TO: Oregon Board of Forestry and State Forester
FROM: Beyond Toxics
DATE: November 17, 2021
RE: Herbicide Application on State-Managed Forest Lands

Dear Chair Kelly, State Forester Mukumoto and members of the Board:

Please consider the following comments related to herbicide application on state-managed forest lands submitted on behalf of Beyond Toxics, a statewide environmental justice organization with offices in Lane and Jackson Counties.

At the September 8, 2021, Board of Forestry meeting, we presented findings to the Board summarizing herbicide applications on Oregon State Forests from January 1, 2020, to August 30, 2021. In that brief 20 month period, 326 tank mixes were applied to all state-managed forest lands. Of those, at least 34% of all sprays on state forest lands were aerial herbicide sprays. Out of the total 326 herbicide applications, 227 or 69.6% contained tank mixes of three or more active ingredients. And in 175 or 54% of the tank mixes used, an additional four or five adjuvants were added.

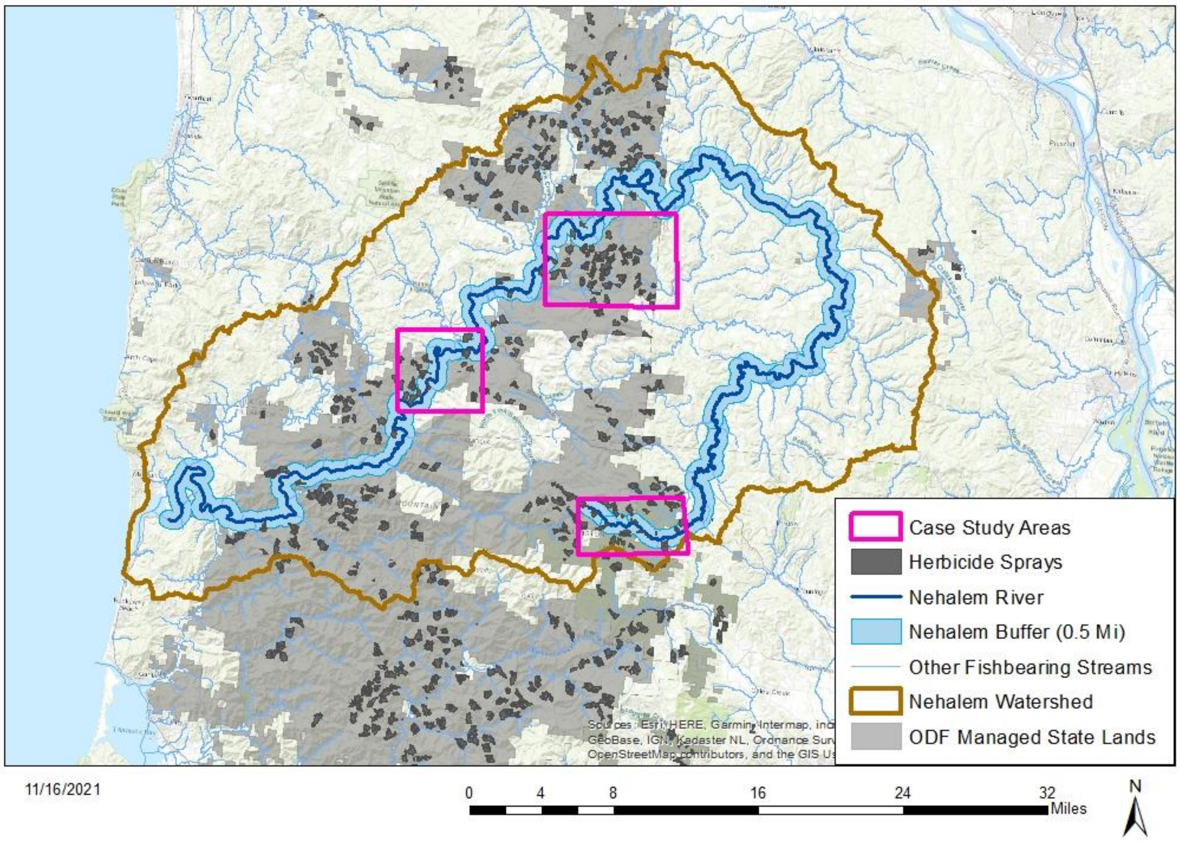
At the November 3, 2021, Board of Forestry meeting, we provided oral comments following up on our initial data analysis of herbicide sprays in state forests. We now submit to the record the following maps created using data obtained from FERNS depicting pesticide applications in the Nehalem Watershed from 2015-2021, including Astoria, Tillamook, and Forest Grove Districts. We also describe potential impacts of pesticides to fish populations and climate considerations associated with continued reliance on pesticide use. We hope this case study focused on the headwaters and other stretches of the Nehalem River can help the Board, Department staff, and public visualize where pesticide sprays take place, note their close proximity to important fish-bearing streams, and consider related impacts.

