Californians For
Pesticide Reform

May 3, 2022

California Air Resources Board (CARB)
1001 I Street
Sacramento, California, 95814
Submitted Online

Re: 2022 Scoping Plan Update – Initial Air Quality & Health Impacts and Economic Analyses Results Workshop

Thank you for the opportunity to comment on the Initial Air Quality & Health Impacts and Economic Analyses Results. We also thank CARB staff for their hard work and incorporation of some pesticide-related EJ concerns into the various scenarios.

I. UNDER STATUS QUO, PESTICIDE USE IS EXPECTED TO INCREASE WITH CLIMATE CHANGE

While we appreciate the improved modeling and the economic, air quality and analyses discussed on April 20 we remain concerned that the proposed models do not go far enough in setting ambitious targets that would transition our agricultural systems away from toxic pesticides and towards safer and more climate-friendly alternative agricultural systems like agroecological and organic agriculture. We urgently need this paradigm shift towards diversified agroecological farming in order to promote public and soil health, food sovereignty and farmer and farmworker livelihoods.

Research shows climate change, without a societal shift, will most likely result in increased synthetic pesticide use due to increased pest pressures.[1] These findings are highly concerning, given pesticides are already applied on cropland in California at a rate 4.5 times higher than the national average.[2] At the same time, many synthetic pesticides are a source of greenhouse gas emissions[3] while alternative agriculture systems that limit synthetic pesticide use, like organic

[1] Taylor, R. A. J., Daniel A. Herms, John Cardina, and Richard H. Moore. (2018). Climate Change and Pest Management: Unanticipated Consequences of Trophic Dislocation. *Agronomy* 8 (1): 7.; Delcour, I., Spanoghe, P., & Uyttendaele, M. (2015). Literature review: Impact of climate change on pesticide use. Food Research International, 68, 7-15.; Bebber, Daniel P., Timothy Holmes, and Sarah J. Gurr. (2014). The Global Spread of Crop Pests and Pathogens. *Global Ecology and Biogeography* 23 (12): 1398–1407.
[2] Ferguson, Rafter, Kristina Dahl, and Marcia DeLonge. (2019). Farmworkers at Risk: The Growing Dangers of Pesticides and Heat. Cambridge, MA: Union of Concerned Scientists. https://www.ucsusa.org/resources/farmworkers-at-risk
[3] Spokas K., Wang D. (2003). Stimulation of nitrous oxide production resulted from soil fumigation with chloropicrin. *Atmospheric Environment* 37: 3501–3507; Spokas K., Wang D., Venterea. R. (2004). Greenhouse gas production and emission from a forest nursery soil following fumigation with chloropicrin and methyl

farming, have been shown to significantly increase carbon sequestration in soils in multiple field trials in California.[4]

II. IDENTIFY PESTICIDE REDUCTION AS A PRIORITY AND A PARAMETER FOR LIMITING ACCEPTABLE ACTIONS UNDER THE SCOPING PLAN TO ENSURE NO MEASURES PROMOTED IN THE SCOPING PLAN INCREASE PESTICIDE USE

A. Ensure no management strategies increase or promote synthetic pesticide use

CARB modeled management strategies that could increase synthetic pesticide use unless organic agriculture and chemical pesticide use reduction are prioritized. These management strategies include reduced till or no till on conventional fields. While they can have benefits for soil health, these strategies can increase herbicide dependence on conventional farms for weed control unless integrated weed management practices that reduce synthetic pesticide use *are also* adopted.[21] CARB must include meaningful targets to reduce synthetic pesticide use and adopt organic agriculture to avoid inadvertently or directly incentivizing chemical pesticide use.

B. Remove herbicide use as a climate-smart strategy from the Scoping Plan

CARB staff modeled herbicide applications in the forestry and grassland sectors as a management strategy under natural and working lands. Chemical herbicide applications should not be considered a climate-friendly management strategy in any landscape. Much of the state's water supply originates in the Sierras so it should be a top concern that herbicides are not used to manage forests in the region that could find their way into our surface and drinking waters. There are a variety of effective methods for managing invasive species that do not rely on herbicides, which can pollute nearby water, air, ecosystems and nearby communities. As an attachment to this letter, we have included additional information about best practices for managing invasive species in forests and grasslands, which do not include the use of herbicides or other pesticides.

