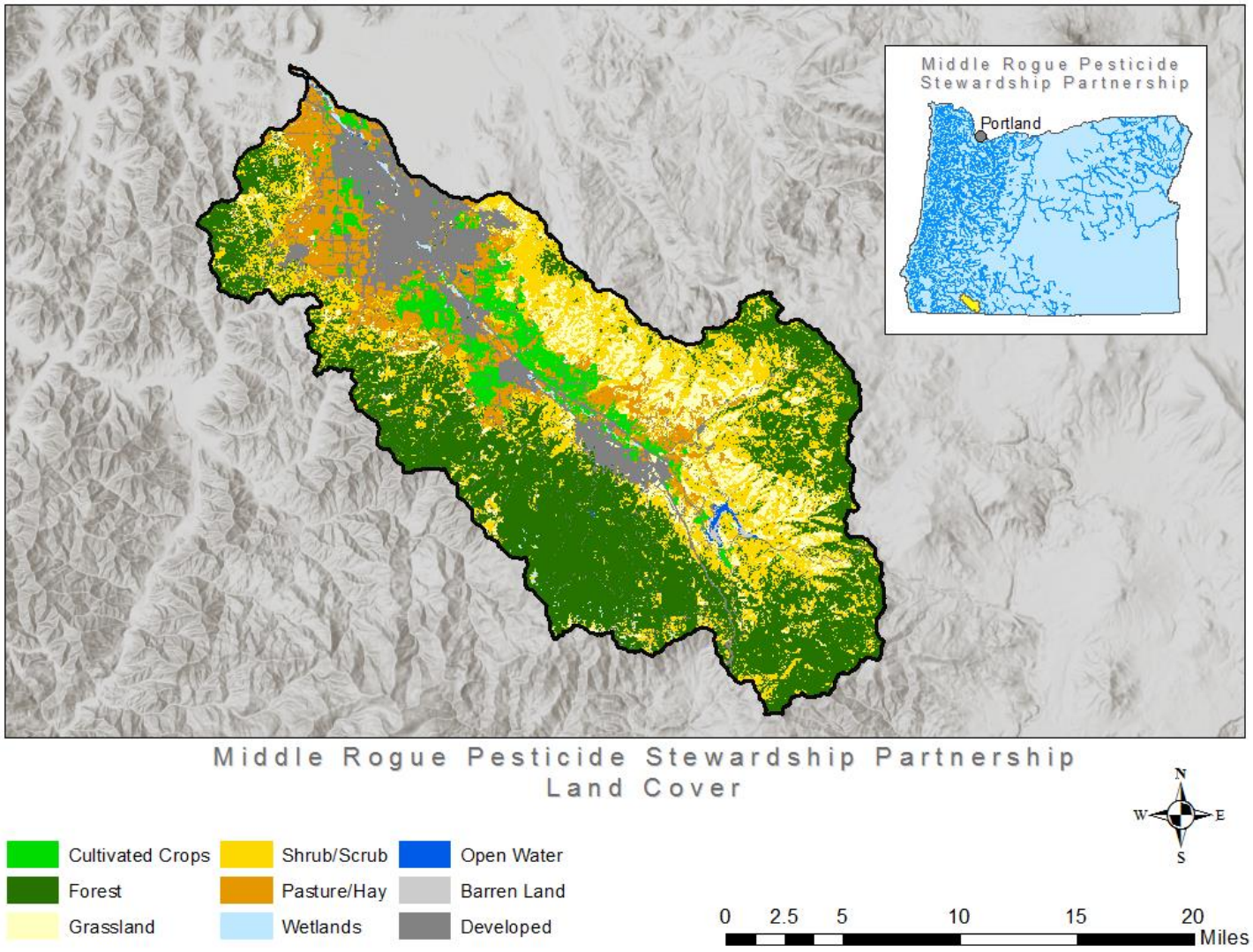


Figure 2. Middle Rogue PSP Area – Land Ownership

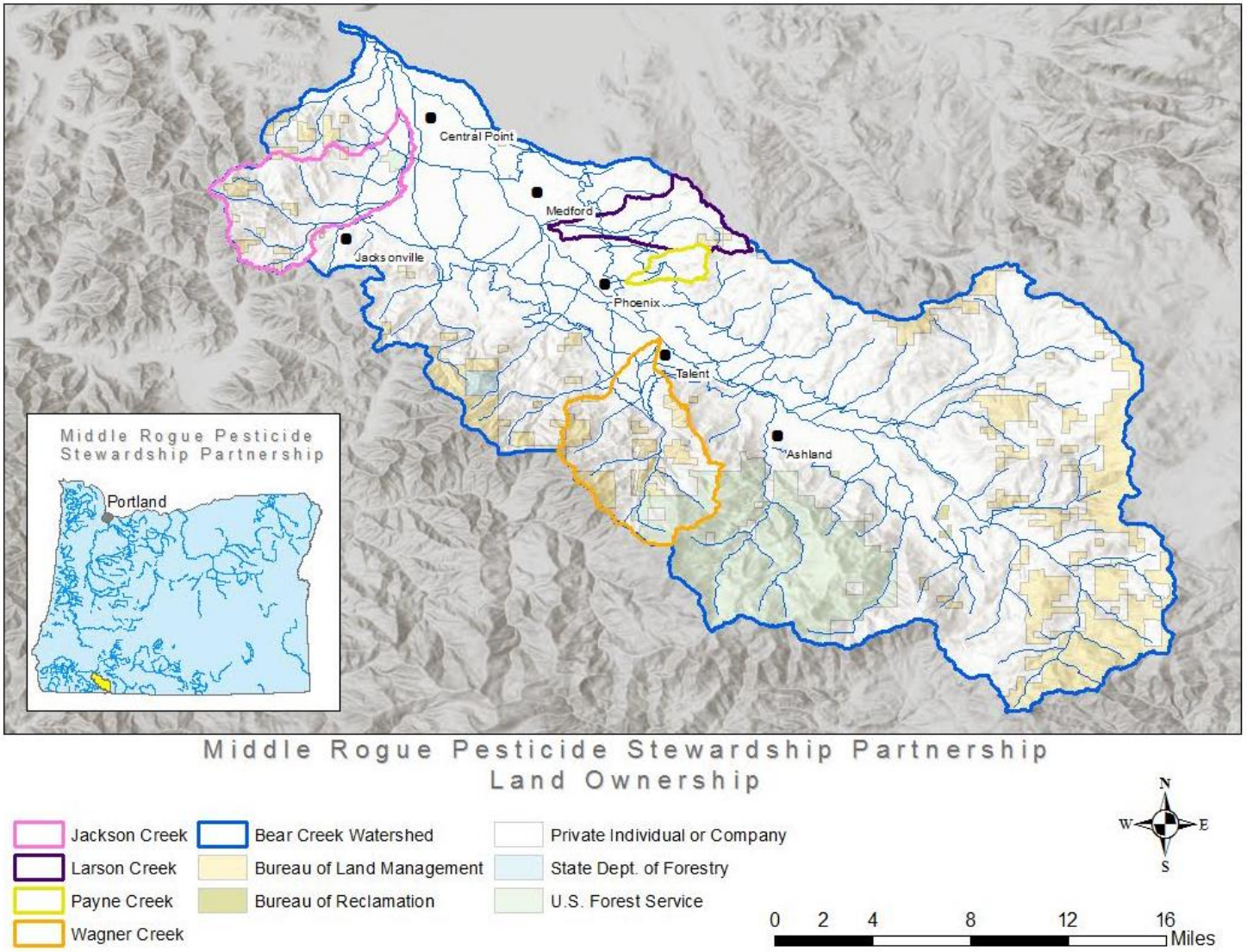
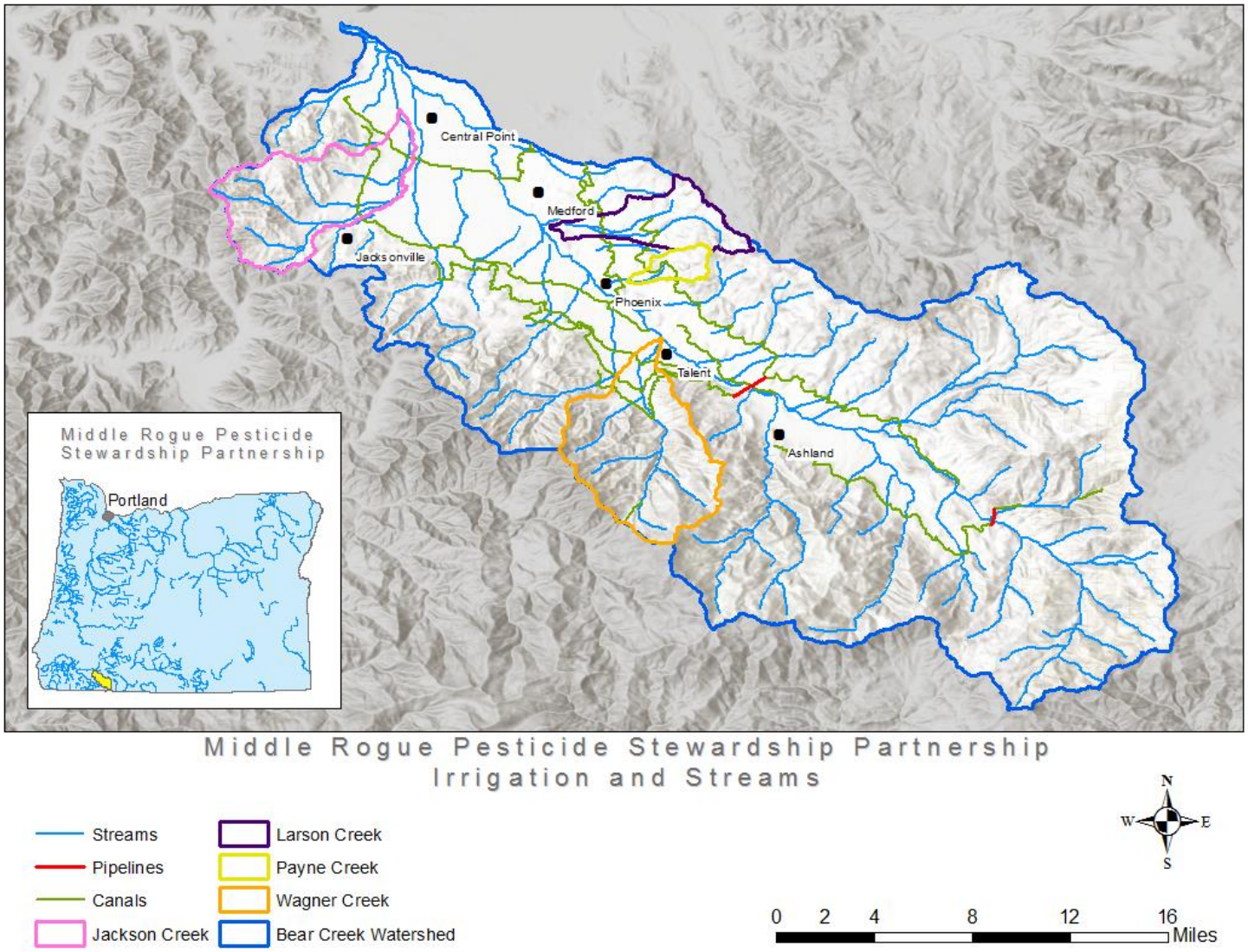


Figure 3. Middle Rogue PSP Area – Irrigation and Streams.



2.2. Jackson Creek Watershed

Jackson Creek Watershed is the second largest sub-watershed of the four sub-basins selected to monitor. It encompasses 12,395 acres and has 58 miles of irrigation infrastructure and streams (Figure4). Land cover is dominated by forest (37.9%) and grassland and pasture (20.7%). Ownership is a mixture of private and public lands (Figure 5, Table 3). Over half the watershed is in private individual or company ownership. The US Bureau of Land Management (BLM) manages a "checkerboard" pattern mixed with private ownership in the upper watershed. Developed land in the lower watershed is primarily urban. Agricultural lands are managed for grass and alfalfa hay, small grains (wheat and barley), vegetable crops, and hemp and cannabis. Two relatively small pear orchard blocks are located in the drainage, and vineyards are increasingly being planted in the area.

Figure 4. Jackson Creek Watershed Land Cover

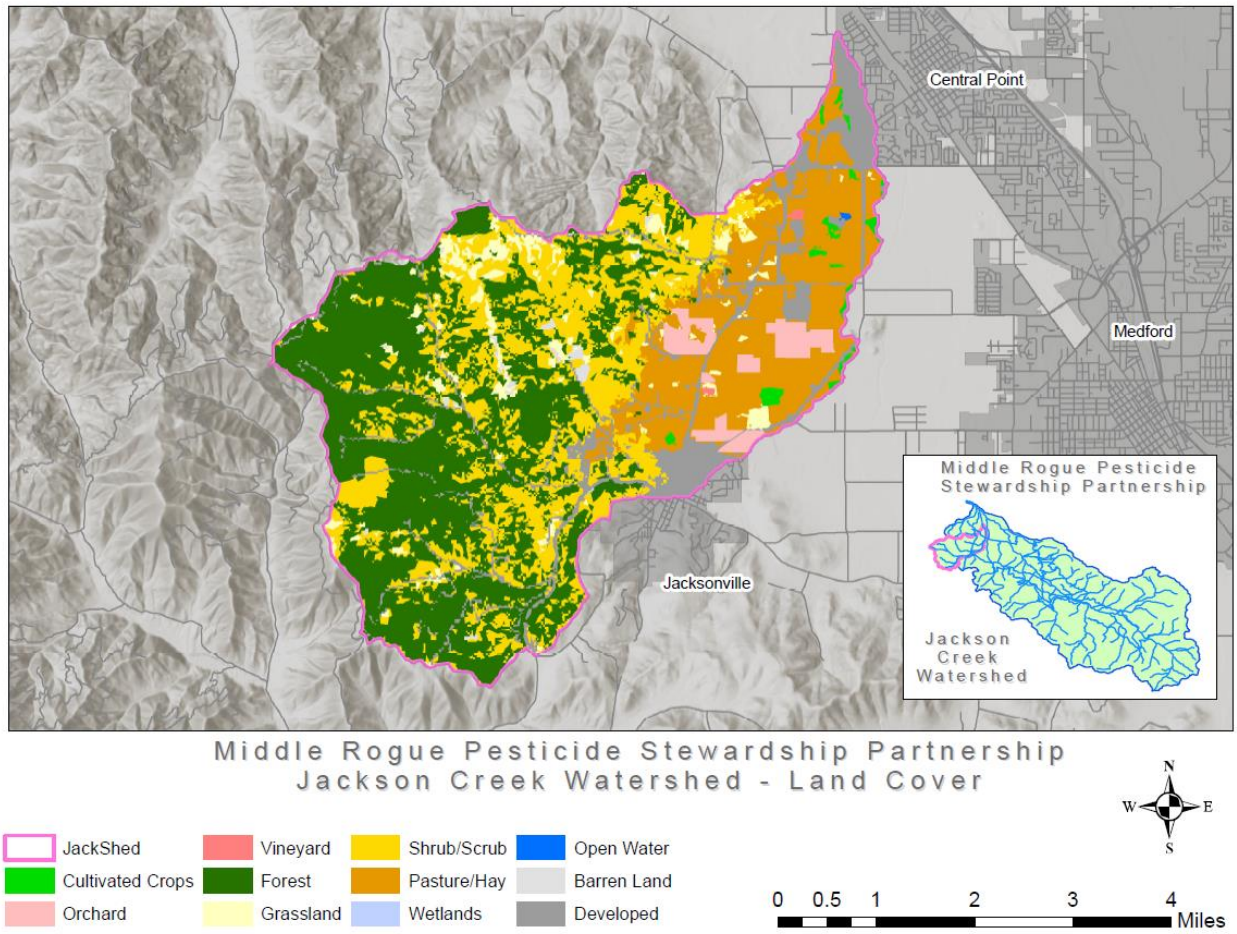
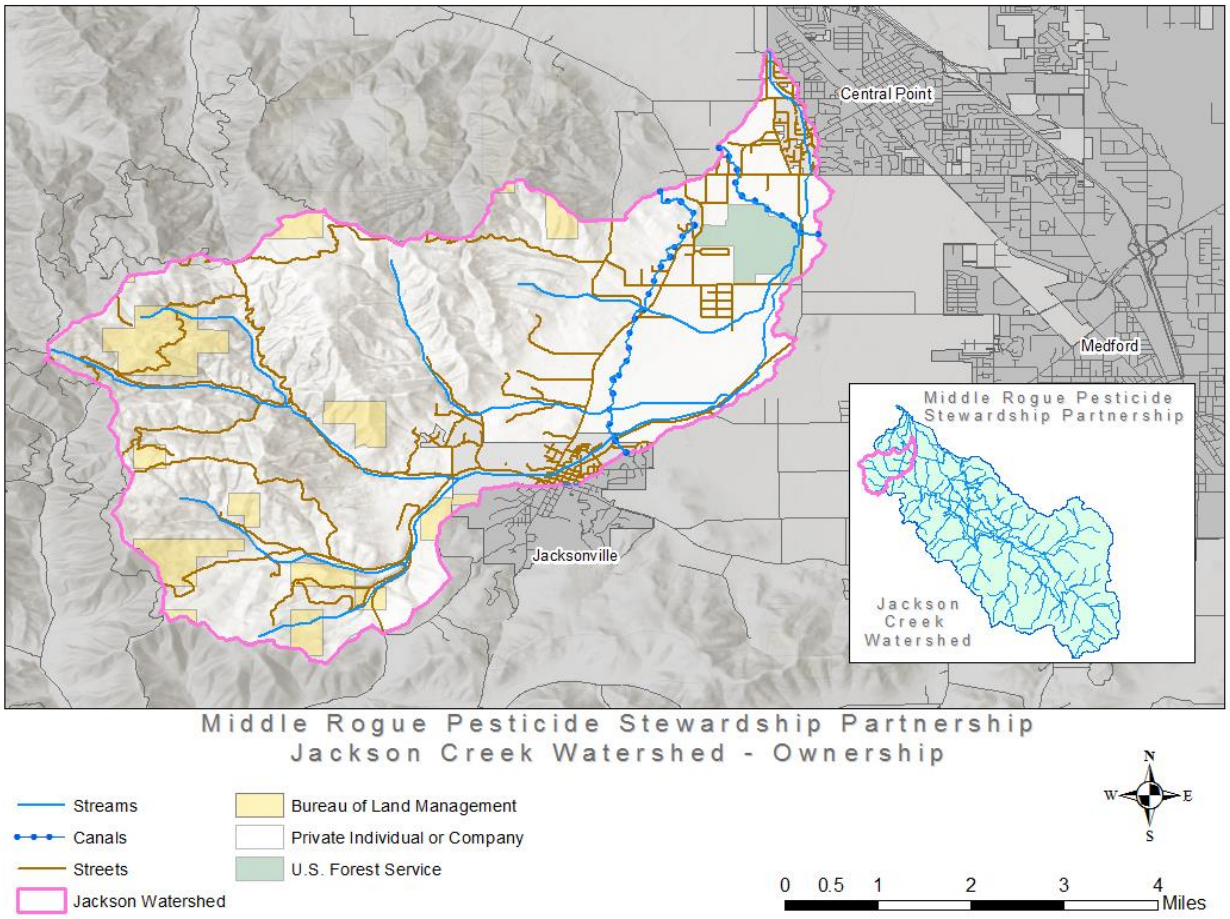


Figure 5. Jackson Creek Watershed – Land Ownership and Streams



2.3. Larson Creek Watershed

Larson Creek watershed is approximately 4,400 acres and contains 14.6 miles of irrigation infrastructure and streams (Figure 7). Ownership is nearly all private mixed with a small amount of BLM checkerboard acreage. Land cover is mostly shrub and scrub (62.2%) and grass and pasture (42.4%) (Figure 6, Table 4). Developed land in the lower watershed is primarily urban. Agricultural lands are managed for grazing and harvest of grass hay; one vineyard is located within the drainage.