We ask that the Board consider the data we have compiled and ultimately call for a moratorium on aerial herbicide sprays and initiate an evaluation of the full range of impacts of herbicide sprays, particularly aerial herbicide applications, on state-managed forest lands on drinking water quality, greenhouse gas emissions, essential fish habitat, and community health and wellbeing.

1. **Case Study of Herbicide Sprays within the Nehalem River Watershed**

   a. **Entire Nehalem Watershed**

2015 - 2021 Herbicide Sprays On State Forests Within Nehalem Watershed

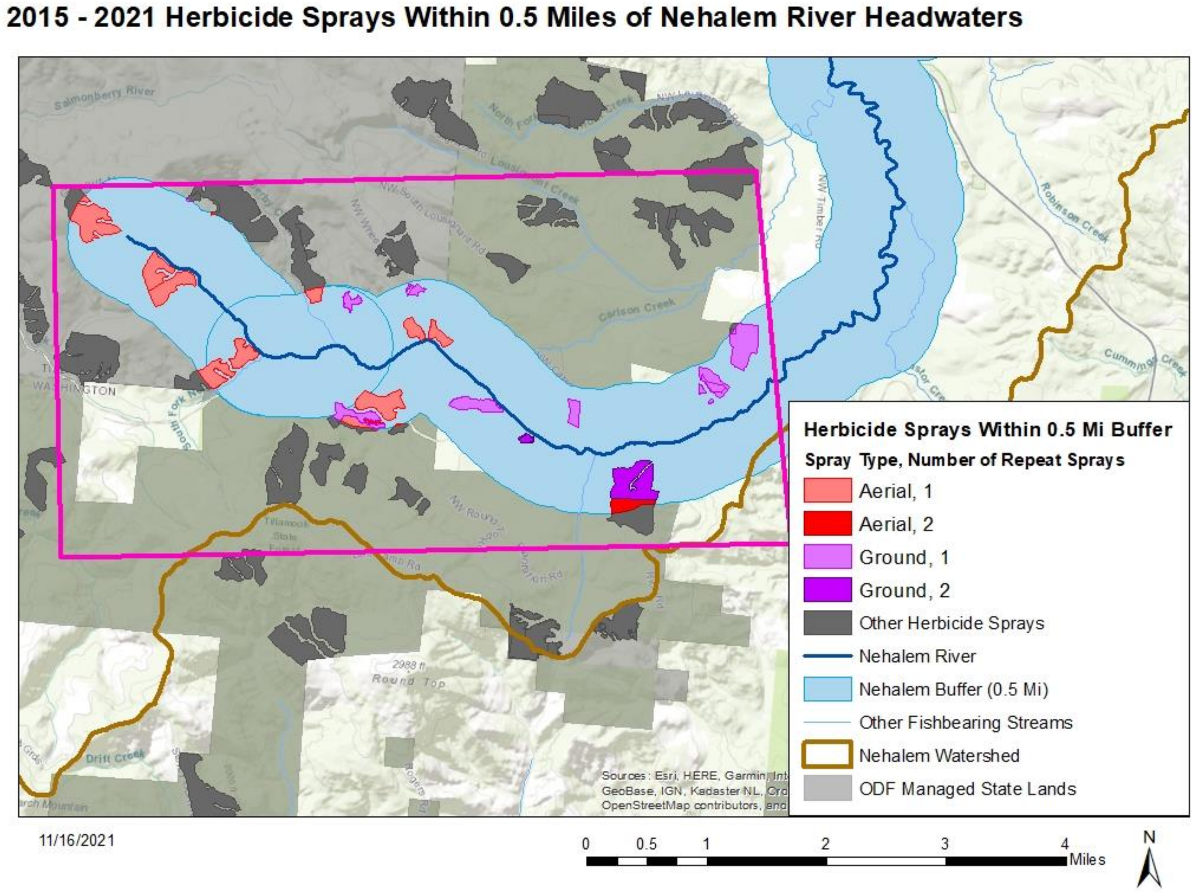


Map 1. The Nehalem Watershed.