III. ENVIRONMENTAL INJUSTICE OF AGRICULTRAL PESTICIDE USE CANNOT BE SUPPORTED BY THE SCOPING PLAN

In addition to the climate benefits of prioritizing reduction of agricultural pesticide use, such reductions would also benefit rural, low-income communities of color whose health is disproportionately impacted by the use of agricultural pesticide. Researchers at California EPA

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isothiocyanate. *Soil Biology & Biochemistry* 37: 475–485; Volatile Organic Compound (VOC) Emissions from Pesticides. Department of Pesticide Regulation. https://www.cdpr.ca.gov/docs/emon/vocs/vocproj/vocmenu.htm.

[4] Kong, A. Y., Six, J., Bryant, D. C., Denison, R. F., & Van Kessel, C. (2005). The relationship between carbon input, aggregation, and soil organic carbon stabilization in sustainable cropping systems. *Soil Sci Soc Am J*., 69: 1078-1085; Wolf, K., Herrera, I., Tomich, T. P., & Scow, K. (2017). Long-term agricultural experiments inform the development of climate-smart agricultural practices. *California Agriculture*, 71: 120-124; Horwath, W. R., Deveˆvre, O. C., Doane, T. A., Kramer, T. W., and van Kessel, C. (2002). Soil carbon sequestration management effects on nitrogen cycling and availability. In ‘‘*Agricultural Practices and Policies for Carbon Sequestration in Soil*’’ (J. M. Kimble, R. Lal, and R. F. Follett, Eds.), 155–164; Pimentel, D., Hepperly, P., Hanson, J., Douds, D., & Seidel, R. (2005). Environmental, energetic and economic comparisons of organic and conventional farming systems. *Bioscience*, 55 (7): 573-583.

have found that pesticide use is the pollution burden with the greatest racial, ethnic and income disparities in the state – disproportionately imposing more of a hazard than multiple air pollutants and other toxic releases.[5] A recent environmental justice study documented that biomarkers for 12 harmful pesticides tracked over the past 20 years were found in the blood and urine of Black or Mexican Americans at average levels as much as *five times higher* than in whites.[6] The authors found that almost all pesticide use in California occurs in the 60% of California zip codes that have the highest percentage of people of color.[7]

Analysis of recent pesticide data[8] in California combined with demographic data[9] reveals a pronounced racial disparity in concentration of pesticide use between counties with the largest share of Latinx residents and those with the smallest. California counties with a majority Latinx population[10] use 906% more pesticides per square mile than counties with fewer than 24% Latinx residents.[11] The two groups of counties have a similar total population and area. In the eleven counties with a majority Latinx population, there were 22 pounds of pesticides used per person in 2018, or 2,373 pounds per square mile. By contrast, for the 25 counties with the lowest proportion of Latinx residents (fewer than 24%), pesticide use was just 2.4 pounds per person, or 262 pounds per square mile.[12]

Deeper analysis of the data finds that an average person who lives in the 11 California counties with a majority Latinx population as compared to the 25 counties with the smallest Latinx proportions:

- Is more than four times (430%) as likely to suffer from an acute pesticide-related illness
- Lives where there are fourteen times (1,362%) more Carcinogenic agricultural pesticides applied per person
- Lives where there are eleven times (1,074%) more agricultural pesticides listed as Reproductive and Developmental Toxicants applied per person.

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[5] Cushing L, Faust J, August LM, Cendak R, Wieland W, Alexeeff G. Racial/ethnic disparities in cumulative environmental health impacts in California: evidence from a statewide environmental justice screening tool (CalEnviroScreen 1.1). Am J Public Health. 2015;105:2341–8.

[6] Donley N, Bullard Robert D, Economos J, Figueroa I, Lee J, Liebman Amy K, Navarro Martinez D, Shafiei F. Pesticides and environmental injustice in the USA: root causes, current regulatory reinforcement and a path forward. BMC Public Health (2022) 22:708, https://doi.org/10.1186/s12889-022-13057-4

[7] Ibid.

[8] California Department of Pesticide Regulation Pesticide Use Report, Total pesticide use in 2018 by county, https://www.cdpr.ca.gov/docs/pur/pur18rep/18sum.htm

[9] California Hispanic or Latino Origin Population Percentage by County, https://www.indexmundi.com/facts/united-states/quick-facts/california/hispanic-or-latino-population-percentage#table

[10] Imperial, Tulare, San Benito, Colusa, Merced, Monterey, Madera, Kings, Kern, San Bernardino, Fresno

[11] Sacramento, San Luis Obispo, Inyo, Alameda, Lake, Del Norte, Lassen, Butte, Marin, San Francisco, Amador, Placer, Modoc, El Dorado, Siskiyou, Tuolumne, Calavera, Sierra, Humboldt, Mariposa, Alpine, Shasta, Nevada, Plumas, Trinity