Figure 6. Larson Creek Watershed – Land Cover

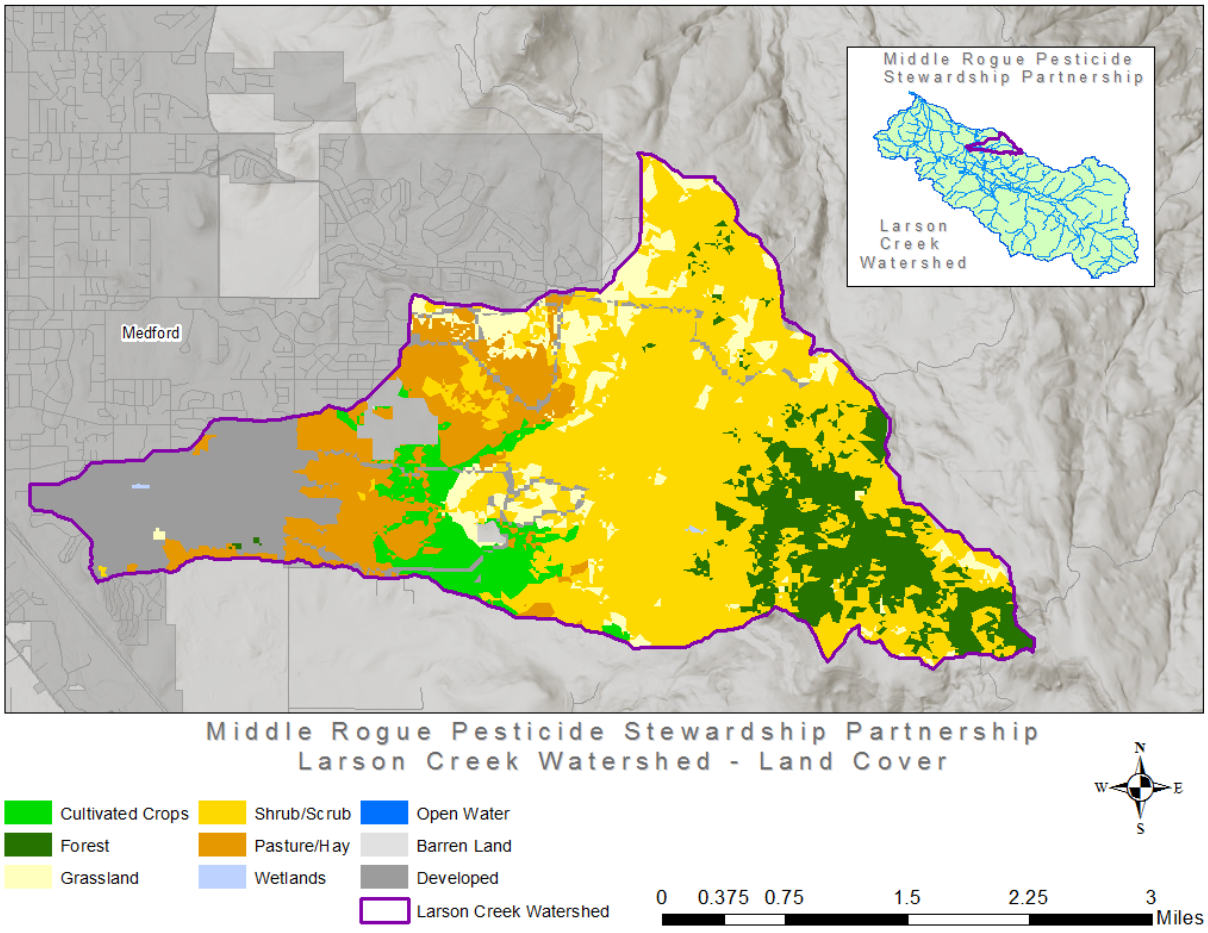
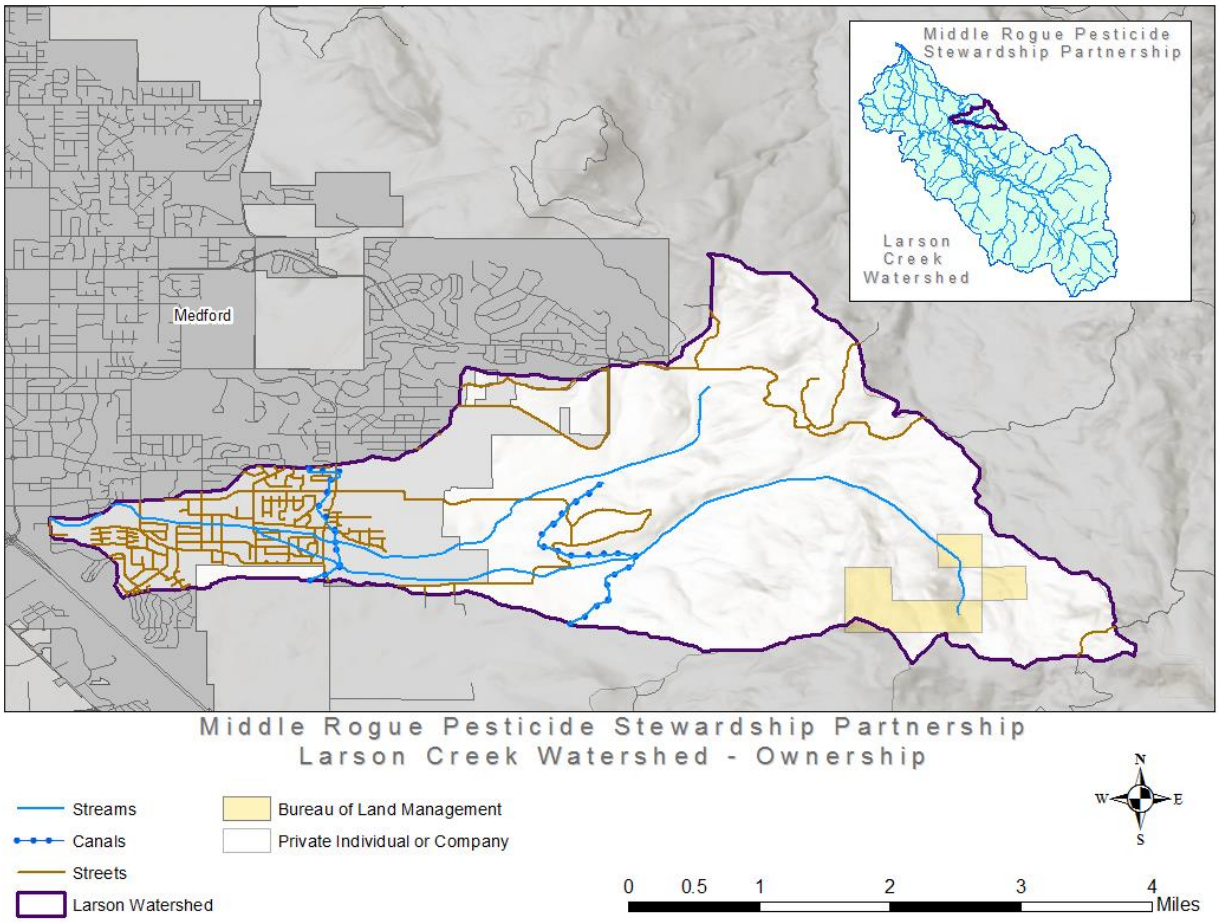


Figure 7. Larson Creek Watershed – Land Ownership and Streams



2.4. Payne Creek Watershed

Payne Creek watershed is approximately 1,500 acres and is the smallest sub-watershed of the four sub-basins selected to monitor (Figure 9). There is 3.7 miles of irrigation infrastructure and perennial streams located in the lower elevation part of the watershed. Ownership is nearly all private and land cover is a mixture of shrub and scrub (54.5%) and cultivated crops (18.9%) (Figure 8, Table 4). The lower part of the watershed is agricultural lands that are managed for grass hay, irrigated grazing land, and pear production. A portion of the orchard acreage has been converted to vineyard

Figure 8. Payne Creek Watershed – Land Cover

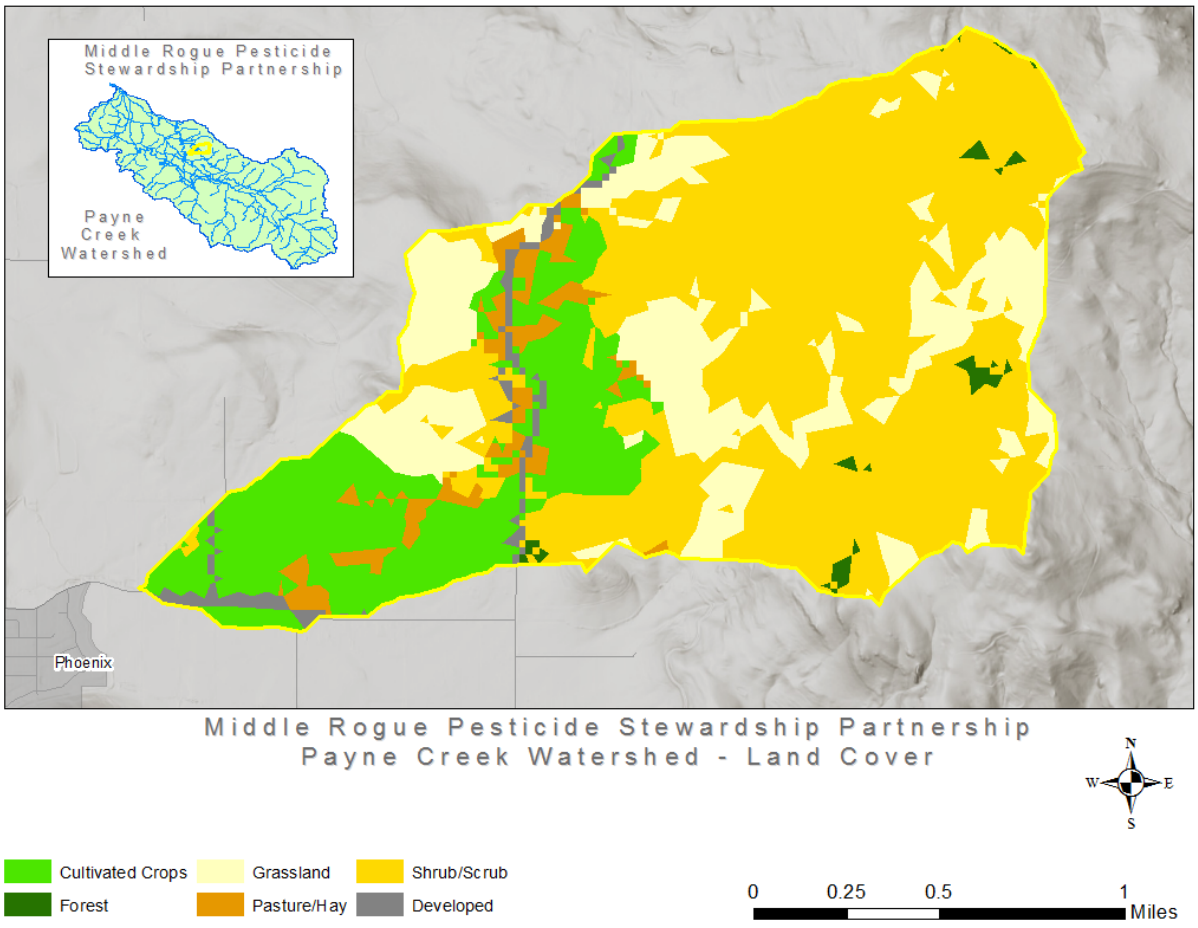
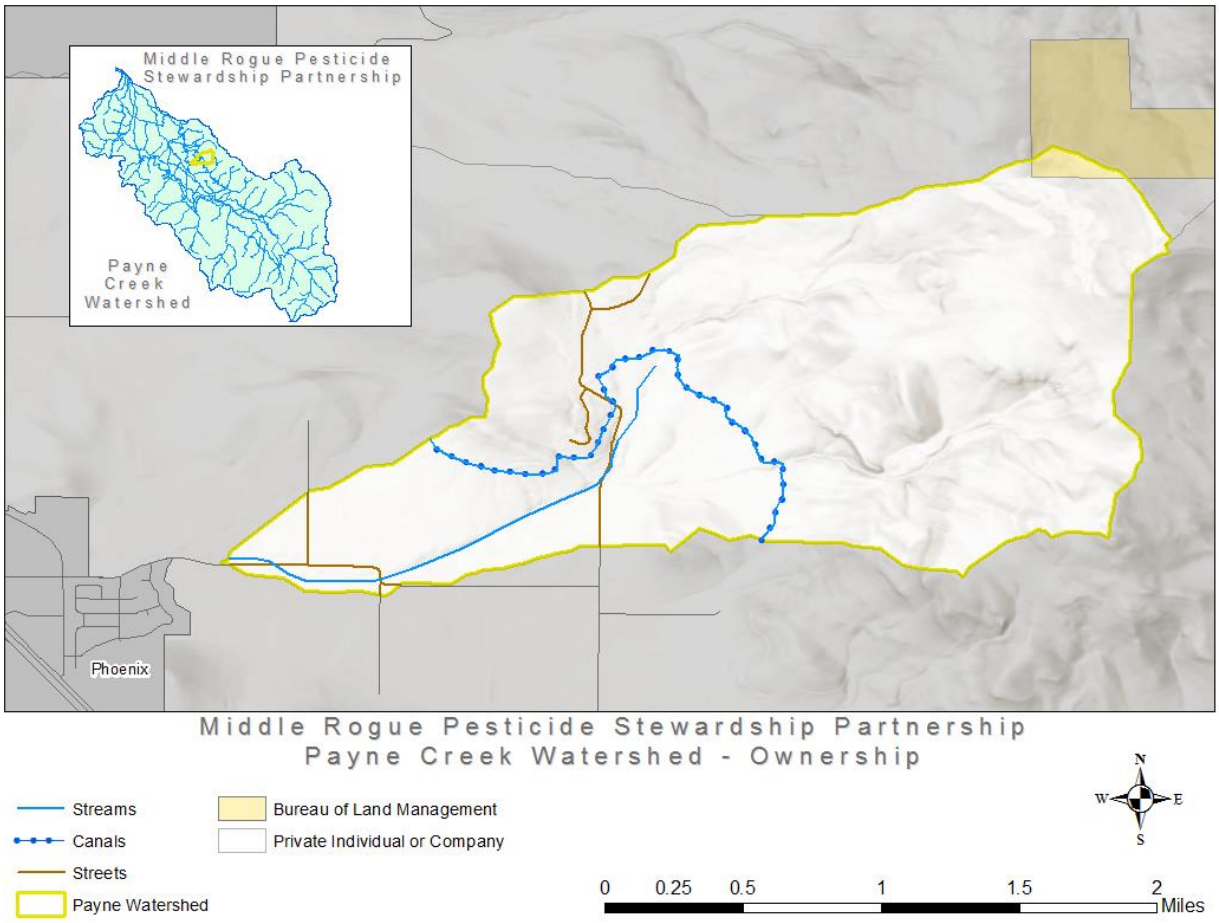


Figure 9. Payne Creek Watershed – Land Ownership and Streams



2.5. Wagner Creek Watershed

Wagner Creek watershed is 14,931 acres and contains 56.7 miles of irrigation infrastructure and streams (Figure 11). Land use is primarily forest (73.2 %) and agriculture (Figure 10). Ownership is a combination of federal lands, BLM (21%) and Forest Service (17%), and private individual or company (62%) (Figure 11). Industrial forestry occurs in the upper watershed on private ground. Agricultural lands are managed as vineyards, pear orchards, and grass hay or pasture with a minor acreage managed as vegetable crops. During recent growing seasons, cannabis and hemp acreage has increased replacing some of the other historic agricultural land use.

Figure 10. Wagner Creek Watershed – Land Cover

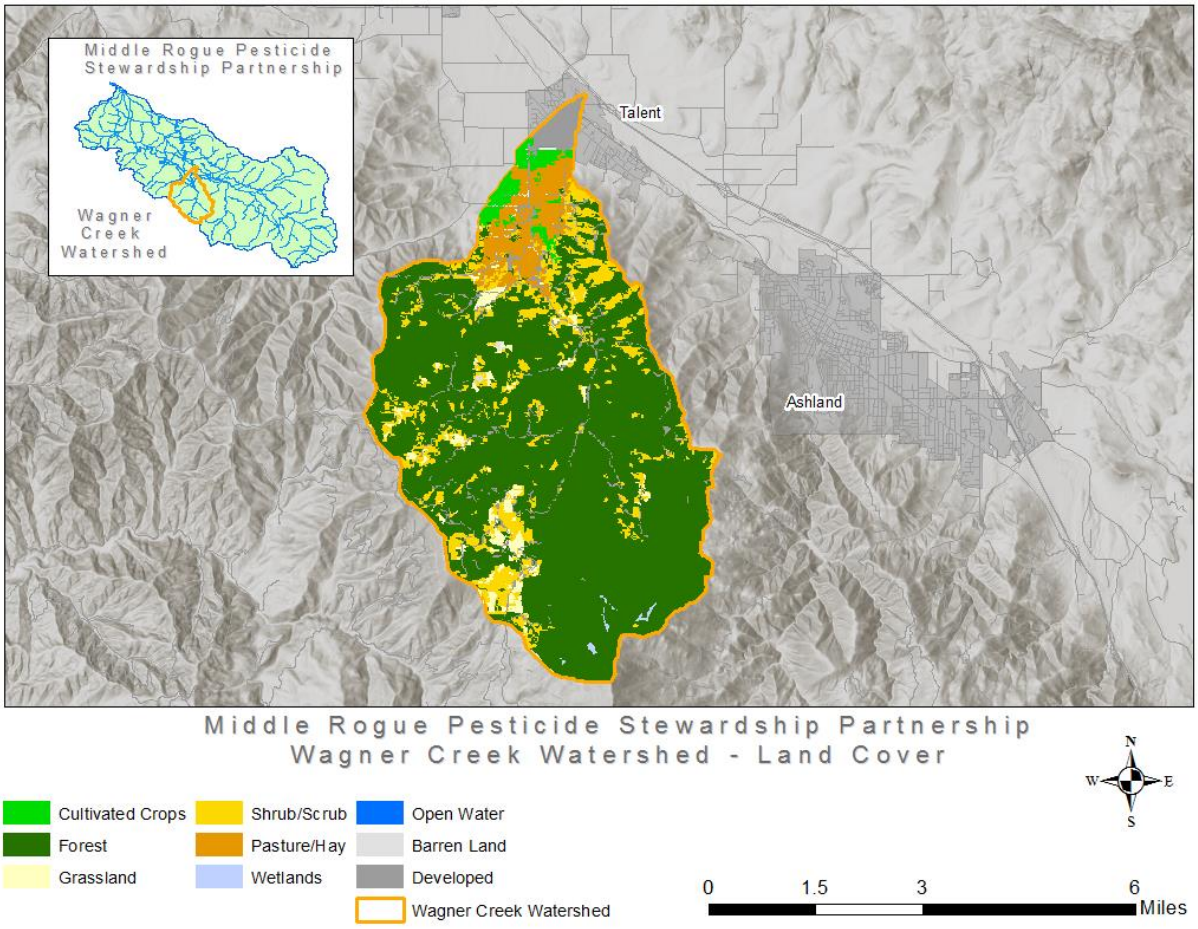
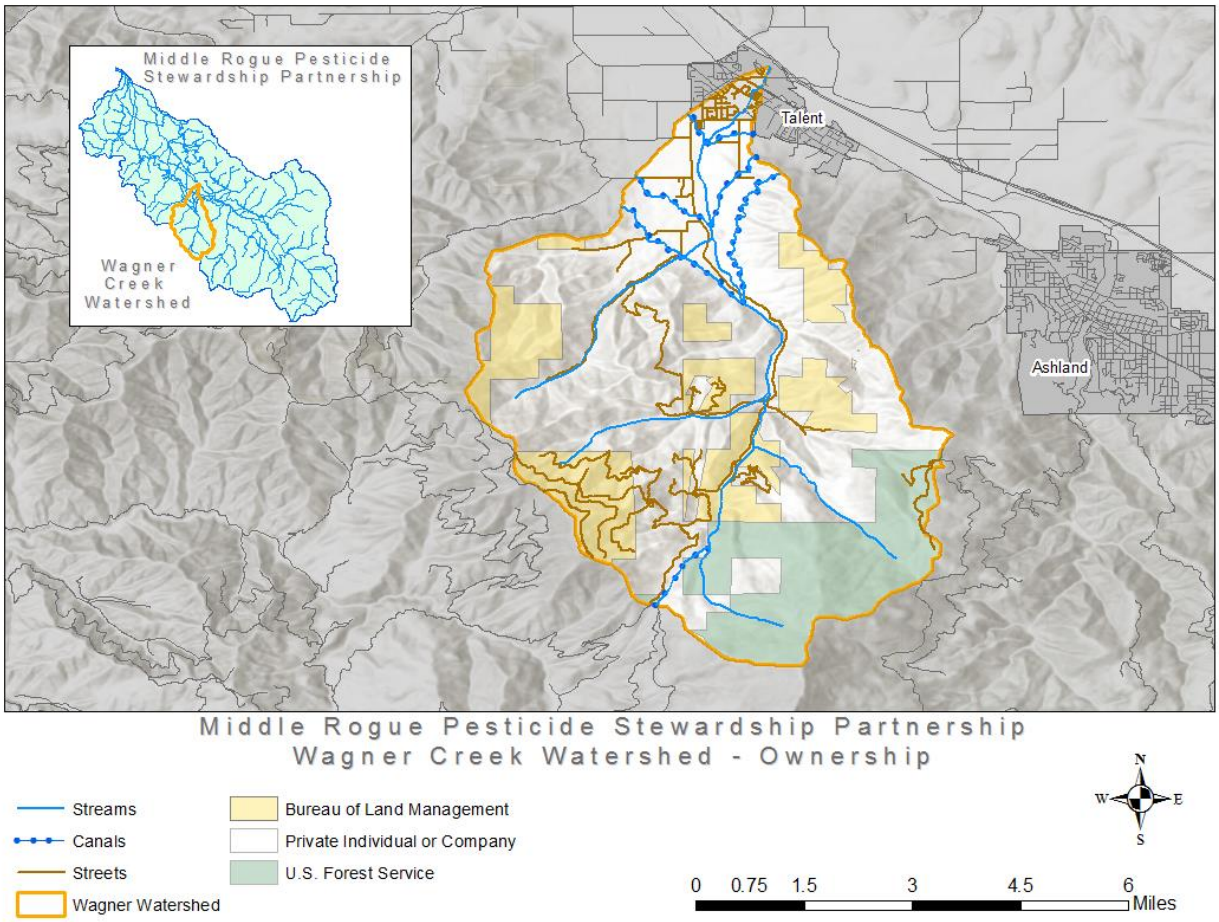


Figure 11. Wagner Creek Watershed – Land Ownership and Streams



3. Pesticides of Concern and Pesticides of Interest

Water quality samples collected by the MRPSP are analyzed by the ODEQ for approximately 130 pesticides. The primary factor considered is the concentration of a pesticide, and the frequency of detection, in water relative to a standard or benchmark. In-stream water quality standards do not exist for most current pesticides; therefore, analysis typically focuses on a comparison to the lowest EPA Aquatic Life Benchmark. The EPA standards are part of the Statewide Pesticide Management Plan, 2011.