Map 1 shows the whole Nehalem River and watershed, which includes portions of the Astoria, Forest Grove, and Tillamook Districts. From 2015 to present, 33 sprays occurred on state forest lands within a 500 foot radius of the Nehalem River. This amounted to 178 acres **total** being sprayed within a 500 foot radius of the river. A total of 82 sprays fell within a 0.5 mile radius of the river, which amounted to approximately 1,600 acres sprayed with pesticides or, counting sites sprayed more than once, an accrual of 1,925 total acres sprayed over time.

The maps below take a deeper look at the "Case Study Areas" outlined in pink.

b. Nehalem Headwaters



Map 2. Headwaters of the Nehalem.

Map 2 shows herbicide applications at the headwaters of the Nehalem River. There were 52 acres sprayed within a 500 foot radius, and many of these were adjacent to perennial streams that form the Nehalem River headwaters.

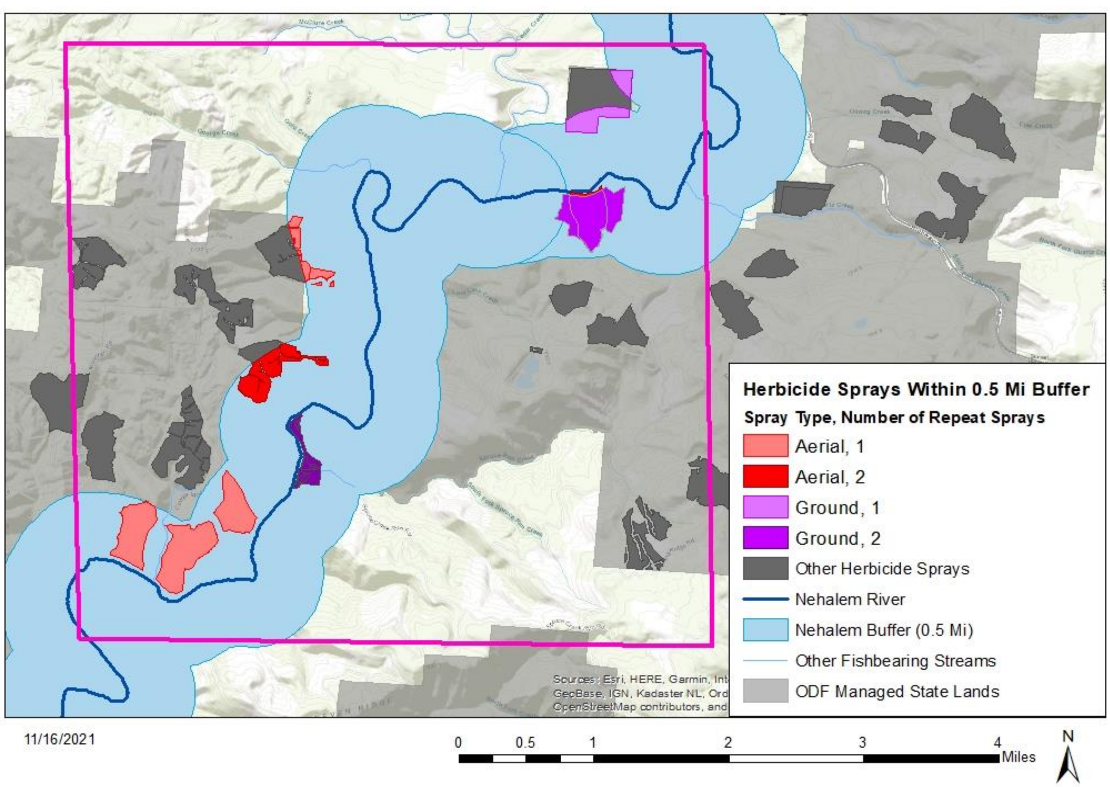
The blue shading depicts a half mile radius on either side of the headwaters. There were 26 total spray applications (with some repeat sites) in close proximity to the headwaters of the Nehalem River, which is within the Forest Grove District. Ten aerial sprays covered 271 acres within a 0.5 mile radius (not counting repeats). One site was aerially sprayed twice. Sixteen ground sprays covered 208 acres total within a 0.5 mile radius (not counting repeats). One site was ground sprayed twice. This information is outlined in Table 1.