[12] A similar analysis just on the fumigant chloropicrin found that use occurs disproportionately in areas with low income and Latinx populations. Almost 70 percent of chloropicrin use occurred in zip codes with populations of Latinx (Hispanic) origin that exceeded the statewide average, and almost 75% occurred in zip codes with median household incomes less than the statewide average. Cox, C. Income and ethnic determinants of use of the soil fumigant, chloropicrin, in California. January 10, 2021. https://www.researchgate.net/publication/348362213_Income_and_ethnic_determinants_of_use_of_the_soil_fumigant_chloropicrin_in_California

IV. ALTERNATIVE 1 WILL BETTER MEET ENVIRONMENTAL JUSTICE CONCERNS

A. Alternative 3 is Not Acceptable

California is witness to the climate crisis happening now, with unprecedented droughts, wildfires and increasing impacts on human health and wellbeing, which disproportionately impact black and brown people, the poor, vulnerable and under-resourced. The state and our world demand urgent action. Any proposed climate plan needs to embrace the most ambitious goals for achieving timely reductions that will bring the greatest benefits to communities in the shortest possible terms. Any target the state sets will be challenging to achieve but the further out our goals are the less likely our actions will have the desired impacts. We urge CARB staff to make clear in the draft Scoping Plan who will be most impacted, both by measures proposed, and by damages from failure to act quickly and equitably. A goal of 2045 is permission for delay. We reject Alternative 3's target of 2045 in favor of Alternative 1's 2035 timeline.

The Scoping Plan is mandated to incorporate environmental justice concerns. This means pursuing direct emissions reductions and proven natural carbon sequestration rather than gambling on carbon capture and other unproven technologies that have potential to further harm EJ communities. Pesticide reduction, conversion to organic farming, and regenerative practices in agriculture have been demonstrated to increase carbon capture and soil restoration, practices that have been effective far longer than removal and storage of carbon by the relatively untested mechanical, energy-intensive methods relied on in each of the current alternatives. To emphasize the latter, and to discount the former, tilts the process heavily toward increasing, not reducing, environmental injustice.

B. We Favor Some Aspects of Alternative 1 But Have Concerns

We support Alternative 1's more urgent approach, recognizing the greater climate and health benefits of acting as quickly as possible. It is problematic that the cumulative health benefits of quicker action are not currently portrayed in the modeling information and urge CARB staff to reflect those health benefits in the draft Scoping Plan, as well as the prolonged climate and health harms that will be disproportionately borne by communities of color if the adopted alternative has a target date of 2045 rather than 2035.

We also appreciate that Alternative 1 incorporates the maximum amount of climate-beneficial management practices in the areas of croplands, wetlands, urban forests, defensible spaces and forests and wonder why these practices aren't maximized across all the scenarios. We appreciate that CARB staff have incorporated organic farming into each of the alternatives but strongly urge CARB include a goal that at least 30% of all agricultural lands be farmed organically *by 2030*, not 2045, in all four scenarios. This would put California in closer alignment with other major agricultural economies, such as those in the European Union, which have *already* adopted a goal of having 25% of all their agricultural lands organically farmed by 2030.

Having noted a number of benefits of Alternative 1, we are concerned that these benefits are largely hidden by being paired with lack of action in forests and grasslands. CARB staff have predicted that inaction in those areas will lead to ongoing wildfires, resulting in higher PM 2.5

levels and increased health harms than what is shown in the other alternatives scenarios. This highlights the very real problem of only having the health impacts of PM 2.5 and ozone modeled and combining very disparate practices together rather than evaluating progressive percentage increases in adoption rates of all management strategies as we recommended in our January 5, 2022 letter on the Natural and Working Lands Scenarios Technical Workshop.

C. Leaps of Faith and Inaccurate Reflection of Climate Impacts of Industrial Agriculture

Although the Scoping Plan is portrayed as based on science and evidence, it is clear from the favoring of unproven direct carbon and carbon sequestration technologies that this is not always the case. The agency appears ready to take leaps of faith in some areas and not others. We urge CARB staff to revisit their assumptions around the more technological forms of carbon sequestration and further consider the overwhelming benefits to climate of natural carbon sequestration in working lands, made possible through pesticide reduction in addition to diversified organic and agroecological farming practices. These natural practices offer solutions to a whole host of issues our society currently faces, poor air and water quality, poor public health, poor soil, loss of biodiversity, loss of pollinators, etc.