Pesticide aquatic life benchmarks have been developed by the EPA for over 500 pesticides. These benchmarks are advisory in nature and are not intended to be used in a regulatory context. However, they provide a "uniform standard" by which the state and PSP's can evaluate and determine the local Pesticides of Interest (POI), Pesticides of Concern (POC) and, in the case of the MRPSP, the Local Problem Pesticide (LPP). Pesticides of Interest are those pesticides that have been identified to have the potential to occur at concentrations approaching or exceeding Federal, State, or Tribal human health or ecological reference points. Pesticides of Concern are a POI which is determined to approach or exceed, or known to approach or exceed, a human health or environmental reference point in a local area, thus posing possible risks to human or ecological life (Pesticide Management Plan for Water Quality Protection, 2011). The LPP is a POC pesticide that has been classified by the MRPSP as requiring particular attention and mitigation efforts.

Using state approved protocol, pesticides detected within the MRPSP are categorized by Oregon Department of Environmental Quality (ODEQ) using a decision matrix according to the detected concentration relative to aquatic life benchmarks and frequency of detection. Detected pesticides are categorized as Low, Moderate, or High Level of Concern (Table 5).

Table 5. ODEQ decision matrix applied to the 2018 detections within the MRPSP.

Middle Rogue Water Quality 2018
Detected concentration relative to aquatic life benchmarks (ALB) and frequency of detection

Frequency of Detection Last 5 Years \ Reference Level	≥ 1 Detections at or above 50% of acute ALB	≥ 3 Detections at or above 50% of chronic ALB	1-2 Detections at or above 50% of chronic ALB	No Detections over 50% of any ALB
100 – 65.1 %	High Level of Concern	High Level of Concern	High Level of Concern	Moderate Level of Concern
65 – 35.1 %	High Level of Concern	High Level of Concern	Moderate Level of Concern	Moderate Level of Concern Diuron Glyphosate/AMPA
0 – 35%	High Level of Concern Oxyfluofen	High Level of Concern Imidacloprid	Moderate Level of Concern	Low Level of Concern 2,6-dichlorobenzamide, Acetamiprid, Bromocil, DEET, Hexazinone, Imazapyr, Metsulfuron- methyl, Pendimethlin Prometon, Propiconazole, Simazine, Sulfometuron methyl, Tebuthiuron

The categorized monitoring data informs the local process of determining the local POC, POI, and the LPP. Using each of the previous three years of categorized data (Table 6) the individual pesticides are

each applied to a decision tree (Figure 12). The current MRPSP POC, POI and LPP are presented in Table 7.

The outcome of this process guides how the MRPSP will allocate resources for education, outreach and mitigation efforts. The MRPSP Technical Advisory Committee (TAC) will meet each winter and will review the results of the analysis of the previous year's monitoring data. The TAC identifies unique or emerging trends in pesticide detections, evaluates patterns of detections across the MRPSP area and progress toward reduction goals, and uses this information to set the annual monitoring schedule. Accordingly, the TAC will update the list of MRPSP POC, POI, and LPP and will adjust the following effort as needed. This process is critical to the success of the MRPSP in achieving the goals set forth in the strategic plan.

Table 6. Results of the ODEQ annual MRPSP analysis and categorization for 2016 – 2018.

Compound	Detection Frequency (Count)			Aquatic Life Ratio			DEQ Classification		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
2,4-D		17% (3)	7% (1)		0			Low	Low
Acetamiprid		2% (2)	8% (6)		0	0.32		Low	Low
Atrizine	1% (1)	1% (1)	1% (1)	0.01	0	0	Low	Low	Low
Bromacil			4% (34)			0.01			Low
Carbaryl	1% (1)			0.01			Low		
Chlorpyrifos		1% (1)			0.85			High	
Diazinon		2% (2)			3.24			High	
Dichlobenil	6% (4)	2% (2)		0	0		Low	Low	
Diuron	44% (31)	48% (39)	40% (31)	0.23	0.33	0.3	Mod	Mod	Mod
Fluridone	3% (2)			0			Low		
Glyphosate	33% (6)	59% (10)	27% (4)	0	0	0	Mod	Mod	Mod
Hexazinone			1% (1)			0.01			Low
Imazapyr	16% (11)	6% (5)	4% (3)	0.02	0	0.01	Low	Low	Low
Imidacloprid	3% (2)	4% (3)	5% (4)	3.49	6.93	17.7	High	High	High
Metsulfuron			17% (13)			0.16			Low
Oxyfluorfen	11% (8)	6% (5)	9% (7)	0.4	1.27	0.99	Low	High	High
Pendimethalin	1% (1)		4% (3)	0		0.01	Low		Low
Prometon	3% (2)		4% (3)	0		0	Low		Low
Propiconazole			1% (1)			0			Low
Simazine		2% (2)	1% (1)		0.02	0		Low	Low
Sulfometuron	34% (24)	11% (9)	8% (6)	0.14	0.18	0.06	Low	Low	Low
Tebuthiuron			1% (1)			0			Low
Triclopyr	6% (1)			0.01			Low		

Figure 12. MRPSP decision tree used to determine the local POC, POI and LPP.

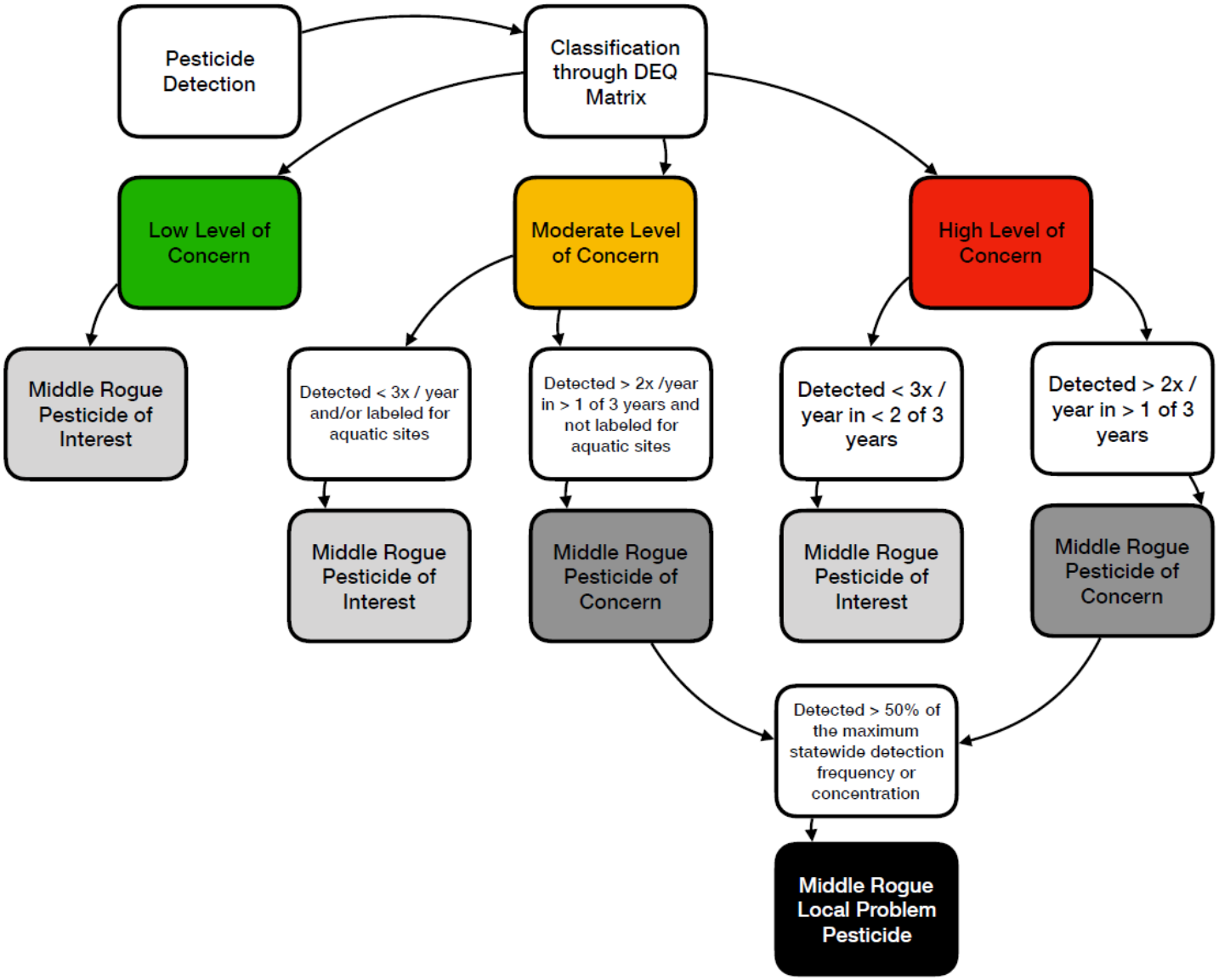


Table 7. 2019 – 2021 MRPSP Pesticide of Concern, Pesticide of Interest and Local Problem Pesticide.

MRPSP Pesticide of Interest		MRPSP Pesticide of Concern	MRPSP Problem Pesticide
2,4-D	Imazapyr	Diuron	Oxyfluorfen
Acetamiprid	Metsulfuron	Imidicloprid	
Atrazine	Pendimethalin		
Carbaryl	Prometon		
Chlorpyrifos	Propiconazole		
Diazinon	Simazine		
Dichlobenil	Sulfometuron		
Fluridone	Tebuthiuron		
Glyphosate	Triclopyr		

3.1. MRPSP Monitoring

As part of the MRPSP water quality is monitored for pesticide residues generally beginning in March and continuing through October. All water samples are analyzed by ODEQ laboratory and in accordance with sampling and analysis plans that are approved within ODEQ. The MRPSP is aware of the existence of other water quality data from credible sources who employ QA\QC equal to that used by ODEQ (USGS, Research Institutions). When that data is available, the MRPSP may choose to also include that information into watershed level pesticide decisions/recommendations. Water samples are collected by individuals from partner organizations who have been trained by ODEQ staff. ODEQ periodically conducts field visits on monitoring events to ensure that the protocols are being properly followed. The monitoring schedule is determined by the MRPSP TAC with consideration of the peak pesticide application periods, local rainfall patterns, and runoff periods in the spring and fall.

The benefits of monitoring under the PSP approach are:

- The process creates awareness through the interaction with outreach in the organizational feedback loop;
- The focus is on pesticides and locations with the greatest concerns;
- The process highlights where there are no problems in the watershed(s) while identifying areas of concern;
- The results provide real-world data to drive local outreach and decision making;
- The methodology incorporates clear environmental outcome measures to strive for.

Watersheds and locations to monitor in the MRPSP area are selected in consultation with local partners, and will continue to be representative of different land uses within the project area. In general, locations are chosen to segregate urban, agricultural and forestry land uses and are located at the downstream end of streams that drain a given land use. Eight initial sample locations on five tributaries to Bear Creek were selected in 2014 as the pilot project. The five tributaries, Wagner, Payne, Coleman, Griffin and Jackson creeks, were selected because they each have urban, agricultural and forestry land uses. Additional samples sites were located at Wagner Creek Park, in the upper reaches of Wagner Creek, at Valley View Rd. and Wagner Creek, and at Beall Rd. and Jackson Creek. Samples were collected every two weeks April through June and August through October.

The results of that effort showed relatively frequent detections of multi-use herbicides in multiple parts of the watershed. In 2015 the MRPSP TAC met and considered the 2014 results and evaluated where to establish five long term sampling locations. Jackson and Wagner creeks were chosen for long term sampling as they both have segregated blocks of forestry, agriculture and urban land uses. Sample sites were located at the downstream end of a land use (urban, agriculture or forestry) to attempt to understand pesticide runoff generated from that land use. One site, Jackson Creek at Bramson was selected to be sampled for glyphosate.

Table 8. MRPSP sample locations Fall 2015-Fall 2016.

Station ID	Location Description
12719	Jackson Creek at Beall Lane
38280	Jackson Creek at Bramson Lane
23074	Wagner Creek at mouth (Bear, Rogue)
38281	Wagner Creek at Wagner Creek Park
38282	Wagner Creek at Wagner Creek Trail

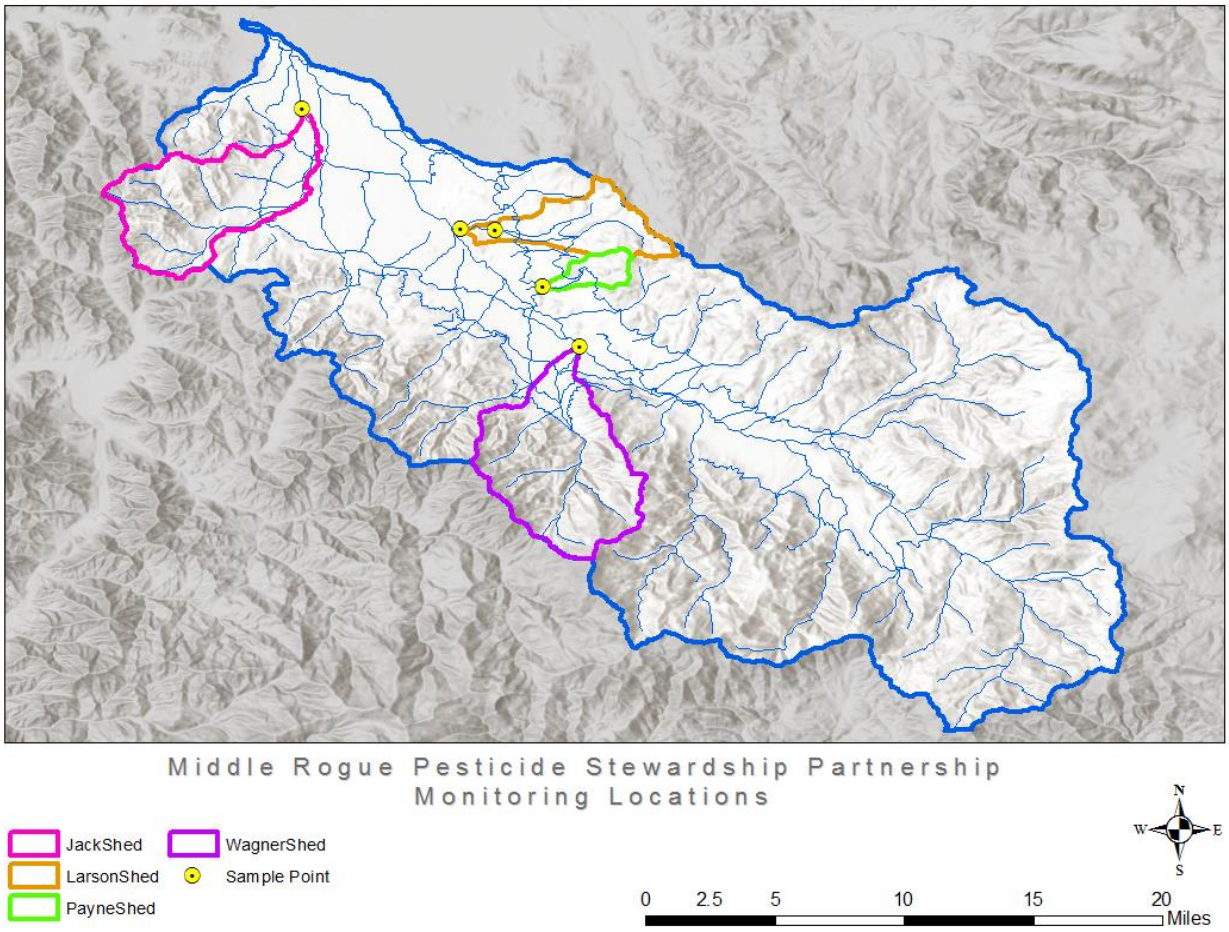
All the initial sample sites were located on the west side of Bear Creek and after two years of sampling, it was realized that these did not adequately represent orchards and vineyards. To compensate, beginning in the spring of 2017, two east side streams, Larson and Payne creeks, were added to the program. Sample locations on these creeks were again chosen that would segregate urban and agriculture land uses. To maintain a total of five sample locations, the site located at Wagner Creek at Wagner Creek Park and the site located at Beall and Jackson Creek were dropped. The Larson Creek sites were only sampled on every other sample occasion and were the only sites sampled for glyphosate.

Table 9. MRPSP sample locations Spring 2017-Fall 2019

Station ID	Location Description
38280	Jackson Creek at Bramson Lane
23074	Wagner Creek at mouth (Bear, Rogue)
38282	Wagner Creek at Wagner Creek Trail
38829	Payne Creek at Fern Valley Rd, W of Marigold Ln
38832	Larson Creek at N. Phoenix Road
11128	Larson Creek at Ellendale Drive (Medford)

In the 2019 Sampling year, the MRPSP decided to drop the Wagner Creek at Wagner Creek Trail site, as there was no discernable difference between data collected at Wagner Creek mouth and Wagner Creek at Wagner Creek Trail (Figure 13).

Figure 13. MRPSP current pesticide sampling locations.



3.2. Critical Area – Jackson Creek Case Study

Case Study: Intensive Sampling for Local Problem Pesticide - Oxyfluorfen in Jackson Creek

The diversity of land-uses in the Middle Rogue watershed and the range of labeled uses for pesticide chemistries detected creates complexity in targeting education and implementation of best practices to reduce those detections. Below is a case study demonstrating how the LPP designation was used to identify and better understand the user group involved in detections of the herbicide, oxyfluorfen. This process illustrates how a critical area is selected and what steps will be typically taken and an issue occurs in the area.