Herbicide Sprays Near Nehalem Headwaters	# of acres sprayed within 500 ft. radius	# of sprays within 0.5 mile radius	# of acres sprayed within 0.5 mile radius	Sites sprayed more than 1 time
Aerial		10	271 (57%)	1
Ground		16	208 (43%)	1
Total	**52**	**26**	**479**	**2**

Table 1. Herbicide sprays near the headwaters of the Nehalem River.

c. Herbicide Sprays Near Lower Third of the Nehalem

2015 - 2021 Herbicide Sprays Within 0.5 Miles of Lower Third Nehalem River



Map 3. Lower third of the Nehalem.

Map 3 shows part of the lower third of the Nehalem River, which includes the Astoria District. There were 95 acres sprayed within a 500 foot radius.

The blue shading depicts a half mile radius on either side of the headwaters. There were 18 total spray applications (with some repeat sites) in close proximity to the lower third of the Nehalem River. Ten aerial sprays covered 408 acres within a 0.5 mile radius (not counting repeats). One site was aerially sprayed twice: once in 2015 and once in 2017. Eight ground sprays covered 193 acres total within a 0.5 mile radius (not counting repeats). One site was sprayed twice: one aerial application in 2015 and one ground application in 2017. Another site was sprayed three times, with both ground and aerial applications in 2016, 2018, 2019. This information is outlined in Table 2.

Herbicide Sprays Near Lower Third Nehalem	**# of acres sprayed within 500 ft. radius**	**# of sprays within 0.5 mile radius**	**# of acres sprayed within 0.5 mile radius**	**Sites sprayed more than 1 time**
Aerial		10	408 (68%)	1
Ground		8	193 (32%)	2
Total	**95**	**18**	**601**	**3**

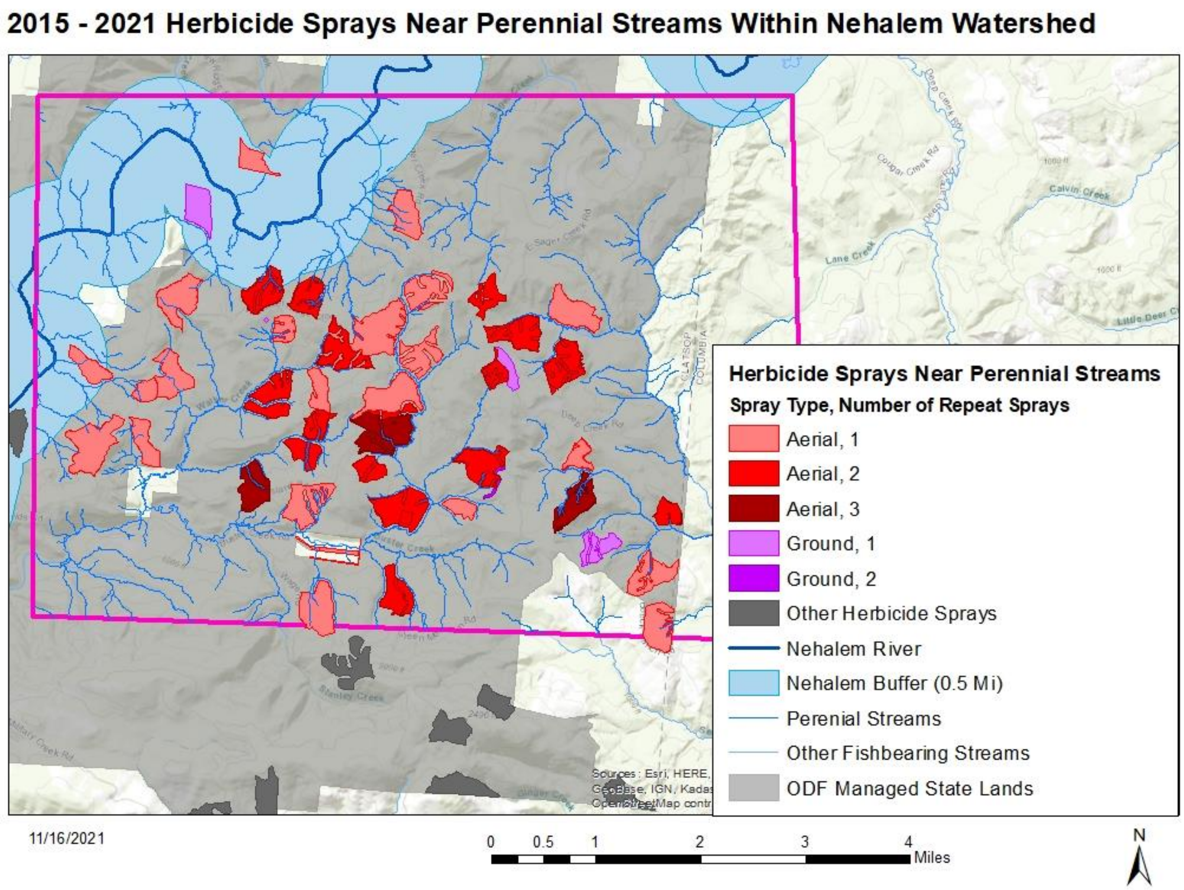
Table 2. Herbicide sprays near the lower third of the Nehalem.