Furthermore, the modeling and scenarios vastly undercount the true climate impacts of the industrial agricultural sector. The models fail to include the tremendous energy impacts of petrochemical inputs from production to disposal of ag chemicals used in industrial agriculture as well as the vast transportation and vehicle miles traveled by trucks, ships and other means in order to export many agricultural goods to other states and around the globe. When produce like this is produced for export, it’s often grown as mono crops, requiring heavy use of pesticides as the biodiversity above and below ground that could have helped with pest management is limited. This kind of export-oriented agriculture also means that the very communities that grow our food are among the most food insecure in the state and in some cases the nation. By not looking at our agricultural sector holistically, our models and scenarios in the Scoping Plan are not set up to support or identify the most robust solutions that could help address many of our climate, ecological and social ailments in a complementary way that will most benefit Californians and the climate.

V. HEALTH IMPACTS OF PESTICIDES

To date the health analyses have not adequately addressed the full range of health impacts and health costs associated with the various scenarios. Besides the limitations of focusing only on PM 2.5 and ozone, it is problematic to focus on acute but leave out chronic health impacts of proposed management strategies and scenarios.

In the case of agriculture, without incentivizing reduced pesticide use, it is likely pesticide exposure will increase with the rise of pests and invasive species due to climate change. More pesticides mean more cancers, more respiratory illnesses, more neurological and developmental disorders, and these ailments all significantly increase health care costs, education costs, lost employment and workforce productivity, none of which is accounted for.

Here is just a sampling of studies that have documented the impacts of pesticides on health:

Fumigants, like 1-3,D not only pose dangerous threats to soils and climate change, they threaten the health of farmworkers and nearby communities. Soil fumigants are particularly dangerous because after killing soil organisms they often move to the air at levels that can trigger almost immediate adverse health effects in people. One recent study found that just a .01 parts per billion increase in 1,3-D concentrations increased the odds of having asthma-related emergency department visits in Central and Southern California.[13] Race had a positive association between 1,3-D and asthma ED visits among Hispanics and Non-Hispanic Blacks while Non-Hispanic Whites had no association. And these fumigants travel far. Just last year state regulators found 1,3-D in the air at unacceptably high levels in violation of California health standards 3 and 7.5 miles away from the closest application sites.

A pair of studies[14] published in 2020 and 2021 established a statistically significant link between several childhood cancers and prenatal residential proximity to applications of 13 agricultural pesticides. The two California studies, by researchers at UCLA and other universities in Southern California, are notable for establishing links between specific childhood cancers and specific pesticides when they are applied *in any amount* at a distance of up to 2.5 miles (4000m) from a residence. The authors of the second study concluded: "Policy interventions to reduce pesticide exposure in individuals residing near agricultural fields should be considered to protect the health of children."

Exposure of children to organophosphate pesticides can exacerbate asthma symptoms. A UC Berkeley CHAMACOS Study found that higher levels of OP metabolites in urine was associated with respiratory symptoms and coughing at 5 and 7 years of age.[15]

Children with higher levels of organophosphate pesticide breakdown products in their urine are more likely to have ADHD.[16]

Children who live in areas of high agricultural activity in the US from birth to age 15 experience a significantly increased risk of childhood cancers.[17]

Of the top 10 pesticides of public health concern applied within ¼ mile of schools in top ag counties in 2010 (DPH Report) four are proposition 65 listed carcinogens: 1,3 Dichloropropene (#2), metam sodium (#3), metam potassium (#4) and captan (#6).

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13 The association between 1,3-dichloropropene and asthma emergency department visits in California, USA from 2005 to 2011: a bidirectional-symmetric case crossover study

14 Authored by Andrew Park, Beate Ritz, Fei Yu, Myles Cockburn, and Julia Heck, all affiliated with prominent Los Angeles-area research institutions, UCLA (three of the four at the Fielding School of Public Health) and USC (Cockburn) in 2020. *International Journal of Hygiene and Environmental Health*, Volume 226, May 2020, 113486, https://doi.org/10.1016/j.ijheh.2020.113486 AND Lead authors Christina Lombardi and Shiraya Thompson, were joined by three co-authors from the previous study, Professors Ritz, Cockburn, and Heck. *Environmental Research,* Volume 197, June 2021, 111078, https://doi.org/10.1016/j.envres.2021.111078

15 Raanan, R et al. "Early life Exposure to OP pesticides and pediatric respiratory symptoms in the CHAMACOS Cohort" Envir Health Perspect. 2015 123:2 179-182.