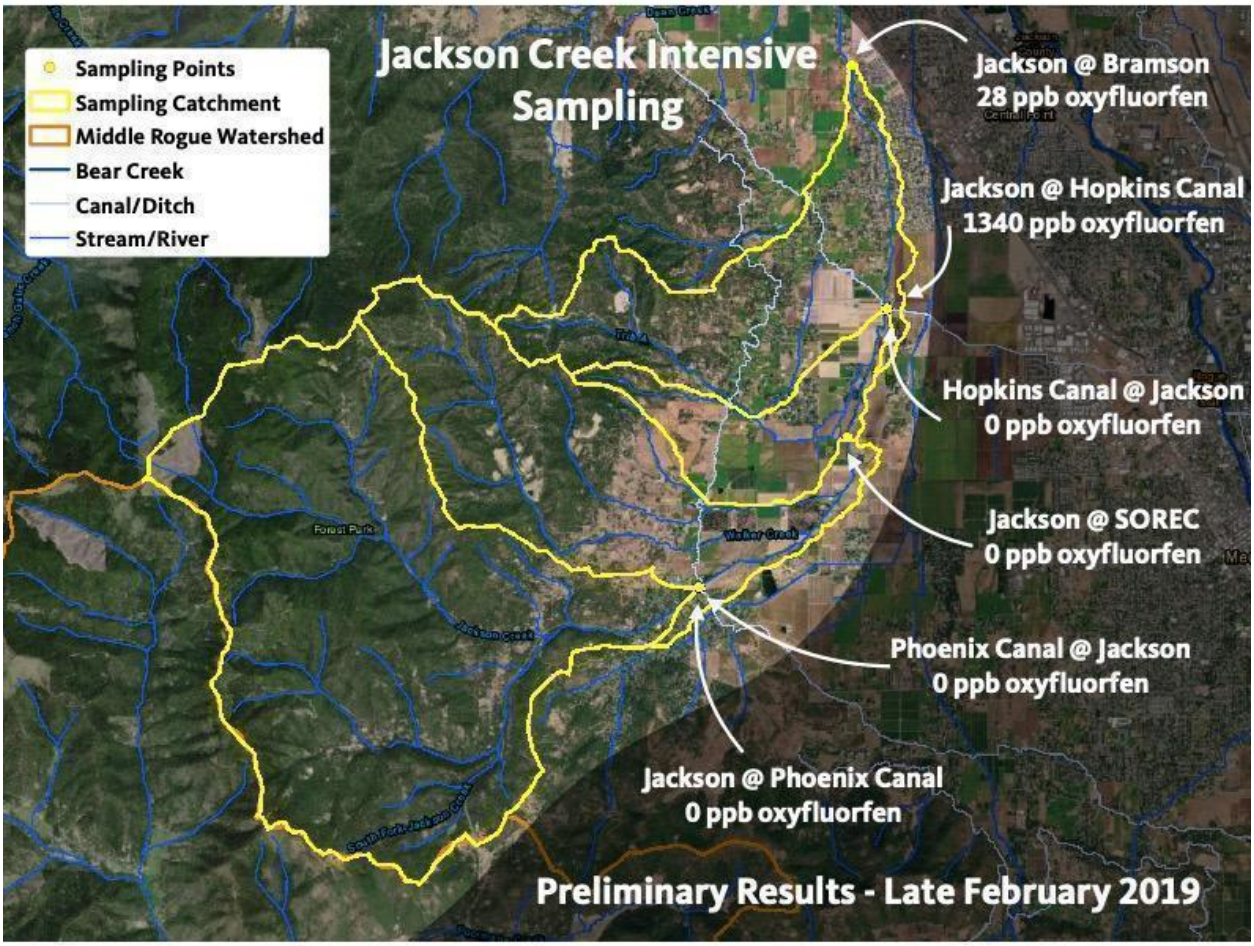
Between 2014 and 2018, the compound oxyfluorfen was detected 27 times in samples collected in the Jackson Creek watershed with one sample detection above the aquatic life benchmark and several samples at concentrations greater than 50% of the benchmark. During the review of the results, these oxyfluorfen detections stood out for occurring fairly consistently through all years of sampling and, up through 2018, all the detections had occurred in only one sampling watershed – Jackson Creek. There was a detection of oxyfluorofen in Payne Creek in 2019. Other compounds detected with similar frequency have been spread across several watersheds. Because of this, further effort to understand the users of oxyfluorfen near Jackson Creek was warranted.

A first effort was made to evaluate the labeled uses of oxyfluorfen. A search of the Pesticide Information Center Online database yielded 15 products containing oxyfluorfen (e.g. Goal, Goaltender, Galigan, etc) with 95 use sites or crops. Of those, right-of-way management, non-crop areas, industrial sites, fallow areas, fencerows, forestry, conifers, nurseries, container-grown plants, ornamental plants, yard plants, adjacent to buildings, pear orchards, vineyards, and a range of vegetable crops are all potential uses occurring in the Jackson Creek watershed. With such a broad range of uses, it became clear that it was not possible to rely solely on approved use-sites to specifically target any particular user group without further information.

A plan was devised in early 2019 to conduct intensive sampling upstream of the main sampling point (Jackson at Bramson) to attempt to evaluate which area of the watershed was responsible for oxyfluorfen detections. Five additional sample points were monitored February to April of 2019. These were located to allow the watershed to be divided into four regions and also to monitor irrigation water brought into the watershed through two irrigation canals. Sampling in late February, yielded oxyfluorfen detections at two of six sampling points (Figure 1). Oxyfluorfen at one site was measured at 1340 ppb or approximately 4.6 times the aquatic life benchmark.

With such a high concentration detected, outreach began with landowners near the site of high detection. One nursery operator reported consistent use of oxyfluorfen for pre-emergent control of weeds around a range of crops. A meeting was arranged with the nursey manager to share the details of the oxyfluorfen detections and to get a fuller understanding of the nursery's herbicide application and irrigation practices. The nursery manager remarked that he had been concerned about potential off-site movement of herbicides but was not aware of ongoing monitoring. The nursery was already in the process of adopting alternative herbicide chemistries with a plan to dramatically reduce oxyfluorfen use during the 2020 season. The nursey manager has been added to the PSP outreach list. Any relevant monitoring data from 2020 will be shared with the nursery manager and used to evaluate the success of efforts to minimize oxyfluorfen presence in Jackson Creek.

Figure 14. Locations of intensive sampling points within the Jackson Creek Watershed and late February 2019 oxyfluorfen detections.



4. Land Uses Related to MRPSP Pesticide Use

The MRPSP engaged with a broad range of community stakeholders during the development of the strategic plan. This was achieved through a series of consultations and meetings where participants discussed local pesticide issues and opportunities, existing and potential partnerships, monitoring data and trends, and past project successes and other accomplishments. The outcome of these efforts is presented here.

4.1. Stakeholder Consultations

Two consultations were held at the SOREC to gather input from a diverse group of stakeholders to define the future state of the MRPSP (Table 10). The purpose of these consultations was to direct the early stages of the strategic planning process and to identify co-developed locally-relevant decision support tools and education to assist pesticide users and other community members to support IPM adoption and best management practices in the Middle Rogue.

The participants at the two meetings were asked to generate possible future actions that responded to the following question:

> ***"If you were able to manage the pests and weeds of concern to you/your organization while minimizing risks to aquatic life—what would you need to be able to do?"***

A list of outcome statements was developed through an interactive group process after individuals had first shared action phrases. The meeting participants clustered the actions into what they considered to be common themes (Appendix 1). This informed an education design process for extension programming. The first two education evens targeted licensed applicators and regular users of pesticides in a pesticide applicators recertification course and a best management practices for pesticide application workshop. This methodology is part of an approach to adaptive, learner-centered education (Halbleib and Jepson, 2016). This methodology maximizes the contribution that stakeholders can make to a science-driven education program design and it is intended to increase the value and impact of extension programs at a time of limited resources and increasing demand. Collectively this provided a foundation on which to move forward in the strategic planning process. The outcome summary and notes of the facilitated consultation processes are included in Appendix 2.

Table 10. Attendees at Stakeholder Consultations, SOREC, 2016.

MRPSP Stakeholder Consultations, Southern Oregon Research & Extension Center Stakeholder	
Bear Creek Orchards	Oregon Department of Transportation
Fort Vannoy Farms	Oregon State University
Grange Co-Op	OVS
Jackson County Roads Department	Pacific Crest
Jackson Soil and Water Conservation District	Results Partners
Naumes, Inc.	

4.2. Decision Support Tools

Decision support tools were identified and developed by SOREC to aid the MRPSP, pesticide applicators and the general public in understanding some of the possible user groups of pesticide chemistries monitored in tributaries of Bear Creek.

Factsheets were created for insecticides, fungicides, and herbicides that detail the use sites and environmental risks for 56 pesticides currently monitored for by the MRPSP. These chemicals are currently labeled for use in Oregon and on crops/sites common in the Bear Creek watershed. An additional 72 chemicals are monitored for by the PSP, but these are either legacy pesticides not currently labeled for use or are materials with use on crops/sites uncommon in the Bear Creek watershed (e.g. field corn or potatoes).

Crop calendars for five major crops and associated pests were created and are organized by the major agricultural land uses in the MRPSP and include the timing of natural and management events for a generalized growing season as well as the time periods when crops are most at risk of damage or yield loss from specific insects, diseases, and weeds. The factsheets and crop calendars are presented in Appendix 3.

A risk reduction table for selected Best Management Practices (Appendix 4) is based upon the European Union's Mitigating the Risks of Plant Protection Products in the Environment, referred to as MAgPIE (Alix et al., 2017). While the goal of MAgPIE was to develop a harmonized approach for risk management among EU countries, the approach achieves quantifiable reductions in pesticide loading while allowing maximum flexibility for the grower/applicator.

A version of this table has been adopted by the National Marine Fisheries Service and appears in the December 2017, Biological Opinion on the Environmental Protection Agency's Registration of Pesticides containing Chlorpyrifos, Diazinon, and Malathion. While this document refers to only three insecticides the approach and relative effectiveness is valid for a majority of commonly used pesticides.

Collectively, these decision support tools identify the common uses of pesticides including the MRPSP POI, POC and LPP. This information is valuable for planning outreach activities, interpreting monitoring results and planning monitoring locations, and will provide supporting information to be used while seeking future grant funding.

4.3. Sector Groups

Understanding the user groups of chemicals that are detected within the MRPSP is important for targeting future outreach activities. The MRPSP technical advisory committee (TAC) sub-divided into "sector" groups organized by land use and applicator type. Sector groups provide forums to discuss the monitoring data, better understand how pesticides are being used, and how to develop best management practices and outreach strategies specific to each land use and type. Meetings were held with each of the following sector groups and a short summary of the meetings are presented. The TAC will continue to meet with the sector groups to update this information as needed.

4.3.1. Field Crops

Field crops in the MRPSP area include cultivated crops, tree nursery, pasture and hay, and cannabis/hemp. The sector group meeting participants generalized two types of landowners on the ends of a user spectrum – those who regularly use pesticides and are unlikely to make changes and those who are intimidated by or oppose the use of pesticides. Opportunities to engage with users varies with experienced growers, for example, often being not up-to-date on best management practices and new growers in need of education including information on integrated pest management (IPM) techniques.

4.3.2. Forestry

Forestry users are divided into two groups; industrial and non-industrial. Pesticide applications within the MRPSP is limited to herbicides unless other concerns arise. Herbicides are primarily applied on industrial forest lands through aerial application or ground application. Pesticides are applied on clear-cut lands where plant competition is greater. Applicators of pesticides during a forest operation are required to file a Notice-of-Use with the Oregon Department of Forestry (ODF). Non-industrial forest land application of pesticides is limited. Opportunities to engage with the forestry industry exist and it was suggested to communicate with applicators at trainings, insert newsletter announcements, and include outreach materials in annual mailings that are sent to industrial forest applicators.

4.3.3. Orchards and Vineyards

Orchards and vineyards primarily produce pears and wine grapes, respectively. Orchard management likely results in the heaviest per acre use of pesticides in the MRPSP area. Many members of this applicator group are aware of the MRPSP monitoring program and have expressed interest in collaborating to offer trainings and implement new technologies, but in some cases, implementation of best practices is limited because of logistical challenges associated with a relatively small group of applicators needing to spray a large number of acres during optimal windows to effectively control pests. Furthermore, many orchards and vineyards are bordered by streams increasing the risk that off-target movement could contaminate surface waters.

A range of economically important insects and diseases are managed with insecticide and fungicide applications, and weeds are generally control in tree- and vine-rows with herbicide. Many, but not all, frequently applied pesticides are monitored for by the MRPSP. See Crop Calendars for more detail on pest management and pesticides used in orchards and vineyards

4.3.4. Right-of-Way

The Right-of-Way sector group includes the Jackson County and local municipality road department's, the Oregon Department of Transportation (ODOT), local power companies, irrigation districts, and railroads. Applicators in this group are heavily regulated. Irrigation districts mechanically clean ditches, mow roads, and use pesticides around signs, gates, and diversion infrastructure. They agreed to supply MRPSP outreach materials in the office if provided the materials. Annually, the county road department treats 100% of paved road shoulders. They use a mechanical and computerized application system. Check dams are installed in ditches prior to confluence with a creek. ODOT applies herbicides in the spring and follows with targeted treatments throughout the remainder of the year. This group recommended the development of targeted information for rural homeowner's pesticide use for road and ditch maintenance.

4.3.5. Urban

Urban users include residential homeowners, municipalities, school districts, rural small acreage landowners, and business owners. Several of the local cities are discontinuing the use of pesticides on public property. Many outreach events targeting this user group occur each year and members of the MRPSP may consider providing education and outreach at these events to the user group about best management practices, IPM, and pesticide alternatives.

5. MRPSP Pesticide Reduction Goals

The overarching goal of the MRPSP is to reduce the frequency of pesticides detected at concentrations greater than 50% of the aquatic life benchmark within the monitored watersheds. More specifically, the goal is for any detection of a given pesticide to be categorized by ODEQ as a Low Level of Concern. The lowest category is for those pesticides detected relatively infrequently at concentrations well below benchmarks.

The aim of the MRPSP is to be able to measure a decreasing trend in the frequency of detections greater than 50% of an aquatic life benchmark based on our allocation of stewardship resources, targeted education, and technical assistance. The work of the MRPSP operates as a feedback loop with a relationship between the following; monitoring and data analysis, outreach and education, and the application of pesticides. A monitoring program designed to facilitate the achievement of the goals is outlined below. Generally, if the goals that are set are achieved the project may enter a maintenance monitoring phase (ODA Pesticide Stewardship Partnerships: Operating Principles and Program Structure, 2012). The length of time the MRPSP remains active will depend on the number of water quality issues identified and the overall trend of the pesticide detections.

5.1. Reduction Targets of POC and LPP

Water quality monitoring during July 1, 2016 through June 30, 2018 indicated the presence of numerous pesticides and pesticide breakdown products. Reduction targets and timelines have been established for the MRPSP POC and LPP's. These targets provide a realistic baseline with which to measure progress. However, it is understood that changes in pests, labeling, and pesticide use practices will occur over time, thereby resulting in the potential changes in the chemistries and concentrations in surface water. A phenomenon of pesticide replacement may also be expected; wherein the MRPSP works to reduce detections and concentrations of one compound causing applicators to switch to another compound which is then detected in surface waters. The reduction targets will be reviewed each year after monitoring data becomes available.

5.1.1. Pesticides of Concern

Diuron has been detected at several monitoring locations within the watershed at concentrations below 50% of the aquatic life benchmark during the period 2016 – 2018. Diuron has also been detected at frequencies above the detection frequency threshold of 35%. Combined, this detection history results in the local MRPSP POC designation. It is the goal of the MRPSP to reduce the frequency of detections of diuron to below 35% while maintaining benchmark concentrations below 50%. Progress will be measured through frequency reductions of 10% until the goal is reached. Diuron is a POC statewide in the Oregon PSP program. This indicates that the scale of surface water contamination with diuron is well larger than the Middle Rogue. Efforts made by the MRPSP will hopefully yield reductions in detections and concentrations of diuron, but regulatory and labeling changes may be required to solve this statewide problem.

Imidacloprid has been detected at three monitoring locations within the watershed and all of them at concentrations greater than the aquatic life benchmark during the period 2016 – 2018 and categorized by ODEQ as a High Level of Concern (Table##). The benchmark exceedances are attributed to the 2017 lowering of the EPA aquatic life benchmark from 1.05 µg/L to the current number of .01 µg/L and not necessarily indicate significant changes in applications or land use. However, because imidacloprid detections are present in samples at concentrations greater than the benchmark, that detection history results in a local MRPSP POC designation. As with diuron, imidacloprid is a POC across Oregon's PSP

program. This indicates that the scale of surface water contamination with imidacloprid may be more related to regulatory and labeling issues rather than local uses or application methods. Efforts at the state level may be required to achieve local goals. However, outreach strategies and technical assistance will be used to address these concentrations with a goal of reversing the recent 2016 – 2018 trend of an annual increase in the number of detections. Progress will be measured through frequency of detection reductions.

5.1.2. Local Problem Pesticide

Oxyfluorfen has been detected in the Jackson Creek watershed at frequencies and concentrations as described in Chapter 3.1. The detections within the watershed were at 50% of the aquatic life benchmark or greater during the period 2016 - 2018. These detections meet the criteria for designation as a LPP within the MRPSP area. Intensive sampling and targeted outreach occurred in 2019. It is the goal of the MRPSP to reduce the frequency of detections of oxyfluorfen to below 35% while achieving benchmark concentrations below 50%. During that time, measurable reductions in concentrations and detection frequencies shall occur each year leading up to the goal of any detection categorized as a Low Category of Concern by December 31, 2021.

5.2. MRPSP Future Monitoring

The TAC will meet each winter to consider the monitoring schedule for the following sampling season. The TAC will evaluate the previous year's monitoring results, emerging trends, and progress towards goals while making a decision to adjust the watershed(s) in which to monitor and the number of samples taken within those watersheds. Specifically, the TAC will review, at a minimum, the monitoring results for the following information;

- Were any new, different, or alarming chemicals detected the previous year;
- Have the detected chemicals been a Low, Medium or High Level of Concern for the previous three years;
- Have the pesticide reduction targets for the watershed been achieved;
- What watershed(s) are suitable for MRPSP monitoring;
- Are changes in land use occurring that requires attention of the MRPSP.

6. Communication, Outreach, and Education

The MRPSP has identified five sector groups that we consider to be priority targets for our communication, outreach, and education efforts. These sector groups are: Field Crops; Forestry; Orchards and Vineyards; Right-of-Way; and Urban. Each of these groups have specific needs relating to the use, understanding, and management of pesticides, and therefore the MRPSP's communication, outreach, and education strategies will be evaluated annually and should uniquely target each group, as needed. Annually, the MRPSP will evaluate the outreach efforts and monitoring results of the previous and identify specific strategies to focus on the following year.

The MRPSP COE Objectives are:

1. Reduce pesticide detections in waterways;
2. Increase implementation of Best Management Practices;
3. Understand the patterns of pesticide use throughout the MRPSP area.

To achieve the MRPSP's three objectives, we propose the following goals. The overarching goal is to reduce the detections and concentrations of POC and LPP using the strategies listed below:

1. Continue to develop a diverse/broad-based regional campaign to reduce pesticides in waterways;
2. Develop relevant communication materials in order to increase understanding of the MRPSP objectives and employing IPM approaches;
3. Work with and between sector groups to increase knowledge and skills to ensure that Best Management Practices (Appendix 4) at the time are known and employed.

6.1. Communication Goals and Key Strategies

Goal: Continue to develop a diverse/broad-based regional campaign to reduce pesticides in waterways.

Key Strategies:

STR-1. Continue to work with key partners and meet with the current sector groups.

- Current MRPSP Partners: Southern Oregon Research & Extension Center, OSU Extension; Jackson County Soil and Water Conservation District; Rogue River Watershed Council; The Grange Co-Op; Stream Smart; Rogue Valley Sewer Services; Cooperative Weed Management Area; The Freshwater Trust; Bear Creek Orchards LLC.; Medford Water Commission; Oregon Department of Environmental Quality; Rogue Valley Council of Governments; Oregon Department of Agriculture; Oregon Department of Forestry

STR-2. Develop new relationships with additional organizations, businesses, local and county governments, and other potential partners as they arise.

- It is important to recognize that while organizational missions will vary among partners and community groups, we must maintain progressive relationships in order to achieve our valley-wide objectives and maintain relevance with a broad audience.

STR-3. Work with partners to prioritize key outreach events to increase community awareness of MRPSP and its work.

- Partners' attendance at events will be based on their relationship to expected audience.

STR-4. Develop "ready to go" outreach material targeted for each identified sector group to facilitate use and presentation by any MRPSP partner.

- Develop per sector group:
    - 2-page factsheet: "How can IPM protect streams?"
    - 2-page factsheet: "Pesticides of Concern & Interest in the Middle Rogue"
    - Presentations: "BMPs for [sector group]", "What is IPM…"
    - Relevant tabling materials
- Develop consistent "event calendar" for outreach opportunities. Recruit sector members as appropriate to deliver message.

Goal: Develop relevant communication materials in order to increase understanding of the MRPSP objectives and Integrated Pest Management (IPM).

Key Strategies:

STR-5. Distill industry-terminology contained in communication material so that it's easily read and understood by public chemical consumers.

- Provide better information on the impacts of pesticides on aquatic life and differences in environmental persistence.
- Create postcards to be distributed at cooperating distributors that highlight the importance of reading the label and proper application; and explains the MRPSP's POCs and POIs.

STR-6. Develop state-of-the-science support materials in order to serve our professional and academic partners.

- Data-driven, chemistry-specific BMPs and extended reports, when applicable, of l case studies arising from MRPSP work.

STR-7. With ODA and DEQ, develop semiannual MRPSP updates and an annual report, that are made available to public.

STR-8. Develop strategies for better diagnosing pests and emphasize pest prevention and avoidance practices as part of the IPM framework.