d. Perennials Streams

Map 4 below shows herbicide sprays that occurred near perennial streams within the Nehalem River Watershed. ODF requires a no-spray buffer on perennial streams, so Map 4 accounts for a 100 foot no-spray buffer.

Map 4 shows the large number of sprays that occurred in close proximity or adjacent to perennial streams, the majority of which were aerial sprays. There were 100 aerial sprays near perennial streams over time, covering 2,214 total acres (not counting repeats). Of these aerial sprays, 15 sites were sprayed twice while four sites were sprayed three times. There were 10 ground sprays over time, covering 135 acres near (not counting repeats). This information is outlined in Table 3.

It must be noted that, despite no-spray buffers, chemicals applied may unintentionally enter waterways--especially in the case of aerial applications. A number of factors including weather and site conditions can cause aerially-applied pesticides to drift into unintended areas, including closer to streams.



Map 4. Herbicide sprays near perennial streams.

Herbicide Sprays Near Perennial Streams within the Nehalem River	# of sprays near 100 ft buffer on perennial streams	# of acres sprayed near 100 ft buffer on perennial streams	Sites sprayed more than 1 time
Aerial	15	2,214 (94%)	19
Ground	10	135 (6%)	0

Total	**25**	**2,349**	**19**

Table 3. Herbicide sprays near perennial streams within the Nehalem River.

2. Pesticides and Fish Populations

To build on the case study maps above, this section describes related impacts of pesticides to important fish habitat.

a. Impacts of Pesticides to Fish

As shown by analyzing the FERNS data, herbicide sprays of chemical tank mixes are occurring throughout the length of the Nehalem River. The spray activity starts in the highest reaches of the perennial streams that form the headwaters of the watershed. Both aerial and ground sprays are also made adjacent to the headwaters themselves. Multitudes of sprays over the years, from the headwaters to the outlet, may result in a pattern of cumulative residues in the waters and soils of critical aquatic wildlife habitat.

After application, pesticides can easily enter rivers and streams, due to high mobility in soil, drift and deposition. Once in the streams, they can affect fish including salmon in many different ways. Certain pesticides reduce the olfactory system of juvenile salmon,[1] which they use to sense predators and eventually navigate back to their birth stream as adults. Pesticides can also make it difficult or impossible for juvenile salmon to adapt to saline environments when they travel downstream and enter the ocean. Other impacts include a disruption in swimming and predator avoidance, fin deformities, and smaller size which all make it harder to survive.[2]

In addition to the known effects of single chemicals, tank mixes of pesticides that are used often have not been tested in their combined state so their true toxicity on fish and aquatic organisms remains unknown. Studies have found mixtures lead to synergistic effects and higher rates of unpredicted mortality. Basically, these chemicals combine to create a soup-like mixture of toxins that weaken the immune systems of salmon, disrupt their endocrine system, and increase population mortality rates.