16 Bouchard M et al. "ADHD and urinary metabolites of organophosphate pesticides" Pediatrics 2010 125(6): 1270-1277. Kuehn, B "Increased Risk of ADHD Associated with Early Exposure to Pesticides, PCBs." JAMA July 2010, 304(1):27-28

17 Carozza L et al "Risk of Childhood Cancers Associated with Residence in Agriculturally Intensive Areas in the US" Envir Health Persp. Jan 2008; 116(4): 559-565.

Pesticides are just as harmful as secondhand smoke to kids. Children exposed to organophosphates have poorer lung function. Researchers analyzed urine samples from 279 children with decreased lung function. The samples were collected five times throughout the children's lives, from the time they were 6 months old up until they turned 5 years old. Each time they measured the amount of organophosphate in their urine, the child had an average of 8 percent less air function for every tenfold increase of the pesticide. The decreased lung function is comparable to a child inhaling their mother's secondhand smoke.

Research has linked childhood organophosphate exposure with brain tumors, leukemia and lymphomas, and birth defects.[18]

The CHAMACOS study is a unique California study that measured pesticide exposure in a cohort of pregnant women in the Salinas Valley and then collected information about the health status of their children. In the children, exposure before birth to pesticides was associated with ADHD behaviors, altered brain function, and poorer social behavior.[19]

The Scoping Plan is a vision document of what we want to be and what we want to do and provides a roadmap on how to get there. California is a global leader in the fight against climate change and requires us to be bold and take chances, to set ambitious goals and deadlines. We are a creative and innovative state, with some of the best minds in the country, and we should push for those solutions that even our children know are best for the environment, climate and public health, such as diversified organic farming and pesticide reduction. Doing so will also ensure the state is upholding its commitment to environmental justice.

Thank you for the opportunity to comment, and we are available to discuss any of the above concerns or recommendations with CARB staff.

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Californians for Pesticide Reform

[18] Organophosphate Pesticides & Child Health: A Primer for Health Care Providers, Pediatric Environmental Health Specialty Unit (PEHSU), Department of Environmental & Occupational Health Sciences University of Washington, https://depts.washington.edu/opchild/chronic.html

[19] Sagiv SK, Klogut K, Harley K, Bradman A, Morga N, Eskenazi B. Gestational Exposure to Organophosphate Pesticides and Longitudinally Assessed Behaviors Related to Attention-Deficit/Hyperactivity Disorder and Executive Function. Am. J Epidemiol. 2021 Nov2; 190(11):2420-2431. doi: 10.1093/aje/kwab173

Sagiv SK, Bruno JL, Baker JM, Palzes V, Kogut K, Rauch S, Gunier R, Mora AM, Reiss AL, Eskenazi B. Prenatal exposure to organophosphate pesticides and functional neuroimaging in adolescents living in proximity to pesticide application. Proc Natl Acad Sci U S A. 2019 Sep 10;116(37):18347-18356. https://pubmed.ncbi.nlm.nih.gov/31451641/

Sagiv SK, Harris MH, Gunier RB, Kogut KR, Harley KG, Deardorff J, Bradman A, Holland N, Eskenazi B. Prenatal Organophosphate Pesticide Exposure and Traits Related to Autism Spectrum Disorders in a Population Living in Proximity to Agriculture. Environ Health Perspect. 2018 Apr 25;126(7):047012. doi: 10.1289/EHP2580

Best practices for managing invasive species in forests and grasslands

Integrated Pest Management

The Natural Resources Conservation Service (NRCS) defines Integrated Pest Management as "*a site-specific combination of pest prevention, pest avoidance, pest monitoring, and pest suppression strategies*."[1] IPM was developed as a process for addressing pests of all kinds as a response to the overuse of chemical pesticides and their associated environmental harms.[2] Pesticide overuse threatens environmental health, disrupts food webs, contaminates drinking water, and undermines pesticide effectiveness.[3]

IPM has become the standard framework for using pesticide on public lands across the Federal government and the Federal, Insecticide, Fungicide, and Rodenticide Act (FIFRA) states that "…the [Environmental Protection Agency] Administrator in cooperation with the Secretary of Agriculture shall develop approaches to the control of pests based on integrated pest management…".[4] IPM practice is codified into the laws and regulations of agencies that manage public lands including: the Department of Interior (DOI)[5], and its Bureau of Land Management (BLM)[6] as well as the United States Department of Agriculture's United States Forest Service (USFS)[7] and the National Parks Service (NPS)[8].