Goal: Work with and between sector groups to increase the knowledge and skills to increase knowledge of and barriers to implementation of best management practices that reduce off-target losses.

Key Strategies:

STR-9. Create a MRPSP Steering Committee as the partnership lead on facilitating outreach and communication with sector groups.

STR-10. Host bi-annual MRPSP meeting for partnership members, new partners, and public.

- Opportunity for feedback and check-in on progress toward communication and outreach goals.
- Present annual monitoring report, evaluate future monitoring strategies, and channels to relay that information.

STR-11. Work with ODA and ODEQ to develop annual MRPSP update that is publicly available.

STR-12. Host and/or partner in at least two events per year.

The use of multiple outreach and communication approaches by the MRPSP partners, we are better able to serve and reach a wide range of pesticide user groups to provide locally-relevant, science-based resources. By using an IPM framework, the MRPSP will enable improved pest management and pesticide application decisions that will reduce the risk of pesticides reaching surface water. Through regular information sharing, as well seeking feedback, the MRPSP will continually adapt and improve this partnership over time.

7. Documentation of Improvements

The MRPSP recognizes that tracking our impact within the community is inherently challenging. However, with the annual monitoring efforts, the identification of key pesticide applicator groups and the goals, objectives and key strategies, the MRPSP has metrics with which to measure and identify progress. Specifically, the MRPSP will;

- Track the progress towards achieving the communication, outreach, and education goals, including;
    - The attendance at public informational meetings, public outreach events, and educational events;
    - The number of website visits to the MRPSP webpage and the Stream Smart website;
    - The frequency of internal sector group meetings, public informational meetings, and education events (Appendix 5);
    - The number of MRPSP outreach materials distributed at events;
    - The recruitment of new partner organizations.

- Document the effectiveness of BMP's that are put in place.
    - Track the extent of BMP's across the MRPSP.

- Complete an assessment of the MRPSP to identify internal and external support for the partnership and the effectiveness of education and training events;
    - Administer a pre/post program evaluation at each presentation and/or class;
    - Update an annual survey of partner organizations about the approach of the MRPSP (Appendix 6);
    - Record results and share with ODA, ODEQ and public at meetings.

- In partnership with ODA and DEQ, develop an annual update monitoring report.

Generally, the use of multiple methods to document improvements will be necessary to establish the effectiveness of the outreach and communication strategies. The MRPSP will consider this information and adapt as needed to steer future management measures.

7.1. Programming Evaluation

In order to gain a better understanding of the impact of our educational events we conduct at-event and follow-up evaluation. The resulting data is used to: 1) adjust learning content and the instructional design for future programs, and 2) document changes in intentions and behavior.

For the 2017 IPM Festival, the at-event evaluation data indicate the program significantly increased the participants' awareness about the POCs as well as altering their intended pesticide application practices for POCs (Table 11). Of the respondents that use or recommend pesticides, more than 80 percent indicated that they would use weather forecasting more often to time or recommend timing to others for pesticide applications. Table 12 shows self-assessed changes in skills, where progress is shown for

the ability to select BMPs that will work in a given setting and the data indicate more support is needed assist learners in balancing protection and production goals.

Table 11. 2017 IPM Festival participant intentions related to future pesticide selection decisions and application practices.

Response	Does knowing the pesticides of concern for the watershed affect what pesticides you intend to apply/recommend in the next season? (*n* = 21)	Does knowing the pesticides of concern for the watershed affect the pesticide application practices you intend use/recommend in the next season? (*n* = 17)
Yes	62%	59%
Unsure	9%	12%
No	5%	0%
Not applicable	24%	29%

Table 12. 2017 IPM Festival retrospective pretest for change in skills (*n* = 16). (Note: participants selected a number between 1 and 7 (1 = no ability or skill; 7 = very able or skilled) or N/A (not applicable) to represent their skill level before and after the event)

My skill to:	Before	After	Change
Select practical BMPs for pesticide application to reduce pesticide losses to surface water	4.25	5.5	1.25
Make pest management decisions or recommendations that balance protection and production goals	4.3	5	0.7

Two months after the 2018 IPM Festival a follow-up survey was conducted with 17 participants responding (about 30% of course participants). Fourteen expressed that their understanding of how pesticides move in the environment was increased a great deal or a lot. Thirteen participants had a significant improvement in their ability to find useful resources on the safe use of pesticides. Ten of the 11 respondents that apply pesticide indicated that what they learned at the IPM Festival would enable them to change one or more pesticide management practice that would protect surface water quality. The spray pattern demonstration and two off-site tours provided value to participants.

7.2. Partner Process Survey

The MRPSP conducted a survey in early 2018 to identify partner opinions of the PSP process and identify opportunities for improvement and to adjust, as needed (Appendix 6). Seven of the ten respondents found that identifying local, pesticide-related water quality issues as the most important aspect of the MRPSP when presented with several choices (Figure 15). The majority of respondents agreed that the people who were attending MRPSP meetings represented a cross-section of stakeholders, however several also disagreed (Figure 16). Respondents were asked who was missing from the MRPSP process that would offer additional perspective (Figure 17).

Figure 15. Response from the partner process evaluation survey.

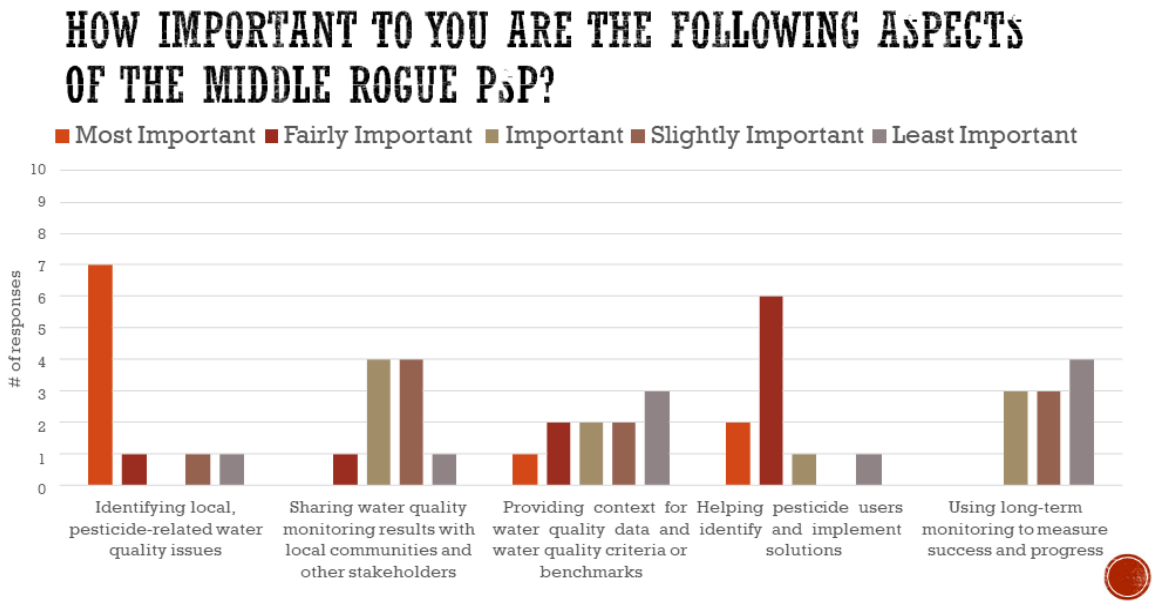


Figure 16. Response from the partner process evaluation survey.

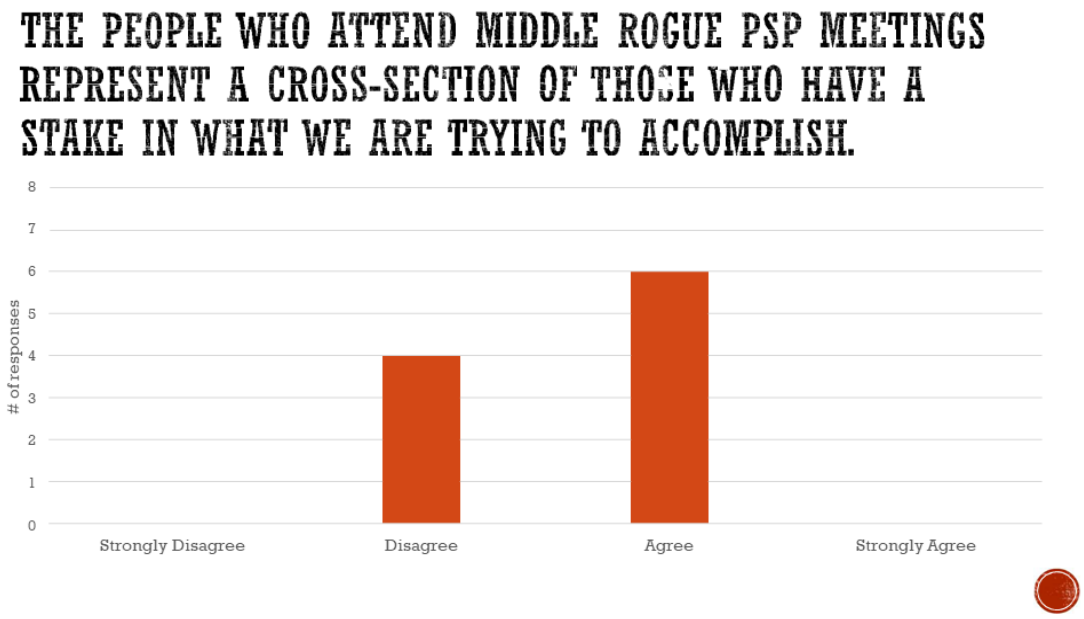
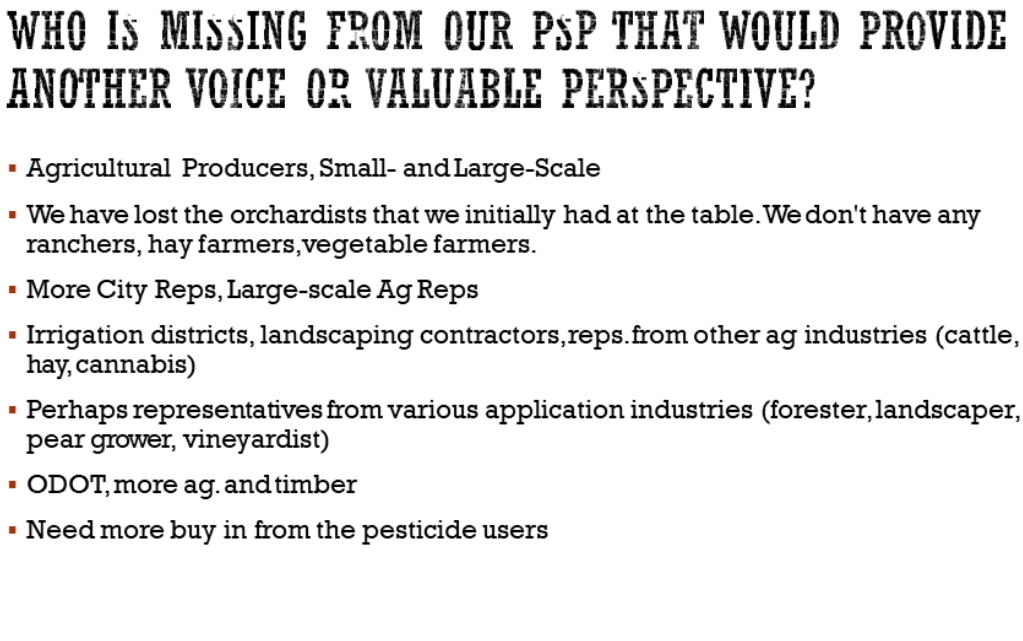


Figure 17. Partner survey comments regarding who was missing from the MRPSP process.



The MRPSP used the information from the survey to expand the partnership and refine the process. In response, the TAC sub-divided into sector groups (Section 4.3) and held small group meetings in an effort to include a broader stakeholder base. Also, additional effort was made to increase attendance at regular MRPSP meetings and share MRPSP monitoring data through partner organizations. This, or a similar, survey will be repeated at regular intervals to continuously refine the MRPSP process.

8. Technical Assistance and Financial Needs

The coordinating council partners are key to ensuring coordination of efforts, maximizing opportunities to leverage resources, and effectively utilizing the strengths of each organization. Relationships need to be cultivated and continue to be strengthened with several relevant partners. The MRPSP will require technical assistance (TA) and ongoing financial support to achieve the goals outlined in the strategic plan. The coordinating council will continue to seek funds and support from diverse sources to ensure this is possible. These needs will change each year depending on the outreach and monitoring priorities established by the TAC.

Many funding streams become available on an annual basis and being aware of those is critical for securing funds. One example of a funding stream is the Drinking Waters Providers Partnership (DWPP).

The DWPP is a collaboration between USDA Forest Service, Oregon Department of Environmental Quality, Washington Department of Health, U.S. Environmental Protection Agency, U.S. Bureau of Land Management, WildEarth Guardians, GEOS Institute and The Freshwater Trust. The Partners share a common vision that watershed restoration is an important and effective way to provide clean, inexpensive drinking water to communities and protect native fish populations, particularly when downstream and upstream users work together. The partnership is accepting proposals through January 17, 2020 for projects that have a federal nexus and address environmental conservation and restoration projects in community/municipal drinking water source areas.

Table 13. Annual Estimated MRPSP TA and funding needs and potential funding sources.

Technical Assistance Needs	Level of Effort	Cost	Notes
Education: Applicator Trainings	1 trainings	$800.00	Labor
Monitoring: Sample Analysis	5 locations	$25,000.00	Seasonal samples
Monitoring: Staff and Travel	70 samples	$2,800.00	Seasonal samples
Partnership Coordination	1.5 day/mo	$5,040.00	Management
Development of Technical Handouts	40 hours	$1,600.00	Technical research
Technical Report	1 report	$1,600.00	Technical report

Communication, Outreach, Education	Level of Effort	Cost	Notes
Community Outreach Events	6 events/ 2 people/8hrs	$3,360.00	Staff time
MRPSP Educational Event	1 event	$2,000.00	Logistics
Development of Outreach Materials	40 hours	$1,400.00	Staff time
MRPSP Materials Printing	NA	$500.00	Printing

Funding Source	Notes
Oregon Watershed Enhancement Board	https://oregon.gov/OWEB
IPM Institute of North America	https://ipminstitute.org/category/grants/
Western IPM Center	http://westernipm.org/index.cfm/center-grants/
Oregon Department of Agriculture	https://oregon.gov/ODA
Western SARE	https://www.westernsare.org/Grants/Types-of-Grants
Natural Resource Conservation Service	https://www.nrcs.gov

8.1 Technical Needs

Several pesticides are often used in southern Oregon which are not currently monitored for by the MRPSP. We request that the Oregon Department of Environmental Quality evaluate the feasibility of developing analytical methods to screen water quality samples for the pesticide chemistries listed in the table below.

Table 14. Pesticides used in southern Oregon currently not monitored for by the MRPSP.

Material	Tradename	Type	Selected Use Sites
Abamectin	Agri-Mek	Insecticide/Miticide	Alfalfa, Apple, Vegetable crops, Non-crop areas, Conifers, Grapes, Pears, Home-use
Chlorantraniliprole	Altacor	Insecticide/Miticide	Pear, Apple, Vegetable crops
Clopyralid	Stinger	Herbicide	Grass Hay, Small Grains, Non-crop areas, Pasture, Rangeland, Vegetable crops, Apple, Pear (SLN)
Clothianadin	Belay	Insecticide	Apple, Grape, Pear, Turf
Dinotefuran	Venom	Insecticide	Grape, Vegetable crops, Buildings, Home-use, Turf
Fenpropathrin	Danitol	Insecticide/Miticide	Pear, Apple, Grape, Berries, Vegetable crops
Fenpyroximate	FujiMite	Insecticide/Miticide	Grape, Apple, Pear, Blueberry
Flumioxazin	Chateau	Herbicide	Alfalfa, Apple, Aquatic Sites, Vegetable crops, Small Grains, Berries, Grapes, Non-crop areas, Conifers, Rights of Way
Indaziflam	Alion	Herbicide	Apple, Grape, Pear, Conifers, Non-crop acres, Rights of Way
Lambda-cyhalothrin	Warrior	Insecticide	Alfalfa, Small Grains, Grass Hay/pasture, Apple, Pear, Conifers
Paraquat	Gramoxone	Herbicide	Alfalfa, Apple, Small Grains, Non-Crop areas,
Spinetoram	Delegate	Insecticide	Apple, Pear, Grape, Berries
Spinosad	Entrust	Insecticide	Alfalfa, Apple, Aquatic sites, Vegetable crops, Grape, Pear, Home-use, etc
Spirotetramat	Ultor	Insecticide	Apple, Pear, Grape, Vegetable crops
Thiamethoxam	Actara	Insecticide	Apple, Grape, Pear, Turf, Vegetable crops, Home-use

9. Coordinating Council Statement of Commitment

9.1. Purpose and Vision of MRPSP

The MRPSP is a voluntary partnership that will meet quarterly to share information across organizations, determine ways to effectively collaborate on actions to achieve the goals of the MRPSP, assess progress on those goals, and act in an advisory capacity on a wide range of decisions, such as current and projected MRPSP initiatives; monitoring; data analysis; water quality conditions; communications and public outreach plans and messages; technical assistance; training opportunities; grant funding; and identification of high priority collaborative projects.

The ***Middle Rogue PSP Strategic Plan*** is:

- A living document to be maintained and modified by the MRPSP;
- A procedural guide, describing the operation of the MRPSP's collaborative work and how MRPSP members commit to interact constructively in good faith;
- An informal agreement among MRPSP members and does not have any legal standing;
- A public document, available for anyone to read and review. Comments about this document should be addressed to the MRPSP.

9.2. MRPSP Structure and Composition

The MRPSP is comprised of local stakeholders and other key interest groups that represent a wide set of sectors and perspectives.

The Technical Advisory Committee are individuals of the MRPSP that offer unique technical skills to the larger group.

The Coordinating Council are individuals of the organizations that participated in the development of the strategic plan.

9.3. Statement of Commitment

The undersigned are acknowledging the voluntary nature of the MRPSP and a commitment to be part of the MRPSP Coordinating Council that will oversee the implementation of the MRPSP Strategic Plan.

Organization	Name
Rogue River Watershed Council	John Speece
Jackson County Soil and Water Conservation District	Kora Mousseaux
Jackson County Soil and Water Conservation District	Karelia Ver Eecke
OSU Southern Oregon Research and Extension Center	Gordon Jones
The Freshwater Trust	Eugene Weir
Rogue Valley Sewer Services	
Oregon Department of Forestry	
Jackson County Road Department	
Grange Co-Op	

References

Alix et. al, European Union's Mitigating the Risks of Plant Protection Products in the Environment, SEATAC, May 2017: ISBN: 978-1-880611-99-9

Halbleib, Mary L and Jepson, Paul C. Adaptive learner-centered education: A toolkit for extension. Oregon State University, 2016.

Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Biological Opinion on the Environmental Protection Agency's Registration of Pesticides containing Chlorpyrifos, Diazinon, and Malathion, December 29, 2017.

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State of Oregon. Pesticide Management Plan for Water Quality Protection, 2011.

United States Geological Survey. National Land Cover Database, 2016.

U.S. Census Bureau. (2019, October 27). Vintage 2018 Population Estimates. URL:https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml

Appendix 1. Outcome statement and recommended actions from two public stakeholder consultations.

Theme	Outcome Statement	Stakeholder Action Phrases
Education	Act upon validated information and tools to implement higher levels of IPM.	Continue and improve the sprayer inspection and maintenance program
		Create more tools for decision making.
		Develop and distribute better outreach materials about IPM.
		Increase access to education on proper application methods.
		Increase the frequency of new technology demonstrations.
		Provide a risk vs. benefit analysis on using pesticides.
		Provide better information on product impact on aquatic life.
Communication	Translate PSP results into communications for diverse audiences.	Build Master Gardener crop protection product homeowner education.
		Combine education into other events for outreach.
		Encourage basic agricultural understanding in new homeowners.
		Inform the public of available resources and increase awareness among the agricultural producers.
		Involve all citizens in crop production methods and what it means to our community.
		Provide public outreach for media—commercials, radio ads for education.
Local Rights/Ordinances/Irrigation	Each stakeholer understands its role in the PSP and understands its role in surface water protection.	Encroachment & expansion of weeds into hay fields/movement and distribution of weeds.
		Grant Funding: options to eradicate weeds and pests, options for equipment.
		Improve enforcement of regulatory violators.
		Make better use of our CWMA (Cooperative Weed Management Area).
		Pipe irrigation infrastructure.
Certification/ Land Use Incentives	Explore market opportunities and cost-share incentives for using best management practices.	Build awareness in the market and value chain.
		Convey current successes in Aguse and production regarding crop protection methods.
		Exploring the marketing opportunities and/or advantages of responsible pesticide use.
		Provide cost share for practices and equipment.
		Public subsidies or encouragement of hedgerow plantings of buffers to streams & urban areas.