---

[1] Tierney KB, Ross PS, Jarrard HE, Delaney KR, Kennedy CJ. "Changes in juvenile coho salmon electro-olfactogram during and after short-term exposure to current-use pesticides." *Environ Toxicol Chem*, vol. 25, no. 10, Oct. 2006, pp. 2809-17. doi: 10.1897/05-629r1.1. PMID: 17022425.

[2] See Baldwin, David H., et al. "A fish of many scales: extrapolating sublethal pesticide exposures to the productivity of wild salmon populations." *Ecological Applications*, vol. 19, no. 8, 2009, pp. 2004-2015; Du Gas, Lindsay, et al. "Effects of Atrazine and Chlorothalonil on the reproductive success, development, and growth of early life stage sockeye salmon (Oncorhynchus nerka)." *Environ Toxicol Chem*, vol. 36, no. 5, 2017, pp. 1354-1364.

b. Fish in the Nehalem

The Nehalem River is the largest “wild fish only” river on the Oregon Coast.[3] It is home to several runs of salmon, including one of the healthiest runs of Oregon Coast coho. Oregon Coast coho are a federally threatened species of salmon[4] that have key spawning habitat in this basin. The table below shows which fish species are present in the Nehalem and the time of year they are present.

Fish Species	**Presence in the Nehalem River**
Summer Chinook	• Start upriver in July through early August • Juveniles make way downstream slowly in June
Fall Chinook	• September to early November • Juveniles move downstream in March and April
Oregon Coast Coho	• August through September • Juveniles spend one year in freshwater
Chum Salmon	• Spawn during November to early December • Fry emerge and move promptly downstream
Cutthroat Trout	• Mid July through September • Fry spend two years in the streams before migrating downstream in the spring
Winter Steelhead	• December to March • Fry emerge in mid-August and spend two full years in freshwater before going to ocean

Table 4. Fish type and presence in the Nehalem.[5]

[3] Wild Salmon Center, “Oregon’s Scenic Nehalem,” https://wildsalmoncenter.org/2018/05/21/oregons-scenic-nehalem/.

[4] NOAA Fisheries, “Oregon Coast Coho Salmon,” https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/oregon-coast-coho-salmon.

[5] Sources for Table 4: Wild Salmon Center, “Oregon’s Scenic Nehalem,” https://wildsalmoncenter.org/2018/05/21/oregons-scenic-nehalem/; Oregon Fishing Info, “Nehalem Bay,” http://oregonfishinginfo.com/Nehalem%20Bay.html; Oregon Department of Fish and Wildlife, “Salmon and Steelhead Recovery Tracker: Nehalem (Independent Population),” http://www.odfwrecoverytracker.org/explorer/species/Coho/run/default/esu/129/145/; Maser, Joseph. “Nehalem River Watershed Assessment: Fish and Fish Habitat,” Portland State University Project, http://web.pdx.edu/~maserj/project/project1/9.htm.

Based on the data we have compiled using the FERNS system, the large majority of the Department's pesticide sprays in the area take place in the summer, so steelhead juveniles will be hit hard because that is when they emerge. Summer Chinook spawn right at the end of the peak spray season, so their egg development may be affected as well. The biggest effects will be on Oregon Coast coho, cutthroat trout, and steelhead, all of which spend one to two years in the Nehalem as juveniles and will thus be exposed to these toxins for longer than other species that migrate downstream immediately, such as chum salmon.

3. Pesticides and Climate Change

Finally, we want to thank the Board for voting to approve the Climate Change and Carbon Plan and emphasize the significance of prioritizing climate mitigation and adaptation in further planning initiatives, including the Western Oregon Forests FMP.