The most important use of IPM on public land is for the management of invasive species as directed by Executive Orders 13112[9] and 13751,[10] which instruct Federal Agencies to prevent the introduction and spread of invasive species. There are approximately 50,000 alien species in the United States that impact the survival of 42% of all threatened and endangered species.[11] Alien species degrade ecosystems by suppressing natural biodiversity, altering food webs, changing nutrient cycling, introducing novel diseases, and can cause significant economic damage.

Alien species cause up to $120 billion a year in environmental damages[12] and the U.S. government spends billions of dollars a year to mitigate and control alien species.[13] IPM is essential to stopping the spread and introduction of alien species on public land, and per the basic tenants of IPM, efforts must focus on the root causes of species spread.

IPM is a process that requires planning that is land-use- and pest-specific that uses the minimum level of pest suppression necessary.[14] IPM relies on prevention, avoidance, monitoring, and suppression (PAMS) techniques in order to decrease pest pressure from a combination of biological, cultural, and chemical controls.[15] Successful management requires the preparation and implementation of strategic, long-term plans with defined threshold values for pest control actions that rely on prevention, education, and restoration that enhance the overall health of an ecosystem.[16] Early Detection and Rapid Response (EDRR) is essential to identifying, monitoring, and removing new alien species from an environment.[17] In IPM, chemical control may only be the last line of defense after preventative and avoidance practices have been implemented, and in IPM, even when pesticides are used, the least toxic options are deployed.

[1] NRCS, "Integrated Pest Management Code 595" (Natural Resource Conservation Service, 2010), https://efotg.sc.egov.usda.gov/references/public/NY/nyps595.pdf.

[2] Gerrit Cuperus, Richard Berberet, and Phillip Kenkel, "The Future of Integrated Pest Management," in *E. B. Radcliffe,W. D. Hutchison & R. E. Cancelado [Eds.], Radcliffe's IPM World Textbook* (St. Paul, MN: University of Minnesota, n.d.), https://ipmworld.umn.edu.
[3] John Peterson Myers et al., "Concerns over Use of Glyphosate-Based Herbicides and Risks Associated with Exposures: A Consensus Statement," *Environmental Health* 15 (February 17, 2016), https://doi.org/10.1186/s12940-016-0117-0; Maarten Bijleveld van Lexmond et al., "Worldwide Integrated Assessment on Systemic Pesticides," *Environmental Science and Pollution Research* 22, no. 1 (January 1, 2015): 1–4, https://doi.org/10.1007/s11356-014-3220-1; Gregor J. Devine and Michael J. Furlong, "Insecticide Use: Contexts and Ecological Consequences," *Agriculture and Human Values* 24, no. 3 (September 1, 2007): 281–306, https://doi.org/10.1007/s10460-007-9067-z.
[4] "Federal Insecticide, Fungicide, and Rodenticide Act," 7 U.S. Code § 136w–3 (c) (2012).
[5] U.S. Department of the Interior, "Department of the Interior Departmental Manual," Chapter 1: Integrated Pest Management Policy, Section 1.5, Part 517, Series 31: Environmental Quality Programs (U.S. Department of the Interior, May 31, 2007).
[6] U.S. Bureau of Land Management, "BLM Vegetation Treatments Using Herbicide Final Programmatic EIS Record of Decision" (U.S. Bureau of Land Management, 2007), 4–6, https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=renderDefaultPlanOrProjectSite&projectId=70300&dctmId=0b0003e880de5eb8.
[7] U.S. Forest Service, "Forest Service Manual 2100-Environmental Management," Chapter 2150 (U.S. Forest Service, March 19, 2013), page 6. Departmental Regulation 9500-4.
[8] U.S. National Park Service, "Management Policies 2006" (Washington, D.C.: U.S. National Park Service, 2006), 48, https://www.nps.gov/policy/MP_2006.pdf.
[9] William Clinton J, "Executive Order 13112 Invasive Species" (Federal Register, February 3, 1999), https://www.govinfo.gov/content/pkg/FR-1999-02-08/pdf/99-3184.pdf.
[10] Barack Obama, "Executive Order 13751 Safeguarding The Nation From the Impacts of Invasive Species" (Federal Register, December 8, 2016).
[11] David Pimentel, Rodolfo Zuniga, and Doug Morrison, "Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States," *Ecological Economics*, Integrating Ecology and Economics in Control Bioinvasions, 52, no. 3 (February 15, 2005): 273–88, https://doi.org/10.1016/j.ecolecon.2004.10.002.
[12] Pimentel, Zuniga, and Morrison.
[13] National Invasive Species Council, "National Invasive Species Council Crosscut Budget" (Washington, D.C.: National Invasive Species Council, January 25, 2018), https://www.doi.gov/sites/doi.gov/files/uploads/crosscut_25january2018.pdf.
[14] NRCS, "Integrated Pest Management Code 595."
[15] NRCS.
[16] Joseph M. DiTomaso, "Invasive Weeds in Rangelands: Species, Impacts, and Management," *Weed Science* 48, no. 2 (April 2000): 255–65, https://doi.org/10.1614/0043-1745(2000)048[0255:IWIRSI]2.0.CO;2.
[17] Lindy Garner, "Early Detection and Rapid Response to New Invasive Grasses in North Central Wyoming" (U.S. Fish and Wildlife Service, April 2019), https://www.doi.gov/sites/doi.gov/files/uploads/wyoming_invasive_grasses_report.pdf.