Appendix 2. MRPSP Stakeholder Consultation Summary, 2016.

Middle Rogue Pesticide Stewardship Partnership Stakeholder Consultations

Southern Oregon Research & Extension Center, 2016

Two consultations were held at the Southern Oregon Research and Extension Center to gather input from a diverse group of stakeholders to define the future state we are seeking to produce through the Middle Rogue Pesticide Stewardship Partnership (PSP). The aim of this project is to co-develop locally-relevant decision support tools and education to assist pesticide users and other community members to support IPM adoption in the Middle Rogue Watershed. This work is funded through a PSP Technical Assistance grant to OSU in partnership with Jackson Soil and Water Conservation District (JSWCD).

March 31, 2016 participants: Randy White (JSWCD), Frank Baratta (Jackson Co. Roads), Kathleen McNamara (Bear Creek Orchards), Barry Tibbetts (Naumes Inc.), Chris Hubert (Results Partners), Jason Cole (Pacific Crest), Andy Smith (Grange Co-op), Bob Niedermeyer, Jerry May, Richard Hilton (OSU), Paul Jepson (OSU), Mary Halbleib (OSU)

August 25, 2016 participants: Shelby Filley (OSU), Jen Sawtell (JSWCD), Mike Scott (ODOT), Kathleen McNamara (Bear Creek Orchards), Jon Meadors (OVS), Andy Smith (Grange Co-op), Bob Crouse (Fort Vannoy Farms), Dalton Strauss, Bob Niedermeyer, Jerry May, Alan Pringle, Bryan Baumgartner, Steve and Kara Glass, Richard Hilton (OSU), Paul Jepson (OSU), Katie Murray (OSU)

The consultation processes were facilitated by Mary Halbleib and Paul Jepson, Integrated Plant Protection Center at OSU. The participants at the two meetings were asked to generate possible, future actions that responded to the following question:

"If you were able to manage the pests and weeds of concern to you/your organization while minimizing risks to aquatic life—what would you need to be able to do?"

A list of outcome statements was developed through a group process after individuals had first shared numerous action phrases, and the group had clustered these actions into what they considered to be common themes.

The next step in this process is to share this summary with the group and others, and conduct an education design process to deliver new extension programming. The first project education event was a pesticide applicators recertification course in January at SOREC, followed by a best management practices for pesticide application workshop on February 28, 2017.

This methodology is part of an approach to adaptive, learner-centered education developed by Mary Halbleib and Paul Jepson (https://catalog.extension.oregonstate.edu/em9144). This methodology maximizes the contribution that stakeholders can make to a science-driven education program design and it is intended to increase the value and impact of extension programs at a time of limited resources and increasing demand.

Outcome Statements Summary

Act upon validated information and tools to implement higher levels of IPM

Translate Pesticide Stewardship Partnership Program results into communications for diverse audiences (Mid and post program priority)

Explore market opportunities and cost share incentives for using best management practices (Post PSP program priority)

Each group/agency/individual understands its role in the PSP understands its role in surface water protection and directs their activities towards risk reduction

Brief summary titles, outcome statements and listed actions

Education Areas

Outcome statement: Act upon validated information and tools to implement higher levels of IPM

PESTICIDES:

Provide better info on product's impact on aquatic life

Risk vs Benefit

Understand pesticide risk and efficacy

Follow the label, all parts of the label Use

and teach specificity of pesticides

Use correct herbicide for the species of weeds

PESTS:

Improve diagnosis of pests Lack of knowledge: pest, target Diminish invasive pests

Solutions to noxious weeds

APPLICATION:

Education on proper application methods

Sprayer inspection and maintenance program (requirement)

Conduct better employee application training Demonstrate new technologies

Precision agriculture

Demonstration of new tech + nozzles/sprayers Canopy density sensing to direct

airblast spraying

ALTERNATIVES TO PESTICIDES:

Provide specific info on beneficial insect population, their movement & how to encourage them

Use and teach alternative pest controls

Provide even a few non-chemical options that help people feel less hopeless

GENERAL:

Provide more tools for decision-making Translate tools for
different audiences' needs Maximize access to education

Resource education (where to go for assistance) OSU, Grange Co-op, Helena Provide education in Spanish

Develop better language about IPM

Communication

Outcome statement: Translate Pesticide Stewardship Partnership Program results into communications for diverse audiences (Mid and post program priority)

Inform the public of resources

Increase public awareness of ag

Develop process for local community open houses

Involve all citizens in crop production methods and what it means to our community

Encourage basic agricultural understanding in new homeowners

Build Master Gardener crop protection product homeowner education Educate

urban users

More involvement in schools

Better living through chemistry; chemical stewardship Too

much bad propaganda

Reluctance to interact with rural agricultural farmers

Set up outreach to Ag user groups—Farm Bureau + Cattleman's Assoc., Irrigation Dist's mailers

Public + Agricultural (Farmer to Farmer) Awareness

Tout “Bee friendly” sprays

Tie into other events for outreach

Provide public outreach for media—commercials, radio ads for education

Local Rights/Ordinances/Irrigation and Weed Control

Outcome statement: Each group/agency/individual understands its role in the PSP understands its role in surface water protection and directs their activities towards risk reduction

Maintain irrigation water rights and service

Cover our irrigation ditches

Make better use of our CWMA (Cooperative Weed Management Area)

Preserve and value agricultural land use

Expand/increase awareness of CWMA (monthly meetings at SWCD—6 years old)

Expand understanding of invasive weed and value of C.P.P.s

Grant Funding: options to eradicate weeds and pests, options for equipment

Too many fallow acres

Encroachment & expansion of weeds into hay fields/movement and distribution of weeds

Per targeted use of herbicides for specific needs, may need help from ODA for labeling
Example: Nutsedge

Better enforcement of violators

More reduced risk crop protection products

Certification and Land Use Incentives

Outcome statement: Explore market opportunities and cost share incentives for using best management practices (Post PSP program priority)

Build awareness in the market and value chain

Label “Rogue Valley Green” to support better practices

Convey current successes in Ag use and production regarding crop protection methods

Exploring the marketing opportunities and/or advantages of responsible pesticide use

Provide cost share for practices and equipment

Introduce more cost share for buffer zones

Public subsidies or encouragement of hedgerow plantings of buffers to streams & urban areas

Miscellaneous

Invite more Federal and State Agencies in process

Labor supply for Ag

Eliminate the word pesticide from the vocabulary, we use crop protection products

Appendix 3. Decision support tool - Pesticide factsheets and crop calendars.

Pesticide Uses and Risks Factsheet & Crop Production Calendars

Middle Rogue Pesticide Stewardship Partnership

This pesticide-use and risk factsheet and associated crop production calendars were developed to aid the Middle Rogue Pesticide Stewardship Partnership (PSP) and general public in understanding some of the possible user groups of pesticide chemistries monitored for in tributaries of Bear Creek. The crop calendars provide the general timings of agricultural production activities and pest management treatments for select crops in the Bear Creek watershed. **When selecting and applying pesticides always read and carefully follow the label directions.**

Understanding the user groups of chemicals detected in surface water is important for targeting educational activities and development of best management practices to reduce contamination. Attempting to attribute pesticide detections in Bear Creek tributaries is complicated by the diverse matrix of land uses in the watershed. Important agricultural land uses include horticultural, field crops, and pasture. Forestry, rights of way, non-crop areas, residential uses, and application to aquatic systems (irrigation canals and control of aquatic and riparian weeds) are important uses of pesticides in the watershed. Many of the land uses occur side-by-side on the landscape, and many pesticides may be used on several different crops or sites. For example, based on tables below, detections of glyphosate could be attributed to numerous pesticide user groups, while detections of EPTC would likely be associated with applications to alfalfa. Careful understanding and targeted monitoring is often required to positively attribute materials detected to any one land use group.

The 2017 USDA Census of Agriculture found that approximately 3,800 acres of pears, 2,800 acres of wine grapes, 14,700 acres of grass hay, 3,500 acres of alfalfa hay, and 300 acres of small grains (wheat and barley) were harvested in Jackson County in that year. Since 2017, acreage of hemp grown in the county has increased dramatically. None of the pesticides allow for use on hemp are monitor by the PSP, but farmers growing hemp may be treating non-crop areas or other use sites with chemicals monitored for by the PSP.

The tables on the following pages detail the use sites and environmental risks for 56 chemicals currently monitored for by the PSP. These chemicals are currently labeled for use in Oregon and on crops/sites common in the Bear Creek watershed. An additional 72 chemicals are monitored for by the PSP, but these are either legacy pesticides not currently labeled for use or are materials with use on crops/sites uncommon in the Bear Creek watershed (e.g. corn or potatoes).

Further information on the use sites for various pesticide chemicals in Oregon can be obtained from the product label and the Washington State University Pesticide Information Center Online: http://cru66.cahe.wsu.edu/labels/Labels.php

This document was supported by a Pesticide Stewardship Partnership Technical Assistant Grant funded by Oregon Department of Environmental Quality and Oregon Department of Agriculture.

Oregon State University
Southern Oregon Research and Extension Center

Written and assembled by Gordon Jones ● September 2019

Table 1: Herbicides	Example Trade Name	Detection Frequency 2014-2018	Pears[1]	Grapes	Alfalfa Hay	Grass Hay	Wheat/Barley	Non-Crop[2]	Home Uses[3]	Forestry[4]	Aquatic Sites	Surface Water Risk[5]	Groundwater Risk[6]
diuron	Karmex	51%	●	●	●	●	●	●	●			●	●
glyphosate	RoundUp	36%	●	●	●	●	●	●	●	●	●	●	●
sulfometron-methyl	Oust	18%						●		●		●	●
oxyfluorfen	Goal, GoalTender	9%	●	●				●	●	●		●	●
2,4-D	Barrage	8%	●			●	●	●	●	●	●	●	●
imazapyr	Arsenal	7%						●		●	●	●	●
metsulfuron methyl	Opensight	5%				●	●	●		●		●	●
dichlobenil	Casoron	2%	●	●				●	●			●	●
atrazine*	Aatrex	2%						●		●		●	●
prometon	Pramitol	2%						●				●	●
pendamethalin	Prowl,	1%	●	●	●		●		●			●	●
bromacil	Hyvar	1%						●				●	●
triclopyr (ester)	Garlon 4	1%				●		●	●	●		●	●
triclopyr (amine)	Garlon 3A	1%				●		●	●	●	●	●	●
simazine	Princep	1%	●					●		●		●	●
fluridone	Sonar	<1%						●			●	●	●
tebuthiuron	Spike	<1%					●	●				●	●
hexazinone	Velpar	<1%			●			●		●		●	●
norflurazon	Solicam	<1%	●	●	●			●				●	●
dacthal	dacthal	ND						●		●		●	●
EPTC	Eptam	ND			●							●	●
fenoprop	Acclaim	ND					●	●	●	●		●	●
linuron	Lorox	ND					●	●				●	●
MCPA	Orion	ND			●	●	●	●	●	●		●	●
MCPP	Mecomec	ND							●			●	●
metribuzin	Sencor	ND			●	●	●					●	●
napropamide	Devrinol	ND		●				●		●		●	●
picloram*	Graslan	ND				●	●	●		●		●	●
pronamide	Barricade	ND		● NB				●	●	●		●	●
pyraflufen-ethyl	Venue	ND				●	●	●		●		●	●
siduron	Tupersan	ND						●	●			●	●
terbacil	Sinbar	ND	● NB		●							●	●

Table 2: Insecticides	Example Trade Name	Detection Frequency 2014-2018	Pears[1]	Grapes	Alfalfa Hay	Grass Hay	Wheat/Barley	Non-Crop[2]	Home Uses[3]	Forestry[4]	Aquatic Sites	Surface Water Risk[5]	Groundwater Risk[6]
imidacloprid*	Admire	6%	●	●			●		●			●	●
acetamiprid*	Assail	4%	●	●	●	●	●	●	●			●	●
carbaryl	Sevin	<1%	●	●	●	●	●	●	●	●		●	●
chloropyrifos*	Lorsban	<1%	●	●	●		●	●		●		●	●
diazinon*	Diazinon	<1%	●							●		●	●
acephate	acephate	ND	● NB					●	●	●		●	●
bifenthrin*	Sniper	ND	●	●		●			●	●		●	●
dimethoate	dimethoate	ND	●			●	●			●		●	●
esfenvalerate*	Asana	ND	●						●			●	●
ethoprop*	Mocap	ND								●		●	●
fenvalerate	Onslaught	ND						●	●			●	●
methiocarb*	Mesurol	ND	● NB	● NB					●			●	●
methomyl*	Lannate	ND		●	●	●	●					●	●
oxamyl*	Vydate	ND	●									●	●
permethrin	many	ND	●	●	●			●	●	●		●	●
pyriproxyfen	Esteem	ND	●	●	●		●	●	●	●		●	●

Table 3: Fungicides	Example Trade Name	Detection Frequency 2014-2018	Pears[1]	Grapes	Alfalfa Hay	Grass Hay	Wheat/Barley	Non-Crop[2]	Home Uses[3]	Forestry[4]	Aquatic Sites	Surface Water Risk[5]	Groundwater Risk[6]
propiconazole	Tilt	< 1%	● NB			●	●		●			●	●
azoxystrobin	Abound	ND		●	●	●	●			●		●	●
chlorothalonil	Bravo	ND						●	●	●		●	●
etridiazole	Truban	ND								●		●	●
pyraclostrobin	Cabrio	ND	●	●	●	●	●		●	●		●	●
triadimefon	Bayleton	ND	● NB							●		●	●
trifloxystrobin	Flint	ND	●	●	●	●	●			●		●	●

*Restricted use pesticide
ND Not detected in Middle Rogue PSP sampling between 2014 and 2018
NB For use on non-bearing trees or vines
[1] Use sites extracted from the Washington State University Pesticide Information Center Online (PICOL) labels for Oregon
[2] Use sites including non-crop areas, roadsides, and rights-of-way
[3] Use sites including forestry, forest release, and conifers
[4] Marked as intended for home use in PICOL
[5] Labels include a surface water advisory or environmental hazard statement indicating toxicity to aquatic organisms
[6] Labels include a groundwater advisory statement related to movement or persistence in groundwater

Middle Rogue Pesticide Stewardship Partnership Crop Calendar – **Pears**

		J	F	M	A	M	J	J	A	S	O	N	D
Timing		Dormancy	Bud swell	First bloom	Full Bloom	Small fruit	Fruit growth	Fruit growth	Fruit maturity & Harvest	Fruit maturity & Harvest	Leaf drop	Dormancy	Dormancy
Pests	Insects	Psylla, Scale & Mites	Psylla, Scale & Mites	Psylla	Psylla	Codling moth, Psylla & Mites	Codling moth, Psylla & Mites	Codling moth, Psylla & Mites	Codling moth, Psylla & Mites	Codling moth			
	Diseases			Scab & Fireblight	Scab, Fireblight, & Powdery Mildew	Scab, Fireblight, & Powdery Mildew	Fireblight	Fireblight	Fireblight				
	Weeds	Winter Annuals & Perennials	Winter Annuals & Perennials	Winter Annuals & Perennials		Summer Annuals & Perennials	Summer Annuals & Perennials	Summer Annuals & Perennials				Winter Annuals & Perennials	Winter Annuals & Perennials
Movement Risks	Thermal Drift												
	Wind Drift												
	Inversion Drift												
	Runoff												

Management

Insect Pest Management

Significant insect pests of pear in southern Oregon include codling moth, pear psylla, mites, true bugs, and scales. A range of oil, sulfur, targeted, and broad-spectrum insecticides are used for control of psylla, mites, and scale insects. Codling moth are controlled with pheromone-based mating disruption, use insecticidal viruses and, targeted broad-spectrum insecticides. Insecticides used for pest control in orchards and tested for in surface water by the Middle Rogue PSP include: imidacloprid, acetamiprid, permethrin, bifenthrin, pyriproxyfen, chlorpyrifos, and diazinon.

Disease Management

The main pathogens of pears in Jackson County are fireblight, scab, and powdery mildew. Fireblight is managed with antibiotics during bloom and cutting infected wood during the rest of the growing season. Powdery mildew is controlled during early season with the use of sulfur, oils, and a range of fungicides. Scab is controlled with cultural practices to maximize airflow through trees and with the use of copper, oil, and fungicides. Rotation among fungicide chemistries is important to limit resistance. No fungicides or antibiotics labeled for pears are currently tested for by the Middle Rogue PSP.

Weed Management

Weeds are controlled in orchard driverows primarily through mowing. Undertree weed control primarily relies on herbicide application. Dichlobenil, diuron, napropamide, norflurazon, pendimethalin, pronamide, simazine, trifluralin are used for pre-emergent weed control and are generally applied November to March. Glyphosate is commonly used for post-emergent weed control during the growing season. All herbicides listed above are tested for in surface waters by the Middle Rogue PSP.

A complete list of pesticides labeled for use in pears in Oregon is available at pnwhandbooks.org

Always read and follow the label when applying pesticides.

Assembled by Gordon Jones, Southern Oregon Research & Extension Center, for the Middle Rogue Pesticide Stewardship Partnership
Sources: Mitcham, E. and R. Elkins. 2007. Pear Production and Handling Manual. University of California Agriculture and Natural Resources.
Jepson, P. 2017. Middle Rogue pesticide movement risk evaluation.
Murray, M. and J. DeFrancesco. 2014. Pest Management Strategic Plan for Pears in Washington and Oregon. Integrated Plant Protection Center.
Thompson, A. *et al.* 2019. EM 8203: 2019 Pest Management Guide for Tree Fruits in the Mid-Columbia Area. Oregon State Extension Service.

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Middle Rogue Pesticide Stewardship Partnership Crop Calendar – Wine Grapes

	J	F	M	A	M	J	J	A	S	O	N	D
Timing	Dormancy	Dormancy	Delayed Dormant	Shoot Growth	Bloom	Fruit Set	Fruit Growth	Veraision	Pre-Harvest	Harvest	Dormancy	Dormancy
Pests												
Insects				Mites	Mites, Hoppers, & Mealybugs	Mites & Hoppers	Leafhoppers	Hoppers & Mealybugs	Hoppers			
Diseases				Powdery Mildew	Powdery Mildew & Botrytis	Powdery Mildew & Botrytis	Powdery Mildew & Botrytis	Botrytis	Botrytis			
Weeds	Winter Annuals & Perennials	Winter Annuals & Perennials	Winter Annuals & Perennials		Summer Annuals & Perennials	Summer Annuals & Perennials	Summer Annuals & Perennials				Winter Annuals & Perennials	Winter Annuals & Perennials
Movement Risks												
Thermal Drift												
Wind Drift												
Inversion Drift												
Runoff												

Management

Insect Pest Management

Insect pest problems in vineyards occur occasionally in Southern Oregon. Many crops are grown without insecticide application. Grape mealybug can vector Grapevine Leafroll-associated Virus, and three-cornered alfalfa hoppers are thought to vector Grapevine Red Blotch Virus. These pests are controlled with cultural practices and insecticide application, often applied through drip irrigation systems. Spider mites and erineum mites are occasionally treated with miticide application. Acetamiprid and imidacloprid are used for of control leaf and tree hoppers in vineyards and are tested for in surface water by the Middle Rogue PSP.

Disease Management

The main fungal pathogens of wine grapes in Jackson County are powdery mildew and Botrytis bunch rot. Powdery mildew is controlled throughout the growing season with the use of oil, sulfur, and a range of fungicides. Botrytis is controlled with cultural practices to maximize airflow through vines and clusters and with the use of fungicides from bloom to pre-harvest. Rotation among fungicide chemistries is important to limit resistance. No fungicides labeled for wine grapes are currently evaluated by the Middle Rogue PSP.

Weed Management

Weeds are controlled in vineyard driverows primarily through mowing. Undervine weed control has primarily relied on herbicide application, but increasingly vineyard managers are using undervine mowing and cultivation. Dichlobenil, diuron, napropamide, norflurazon, pendimethalin, pronamide, simazine, trifluralin may be used for pre-emergent weed control and applied November to March. Glyphosate is commonly used for post-emergent weed control during the growing season. All herbicides listed above are tested for in surface waters by the Middle Rogue PSP.

A complete list of pesticides labeled for use in wine grapes in Oregon is available at pnwhandbooks.org

Always read and follow the label when applying pesticides.