The Pacific Northwest has warmed by about 3 degrees F (or 1.7 degrees C) in the past half-century.[6] Higher temperatures create imbalances in natural systems, causing more outbreaks and damage from pests and invasive weeds. This leads to increased reliance on pesticide use as there are more pests to manage.[7]

However, pesticides contribute to the climate crisis throughout their manufacture, transport and application. When pesticides are made, greenhouse gases including carbon dioxide, methane and nitrous oxide are emitted.[8]

While all communities deserve protected, clean drinking water, pesticide use has put crucial drinking water sources at risk. Further, warming waters may increase pesticide toxicity. As water temperatures rise, the harms from even small amounts of pesticides in waterways worsen for fish and other aquatic life.

Additionally, studies show pesticides kill over 70% of the microbial diversity in soils.[9] Mature and old growth trees, diverse vegetation, and healthy soils are needed to maximize the carbon sequestration potential of our forests.

---

[6] Johnson and Cline. "Northwest US faces hottest day of intense heat wave," June 28, 2021. Available at https://apnews.com/article/canada-heat-waves-environment-and-nature-cc9d346d495caf2e245fc9ae923adae1.

[7] Matzrafi M. "Climate change exacerbates pest damage through reduced pesticide efficacy." *Pest Management Science*, vol. 75, no. 1, 2019, pp. 9-13, doi: 10.1002/ps.5121.

[8] Heimpel GE, Yang Y, Hill JD, Ragsdale DW. "Environmental consequences of invasive species: greenhouse gas emissions of insecticide use and the role of biological control in reducing emissions." PLoS ONE, vol. 8, no. 8, 2013, e72293. Available at https://doi.org/10.1371/journal.pone.0072293.

Finally, as pollinator populations are declining due to climate change, pesticide use causes additional stress. Recent research indicates high bee abundance and diversity in PNW forests.[10] However, pesticide use can degrade pollinator habitat, particularly for ground nesting native bees, and exposure to heavily-used glyphosate can harm the development of a pollinator's gut microbiome, lowering lifespans and decreasing their ability to withstand pathogens.[11]

While numerous goals included in the draft FMP address these concerns, we advocate for the inclusion of a specific chemical spray goal. We greatly appreciate Chair Kelly recognizing this request and expressing support for this revision during the November 3rd meeting.

Overall, it is crucial that ODF draft strategies to support resilient, climate-adapted forests that can withstand disturbances and changing conditions. We look forward to continuing to work with ODF staff as the process continues and ask that the Board please support a strong FMP that prioritizes ecologically-sound and just forest management that supports the health of our forested ecosystems and communities.

Thus, we ask that the Board consider the data we have compiled and ultimately call for a moratorium on aerial herbicide sprays and initiate an evaluation of the full range of impacts of herbicide sprays, particularly aerial herbicide applications, on state-managed forest lands on drinking water quality, greenhouse gas emissions, essential fish habitat, and community health and wellbeing.

Thank you very much for your consideration of our comments.

Sincerely,

Lisa Arkin, Executive Director, Beyond Toxics
larkin@beyondtoxics.org

Grace Brahler, Oregon Climate Action Plan and Policy Manager, Beyond Toxics
gbrahler@beyondtoxics.org

Emily Cook, Environmental Science Coordinator, Beyond Toxics
ecook@beyondtoxics.org

---

[9] Gunstone, Tari, et al. "Pesticides and Soil Invertebrates: A Hazard Assessment." *Frontiers in Environmental Science*, vol. 9, 2021, p. 122. Available at https://www.frontiersin.org/article/10.3389/fenvs.2021.643847, DOI=10.3389/fenvs.2021.643847.
[10] This is true even in intensively managed forests or forests damaged by wildfire. Christine Buhl, Ph.D., Oregon Department of Forestry Entomologist. Forest Bee Pollinators Handout, 2020. Available at https://www.oregon.gov/odf/Documents/forestbenefits/forest-bee-pollinators.pdf.
[11] Motta, Erick V. S., et al. "Glyphosate Perturbs the Gut Microbiota of Honey Bees." *Proceedings of the National Academy of Sciences of the United States of America*, vol. 115, no. 41, National Academy of Sciences, 2018, pp. 10305–10, https://www.jstor.org/stable/26532174.

Jenna Travers, Water Quality Intern, Beyond Toxics
jtravers@beyondtoxics.org