Harms of Herbicides Commonly-Used for Weed Management in Forests and Grasslands

Glyphosate

A 2015 EPA analysis found multiple environmental harms from glyphosate use. Use of glyphosate in accordance with the label was found to:

1. Result in concentrations that can potentially impact the survival and biomass of aquatic plants, upland plants, and riparian/wetland plants.[1]
2. Result in residues on foliage that can potentially impact the growth of herbivorous birds, reptiles and terrestrial amphibians.[2]
3. Potentially impact the growth and reproduction of terrestrial mammals following ground applications of glyphosate.[3]

This analysis also indicated that considerable no-spray buffers would be needed to keep off-target plants from being harmed by glyphosate use, more than 1000 feet for certain aerial applications and nearly 400 feet for certain ground applications.[4] The states of California and Arkansas both adopted mandatory no-spray buffers of 500 feet for aerial applications.[5]

Ecological incident data also reinforce the finding that the current labelled uses of glyphosate are having devastating effects to plant and animal life outside of the sprayed field.[6] Approximately 600 incidents have been reported and logged on the Ecological Incident Information System (EIIS) and Avian Monitoring Information System (AIMS) databases. A separate Incident Data System (IDS) database has identified 269 separate aggregate incident reports. Ecological incidents are also significantly underreported for pesticides so this should be viewed as the absolute bare minimum of ecological incidents that involve glyphosate.

A recent draft biological evaluation was recently conducted by the EPA on how use of glyphosate may affect all endangered and threatened species in the United States. The agency concluded that glyphosate would "Likely Adversely Affect" 1676 out of 1795 listed species (93%) and adversely modify 759 out of 792 designated critical habitat in the U.S.[7] This includes nearly every single listed species and critical habitat in the United States and all that reside in or near the action area being considered.[8]

The EPA has found that glyphosate poses a risk to a federally listed amphibian, the California Red-legged frog, making a Likely to Adversely Affect determination for the species.[9] Some glyphosate formulations and co-formulants have been found to be "highly toxic" to certain species of fish.[10]

Researchers have found negative associations between glyphosate use and monarch population size.[11] Use of glyphosate has been tied to widespread declines of milkweed, which is essential to monarch butterfly survival.[12]

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[1] EPA. Preliminary Ecological Risk Assessment for Glyphosate and Its Salts. Sept. 8, 2015 page 2. Available here: https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0361-0077.
[2] *Id.*
[3] *Id.*
[4] *Id.* page 92.
[5] EPA. Drinking Water Assessment for the Registration Review of Glyphosate. June 15, 2017. Pg. 16.
[6] EPA. Preliminary Ecological Risk Assessment for Glyphosate and Its Salts. Sept. 8, 2015. Pgs 59-62. Available here: https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0361-0077.
[7] EPA. Draft National Level Listed Species Biological Evaluation for Glyphosate. November 2020. Available here: https://www.epa.gov/endangered-species/draft-national-level-listed-species-biological-evaluation-glyphosate. Executive Summary.
[8] *Id.* at Appendix 4-1
[9] EPA. Risks of Glyphosate Use to Federally Threatened California Red-legged Frog (Rana aurora draytonii). Pesticide Effects Determination. October 17, 2008. Available here: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/glyphosate/determination.pdf.
[10] *Id.* at 82, 84.
[11] Semmens, B. X., D. J. Semmens, W. E. Thogmartin, R. Wiederholt, L. Lopez-Hoffman, J. E. Diffendorfer, J. M. Pleasants, K. S. Oberhauser and O. R. Taylor (2016). "Quasi-extinction risk and population targets for the Eastern, migratory population of monarch butterflies (Danaus plexippus)." Sci Rep 6: 23265.
[12] Center for Biological Diversity, Petition to Protect the Monarch Butterfly (*Danaus Plexippus Plexippus*) Under the Endangered Species Act, 7 (2014), available at http://www.biologicaldiversity.org/species/invertebrates/pdfs/Monarch_ESA_Petition.pdf ("A primary threat to the monarch is the drastic loss of milkweed caused by increased and later season use of the herbicide glyphosate in conjunction with widespread planting of genetically engineered, herbicide-resistant corn and soybeans in the Corn Belt region of the United States and to planting of genetically-engineered cotton in California. In the Midwest, nearly ubiquitous adoption of,