Assembled by Gordon Jones, Southern Oregon Research & Extension Center, for the Middle Rogue Pesticide Stewardship Partnership

Sources: Hellman, E. 2003. Oregon Viticulture. Oregon State University Press.
Jepson, P. 2017. Middle Rogue pesticide movement risk evaluation.
Murray, M. and J. DeFrancesco. 2016. Pest Management Strategic Plan for Winegrapes in Oregon. Integrated Plant Protection Center,
Skinkis, P. *et al.* 2019. EM 8413: 2019 Pest Management Guide for Wine Grapes in Oregon. Oregon State University Extension Service.

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Middle Rogue Pesticide Stewardship Partnership Crop Calendar – **Alfalfa Hay**

	J	F	M	A	M	J	J	A	S	O	N	D
Timing	Dormancy	Green Up	Growing	Growing	1st Cutting	Regrowth	2nd Cutting	Regrowth	3rd Cutting	Regrowth	Regrowth	Dormancy
Pests												
Insects				Alfalfa Weevils	Alfalfa Weevils	Alfalfa Weevils						
Diseases					Downy Mildew	Downy Mildew	Downy Mildew	Downy Mildew				
Weeds		Winter Annuals & Perennials	Winter Annuals & Perennials	Winter Annuals & Perennials		Summer Annuals & Perennials	Summer Annuals & Perennials			Winter Annuals & Perennials	Winter Annuals & Perennials	Winter Annuals & Perennials
Movement Risks												
Thermal Drift												
Wind Drift												
Inversion Drift												
Runoff												

Management

Insect Pest Management

The most economically important pest of alfalfa is the alfalfa weevil, which can reduce the yield and quality of alfalfa by skeletonizing leaves. Alfalfa weevil damage is limited by early harvest and the application of insecticides. Carbaryl, malathion, chlorpyrifos, dimethoate, and permethrin are labeled for the control of alfalfa weevil and are monitored for by the Middle Rogue PSP.

Disease Management

Control of diseases in alfalfa is obtained by planting resistant varieties and the use of fungicides, primarily as seed treatment but also occasional foliar applications. Of the fungicides labeled for alfalfa and monitored by the Middle Rogue PSP, pyraclostrobin and azoxystrobin are used as both seed treatments and foliar sprays, while trifloxystrobin is only labeled as a seed treatment on alfalfa.

Weed Management

Weed control in alfalfa is primarily achieved with the production of vigorous stands and proper fertilization, irrigation and harvest management. Herbicides labeled for alfalfa and tested for by the Middle Rogue PSP include diuron, hexazinone, norflurazon, terbacil, pronamide, and metribuzin for winter annual control, and trifluralin, pendimethalin, and EPTC for summer annual weed control.

A complete list of pesticides labeled for use on alfalfa hay in Oregon is available at *pnwhandbooks.org*

Always read and follow the label when applying pesticides.

Assembled by Gordon Jones, Southern Oregon Research & Extension Center, for the Middle Rogue Pesticide Stewardship Partnership

Sources: Jepson, P. 2017. Middle Rogue pesticide movement risk evaluation.
Orloff, S. and H. Carlson. 1997. Intermountain Alfalfa Management. UC ANR # 3366.
Summers, C. and D. Putnam. 2008. Irrigated Alfalfa Management for Mediterranean and Desert Zones. UC ANR #3512.

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Middle Rogue Pesticide Stewardship Partnership Crop Calendar – **Grass Hay**

		J	F	M	A	M	J	J	A	S	O	N	D
Timing		Dormancy	Green Up	Vegetative	Transition	Heading / 1st Cutting	1st Cutting	Vegetative	Vegetative	Vegetative/ 2nd Cutting	2nd Cutting	Vegetative	Dormancy
Pests	Insects					Grasshoppers	Grasshoppers	Armyworms & Grasshoppers	Armyworms	Armyworms			
	Diseases												
	Weeds		Winter Annuals & Perennials	Winter Annuals & Perennials	Winter Annuals & Perennials		Summer Annuals & Perennials	Summer Annuals & Perennials			Winter Annuals & Perennials	Winter Annuals & Perennials	
Movement Risks	Thermal Drift												
	Wind Drift												
	Inversion Drift												
	Runoff												

Management

Insect Pest Management

Insect pests only occasionally cause enough damage to Southern Oregon grass hay fields to warrant treatment. Armyworms can be controlled with a range of insecticides including carbaryl as a spray or bait, bifenthrin, or malathion, all of which are tested for in surface water by the Middle Rogue PSP. Armyworms are an occasional pest of hayfields in eastern Jackson county. Treatment options include carbaryl, malathion, diflubenzuron or early mowing.

Disease Management

Pathogens rarely cause enough damage to grass hay to warrant treatment. Selection of disease resistant forage varieties is the main strategy to prevent infection. No fungicides are currently labeled for perennial grass hay in Oregon, but several fungicides are labeled for use in grass-legume mixtures. Of those, azoxystrobin is the only compound monitored by the Middle Rogue PSP.

Weed Management

Primary weed control for grass hay fields is the competition from vigorous forage crops. Proper irrigation, fertilization, and harvest management are key tools in weed control for hay fields. A wide range of herbicides are labeled for use on grass hay. Of the compounds tested for by the Middle Rogue PSP, MCPA, 2,4-D, dicamba, picloram, and triclopyr selectively control broadleafed plants, while diuron and metsulfuron methyl control both broadleaf and grass weeds, and glyphosate is labeled for spot spraying.

A complete list of pesticides labeled for use on grass hay in Oregon is available at *pnwhandbooks.org*

Always read and follow the label when applying pesticides.

Assembled by Gordon Jones, Southern Oregon Research & Extension Center, for the Middle Rogue Pesticide Stewardship Partnership

Sources: Jahns, T. *et al.* 2007. Pest Management Strategic Plant for Non-Rangeland Forages in the Western States. Western IPM Center.
Jepson, P. 2017. Middle Rogue pesticide movement risk evaluation.
Wilson., R. and S. Orloff. 2006. Controlling Weeds in Grass Hay and Alfalfa-grass Mixtures. 37th California Alfalfa & Forage Symposium.

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Middle Rogue Pesticide Stewardship Partnership Crop Calendar – **Winter Grain**

	J	F	M	A	M	J	J	A	S	O	N	D
Timing	Dormancy	Green Up	Vegetative	Transition	Heading	Maturity	Harvest			Planting	Vegetative Growth	Dormancy
Pests												
Insects				Cereal Leaf Beetle	Cereal Leaf Beetle	Cereal Leaf Beetle	Cereal Leaf Beetle			Aphids & Hessian Fly	Aphids & Hessian Fly	
Diseases				Rust & Septoria	Rust & Septoria					Seed Treatments		
Weeds		Winter Annuals	Winter Annuals	Winter Annuals		Summer Annuals				Winter Annuals	Winter Annuals	
Movement Risks												
Thermal Drift												
Wind Drift												
Inversion Drift												
Runoff												

Management

Insect Pest Management

Insect pests are controlled in winter grain crops with crop rotation, foliar pesticide applications, and seed treatments. Aphids and Hessian fly are controlled with seed treatments of neonicotinoid pesticides including imidacloprid. Carbaryl, malathion, chlorpyrifos, dimethoate, and methomyl are labeled for use on a range of insect pests in small grains, particularly winter wheat, and are monitored for by the Middle Rogue PSP.

Disease Management

Diseases are primarily controlled through crop rotation and selection of disease-resistant varieties. Fungicides are used both as a seed treatment and as a foliar spray. Four fungicides monitored for by the Middle Rogue PSP and labeled for use in small grains are: pyraclostrobin, trifloxystrobin, azoxystrobin, and propiconazole. Barley yellow dwarf virus affects small grains; it's spread is limited through the control of aphids.

Weed Management

A range of grass and broadleafed weeds are problematic in small grain fields. Crop rotation and production of vigorous stands of grain reduce the need for chemical weed control. Of the compounds labeled for small grains and monitored for by the Middle Rogue PSP, pyraflufen, MCPA, 2,4-D, dicamba, and metsulfuron methyl are used for broadleaf weed control, and diuron, pendimethalin, trifluralin, and metribuzin control broadleaf and certain grass weeds.

A complete list of pesticides labeled for use on winter grain crops in Oregon is available at *pnwhandbooks.org*

Always read and follow the label when applying pesticides.

Assembled by Gordon Jones, Southern Oregon Research & Extension Center, for the Middle Rogue Pesticide Stewardship Partnership

Sources: Himyck, R. *et al. 2004.* Pest Management Strategic Plan for PNW Small Grains. Western IPM Center.
Jepson, P. 2017. Middle Rogue pesticide movement risk evaluation.

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Appendix 4. Risk reduction table for Best Management Practices.

Drift Measures	Estimated % Reduction in Loading	Effectiveness
No Spray Drift Buffers		
1. Ground boom/chemigation buffer		
a. 10 meters (33 feet)	90	High
2. Air blast buffer		
a. 10 meters (33 feet)	80	Moderate
b. 20 meters (67 feet)	95	High
3. Aerial buffer		
a. 20 meters (67 feet)	25	Low
b. 100 meters (328 feet)	85	Moderate
c. 150 meters (492 feet)	90	High
Spray Drift Reduction (Range corresponds with EPA Star Program)		
1. Technology		
a. Category One	25-50	Low
b. Category Two	50-75	Moderate
c. Category Three	75-90	High
d. Category Four	>90	High
2.Granular treatment	99	High
3.Spot application < .1 acre	99	High
4. Riparian plantings	27-36	Low
5. Functional riparian plantings alongside waterways > 10m	99	High
Runoff/Drainage Measures		
1. Vegetated filter strips		
a. 5 meters (17 feet)	40	Low
b. 10 meters (33 feet)	65	Low
c. 20 meters (66 feet)	80	Moderate
d. Inter row	50	Low
2. Spot applications < .1 acres	99	High
3. Vegetated ditches	50	Low
4. No-till / Reduced tillage	50	Low
5. Retention Ponds	75	Moderate
6. Functional riparian plantings alongside waterways > 10m	99	High
7. Participation in recognized stewardship program per strategic plan	99	High

Appendix 5. SOREC Events & Educational Programs Focused on IPM 2018 - 2019

Events & Educational Programs Focused on IPM, safe use of pesticides, and protecting surface water based on results from the Middle Rouge PSP including discussion of pesticides of concern.

July 18 2019 – Orchard Sprayer Patternator Demonstration & PSP monitoring update – Gordon Jones & Rick Hilton – Southern Oregon Pear Field Day – 22 participants

June 20, 2019 – Middle Rogue Pesticide Stewardship Partnership Update – Gordon Jones - SOREC Tree Fruit Pest Management Forum – 15 participants

April 16, 2019 - Agriculture Extension in the Rogue Valley – Gordon Jones – Presentation to Jackson County Farm Bureau – 20 participants

March 15, 2019 - Safe Use of Pesticides – Gordon Jones - Master Gardener Seeds of Spring Meeting – 10 participants

February 21, 2019 – Middle Rogue Pesticide Stewardship Partnership Update – Gordon Jones - SOREC Tree Fruit Pest Management Forum – 12 participants

February 7, 2019 - Managing Troublesome Weeds – Gordon Jones – SOREC Land Stewards Continuing Education Event – 50 participants

November 6, 2018 – IPM for Land Owners – Gordon Jones – Presentation to the 2018 Land Steward Cohort – 25 participants

November 1, 2018 – IPM and Pesticide Stewardship in the Middle Rogue- Gordon Jones – Douglas County IPM Seminar – 17 participants

October 25 2018 – SOREC Pear Research Advisory Board – Gordon Jones – 6 participants

October 19 2018 –Winegrape IPM in Southern Oregon - Southern Oregon Wine Institute Guest Lecture – Rick Hilton – 23 participants

September 20, 2018 – 2nd Middle Rogue IPM Festival – Gordon Jones, et al. – 51 participants

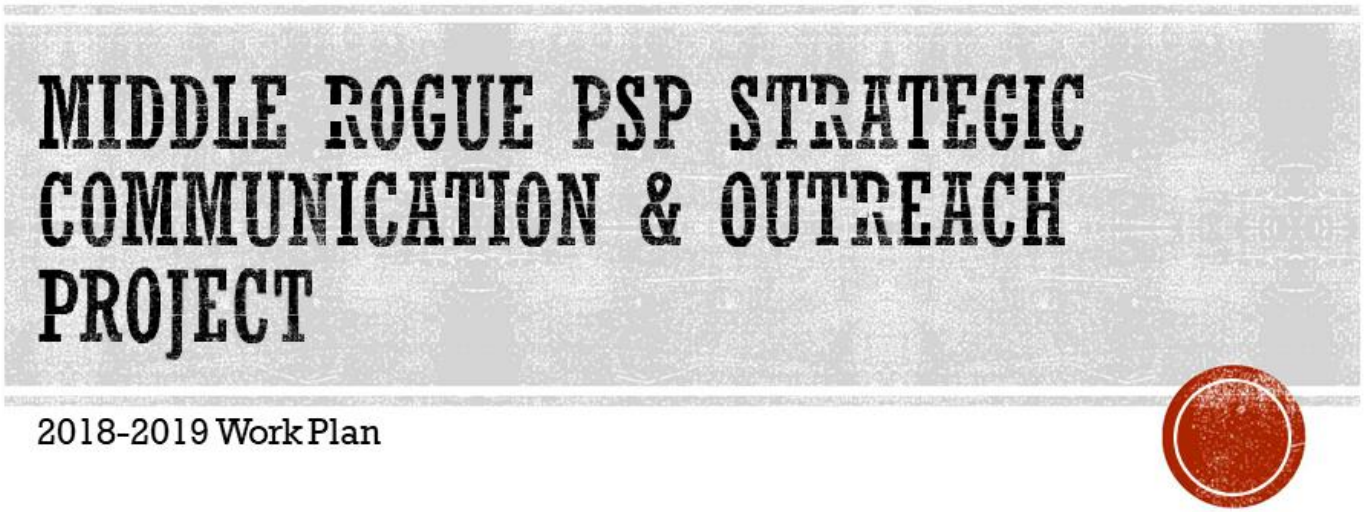
July 12, 2018 – Middle Rogue PSP Update - SOREC Pear Field Day – Gordon Jones – 25 participants

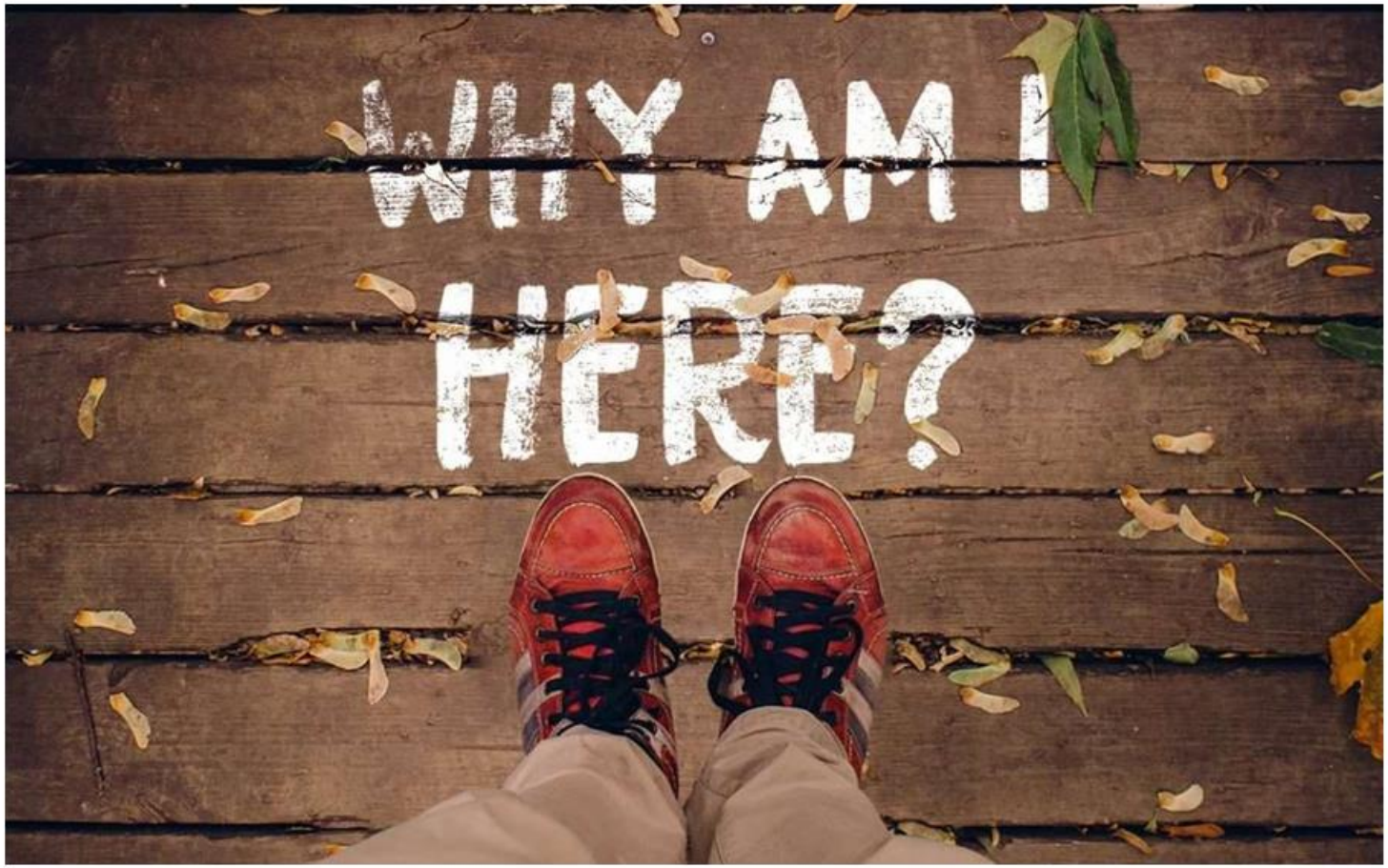
May 3, 2018 - Middle Rogue Pesticide Stewardship Partnership Update – Gordon Jones - SOREC Tree Fruit Pest Management Forum – 10 participants

March 18 2018 – Middle Rogue PSP Update- Southern Oregon Grape Day – Gordon Jones – 60 participants.

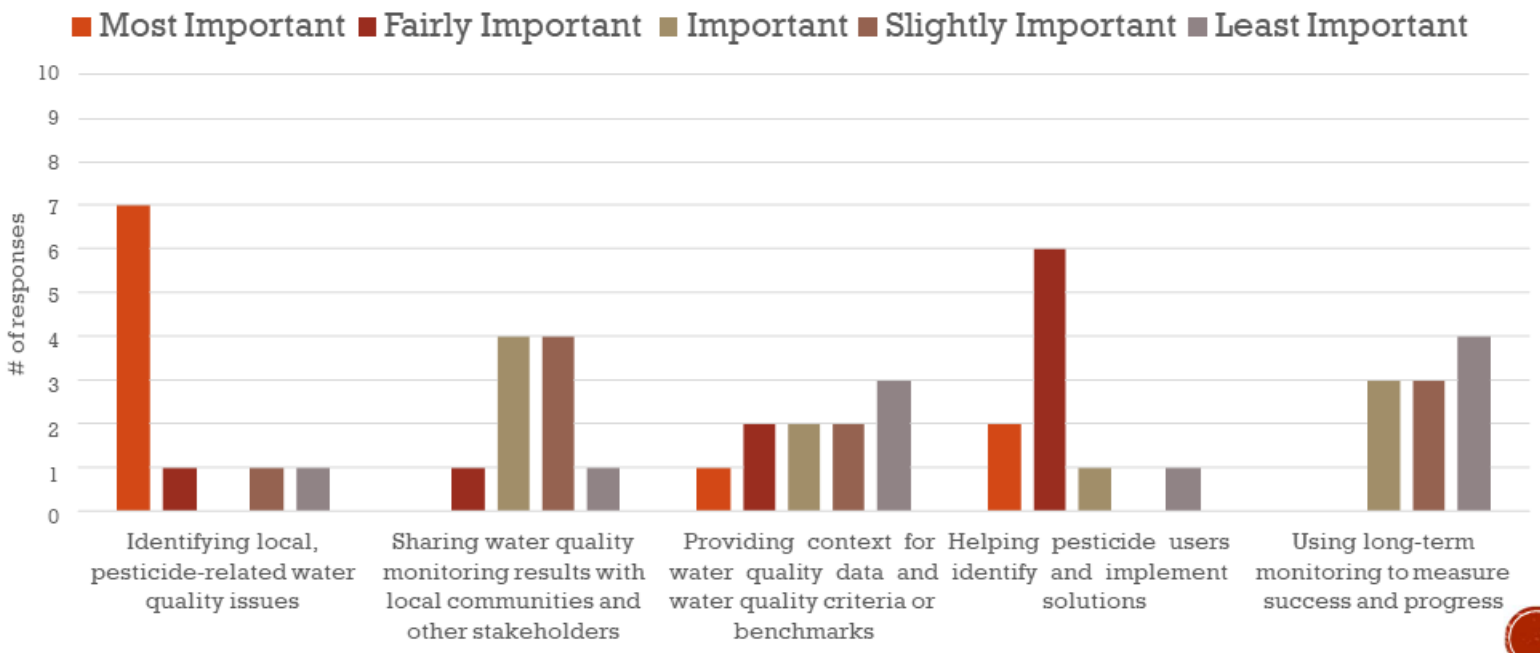
February 1, 2018 – Vineyard IPM in the Middle Rogue – Oregon Vineyard Supply Grower Meeting – Rick Hilton – 55 participants.

Appendix 6. Partner evaluation survey to gauge partner opinion of the MRPSP process.

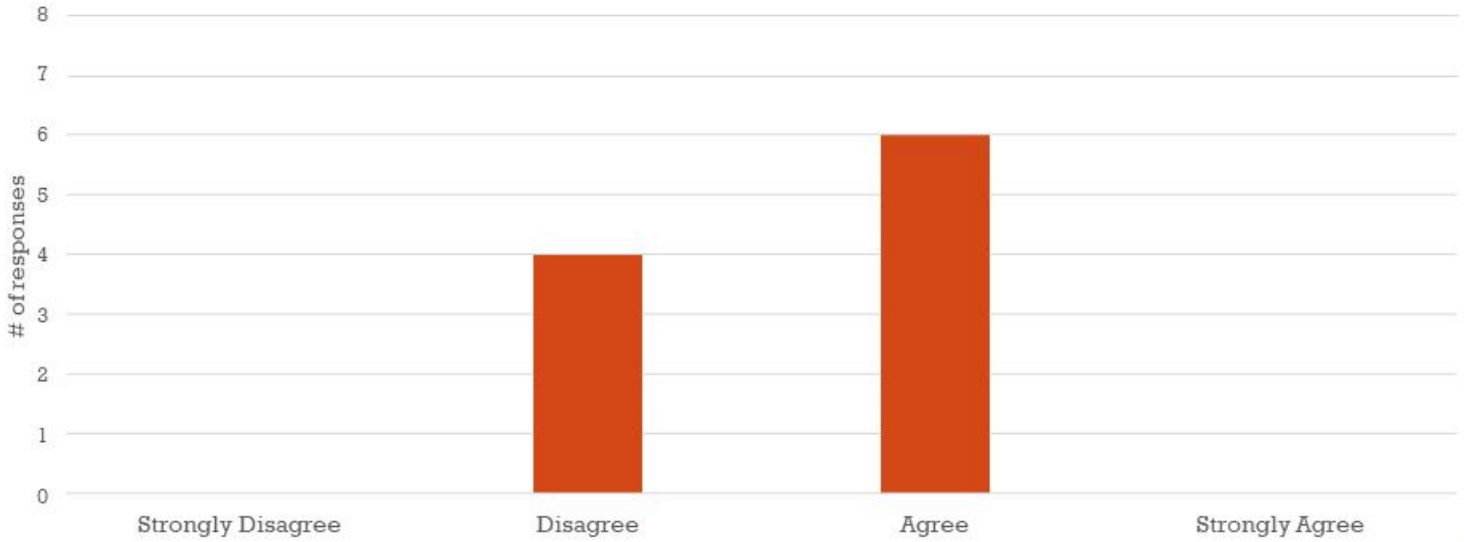



WHY AM I
HERE?

How important to you are the following aspects of the Middle Rogue PSP?



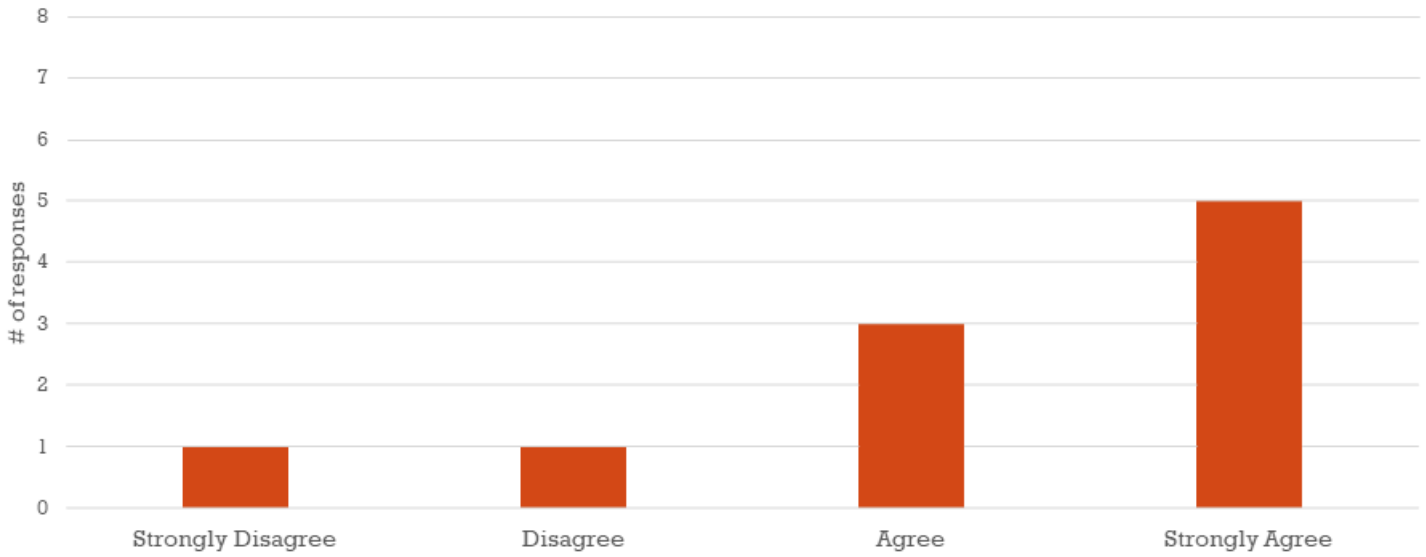
THE PEOPLE WHO ATTEND MIDDLE ROGUE PSP MEETINGS REPRESENT A CROSS-SECTION OF THOSE WHO HAVE A STAKE IN WHAT WE ARE TRYING TO ACCOMPLISH.



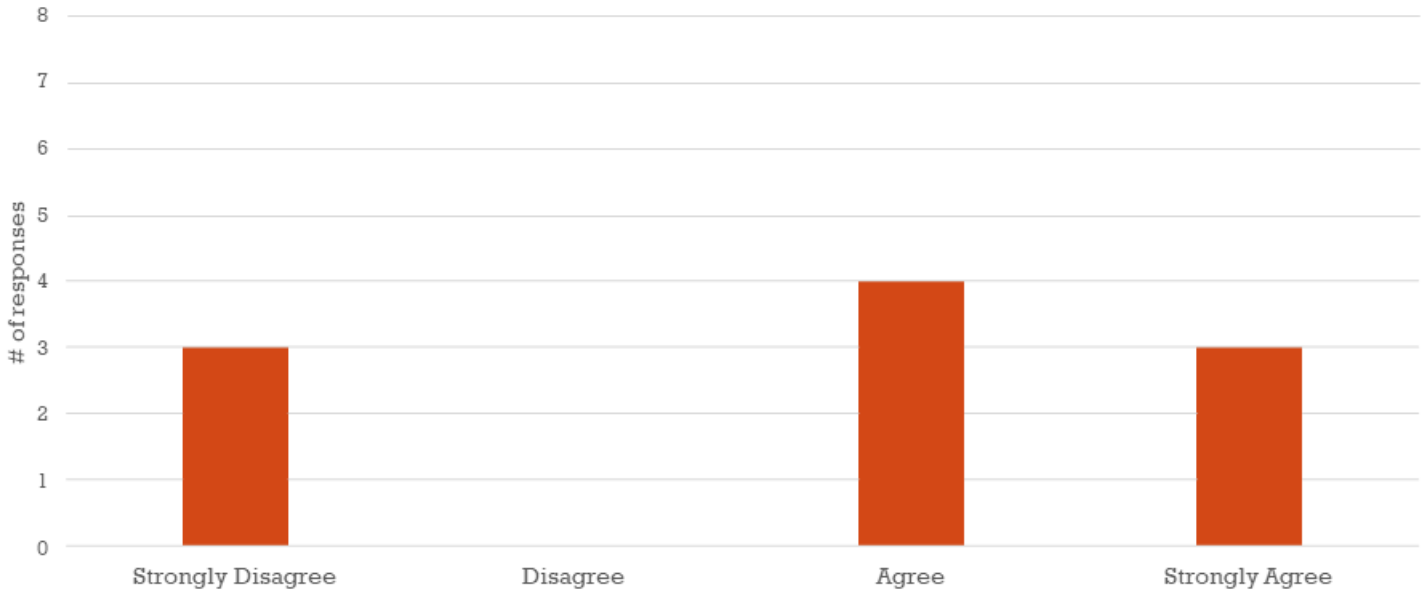
WHO IS MISSING FROM OUR PSP THAT WOULD PROVIDE ANOTHER VOICE OR VALUABLE PERSPECTIVE?

- Agricultural Producers, Small- and Large-Scale
- We have lost the orchardists that we initially had at the table. We don't have any ranchers, hay farmers, vegetable farmers.
- More City Reps, Large-scale Ag Reps
- Irrigation districts, landscaping contractors, reps. from other ag industries (cattle, hay, cannabis)
- Perhaps representatives from various application industries (forester, landscaper, pear grower, vineyardist)
- ODOT, more ag. and timber
- Need more buy in from the pesticide users

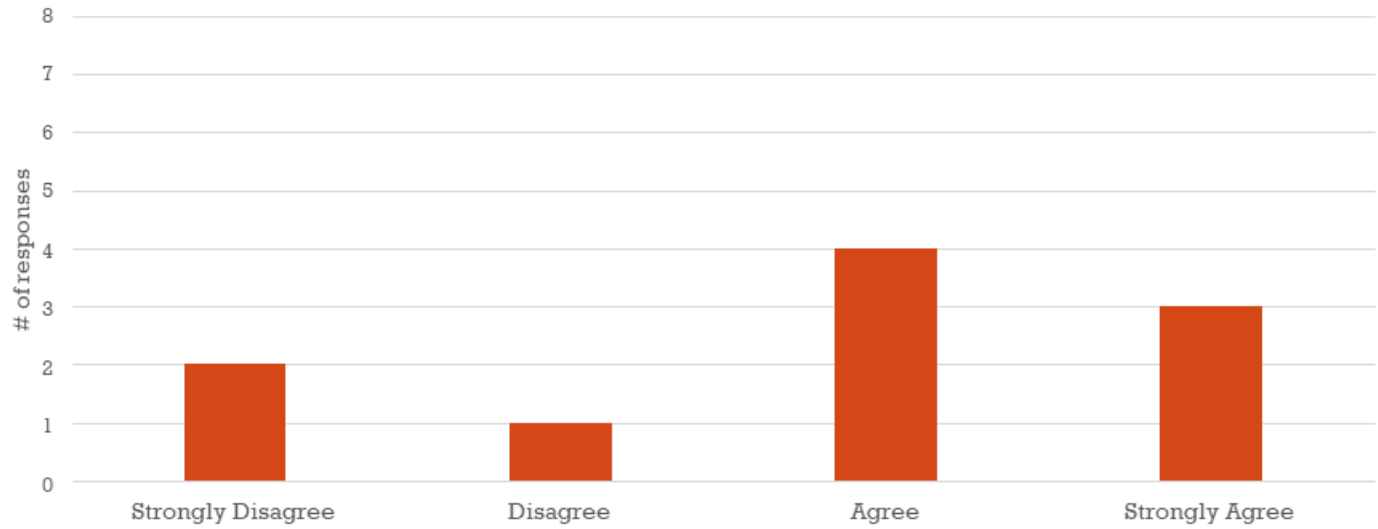
MY ORGANIZATION WILL BENEFIT FROM BEING INVOLVED WITH THE MIDDLE ROGUE PSP.



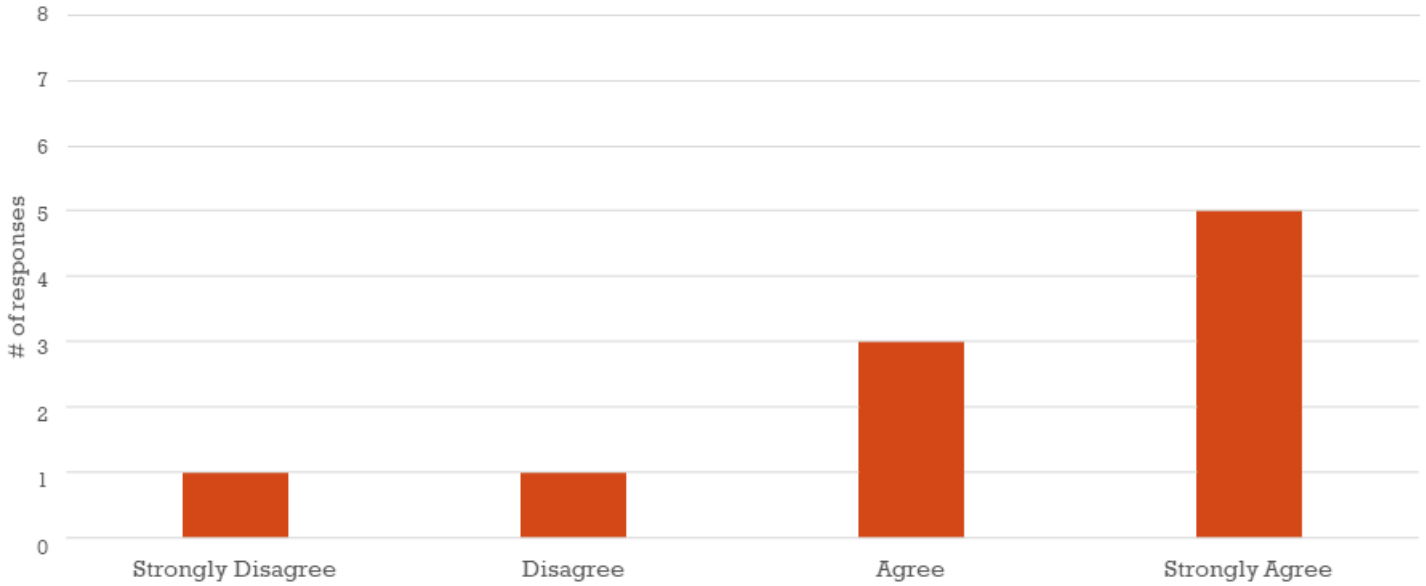
I HAVE A CLEAR SENSE OF MY ORGANIZATION'S ROLES AND RESPONSIBILITIES IN THE MIDDLE ROGUE PSP.



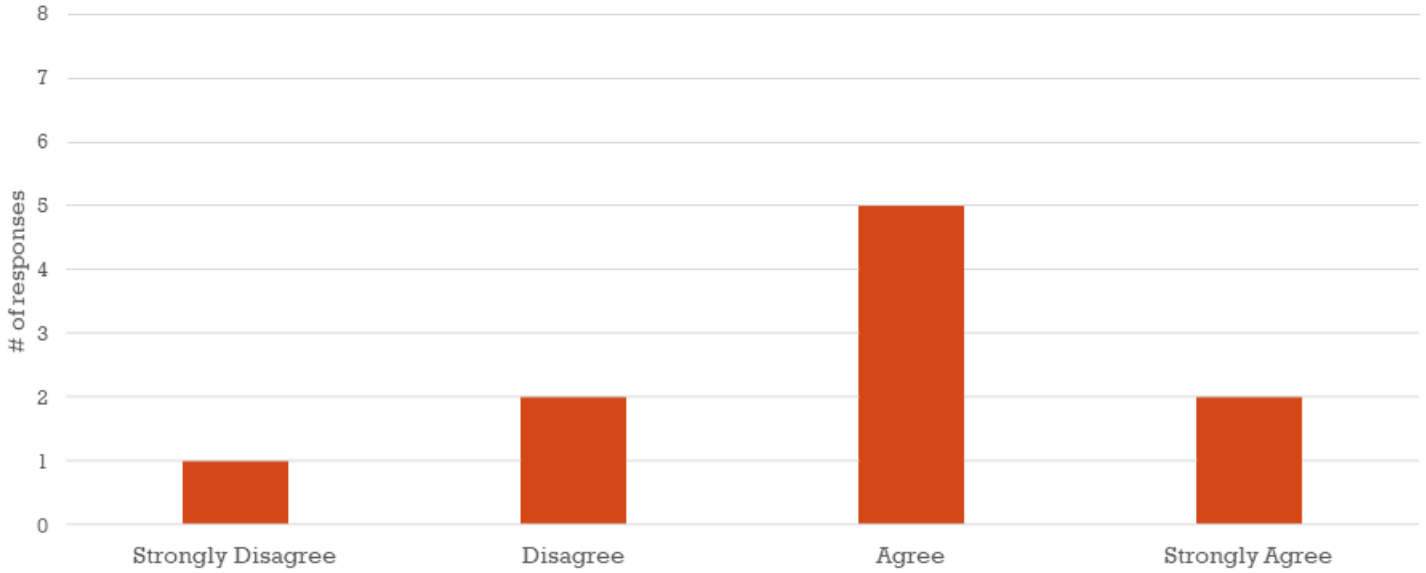
I HAVE A CLEAR UNDERSTANDING OF WHAT THE MIDDLE ROGUE PSP IS TRYING TO ACCOMPLISH.



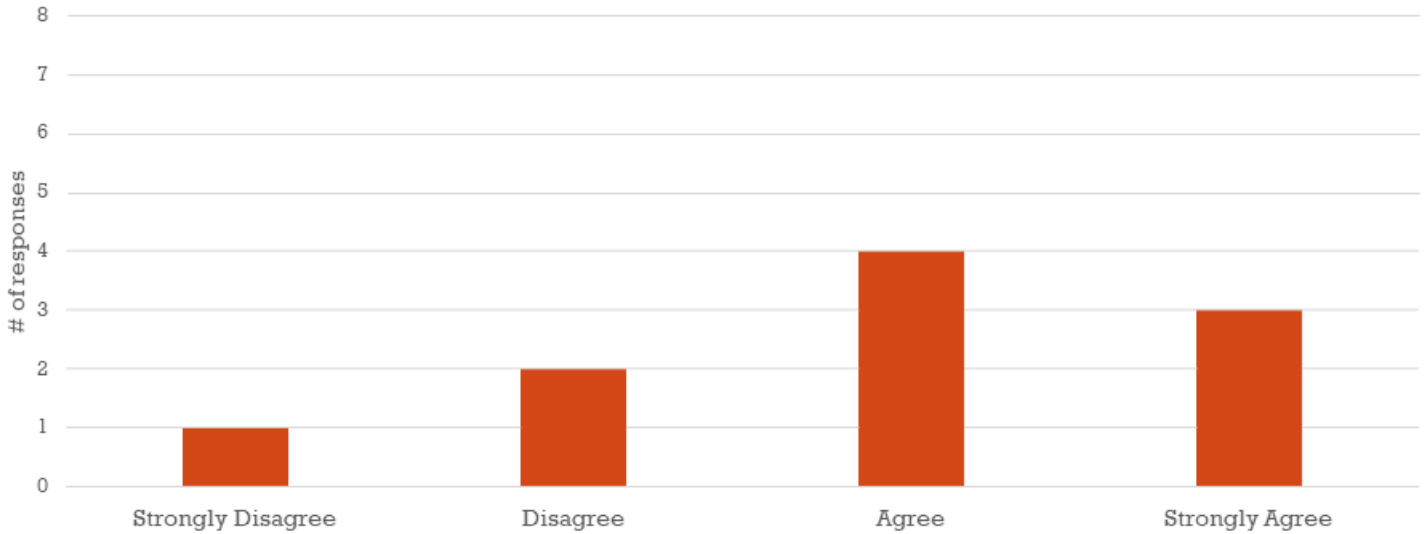
I AM INFORMED AS OFTEN AS I SHOULD BE ABOUT WHAT GOES ON IN THE MIDDLE ROGUE PSP.



WHEN DECISIONS NEED TO BE MADE THERE IS AN OPEN PROCESS THAT IS RESPECTFUL OF VARIOUS OPINIONS.



THE STRATEGY FOR THE MIDDLE ROGUE PSP MAKES GOOD USE OF THE MY ORGANIZATION'S IN-KIND RESOURCES (E.G. SKILLS, EXPERTISE, INFORMATION, DATA, CONNECTIONS, EQUIPMENT).



THE APPROACH OF THE MIDDLE ROGUE PSP MAKES GOOD USE OF MY ORGANIZATION'S TIME.