glyphosate-resistant 'Roundup Ready' corn and soybeans has caused a precipitous decline of common milkweed, and thus of monarchs, which lay their eggs only on milkweeds. The majority of the world's monarchs originate in the Corn Belt region of the United States where milkweed loss has been severe, and the threat that this habitat loss poses to the resiliency, redundancy, and representation of the monarch cannot be overstated.").

Hexazinone

EPA has found that approved hexazinone uses can expose non-target terrestrial plants to as much as 500 times the concentration needed to cause harm and that harmful exposures can exist greater than 1,000 feet from the treated area.[1] EPA found that non-agricultural uses of hexazinone can result in risks of concern to small herbivorous and insectivorous birds, reptiles and terrestrial amphibians[2] and that mammals can be exposed to as much as 80-times the amount known to cause reduced female pup body weights at birth and during lactation.[3]

For the granular uses of the herbicide, EPA found that large birds, reptiles and terrestrial amphibians would only need to ingest one granule to exceed EPA's risk of concern for ESA-listed species and three granules for non-ESA-listed species.[4] The outlook is even worse for mammals, needing to ingest less than one granule to trigger the EPA's risk of concern for ESA-listed and non-ESA-listed mammals.[5]

The EPA has found that the labelled uses of hexazinone can potentially harm a federally listed amphibian, the California Red-legged frog, making a Likely to Adversely Affect determination for the species.[6]

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[1] EPA. Registration Review – Preliminary Ecological Risk Assessment for Hexazinone. September 17, 2015. Pgs. 69, 79. Available here: https://www.regulations.gov/document?D=EPA-HQ-OPP-2009-0755-0021.
[2] *Id*. at 62-63.
[3] *Id.* at 49, 67.
[4] *Id.* at 76-77.
[5] *Id*. at 77.
[6] EPA. Risks of Hexazinone Use to Federally Threatened California Red-legged Frog (Rana aurora draytonii). Pesticide Effects Determination. February 20, 2008. Available here: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/hexazinone/analysis.pdf.

Triclopyr

EPA has found that the range, pastureland, and rights-of-way uses of triclopyr can expose birds, reptiles and terrestrial amphibians to levels of the herbicide that cause reduced survival of offspring.[1] The same uses can expose mammals to 37 times the amount of triclopyr known to reduce litter size.[2] All labelled uses of triclopyr were found to expose adult and larval bees to levels estimated to reduce survival and larval emergence.[3] Harm to bee larva was estimated more than 1000 feet from the application site.[4] Terrestrial plants were also estimated to be exposed to levels of triclopyr that were known to cause harm more than 1000 feet away from the site of application, even for ground applications.[5]

Triclopyr butoxyethyl ester (BEE) is classified as "highly toxic" to aquatic organisms. Range, pastureland and meadow uses of BEE can expose fish and aquatic invertebrates to levels of the pesticide known to cause acute harm.[6] The EPA has found that triclopyr poses a risk to a federally listed amphibian, the California Red-legged frog, making a Likely to Adversely Affect determination for the species.[7]

[1] EPA. Triclopyr (Acid, Choline salt, TEA salt, BEE): Draft Ecological Risk Assessment for Registration Review. Sept. 30, 2029. Pg. 6. Available here: https://www.regulations.gov/document?D=EPA-HQ-OPP-2014-0576-0026.
[2] *Id.* at 8.
[3] *Id.* at 9.
[4] *Id.* at 90.
[5] *Id.* at 94-95.
[6] *Id.* at 9.
[7] EPA. Risks of Triclopyr Use to Federally Threatened California Red-legged Frog (Rana aurora draytonii) Pesticide Effects Determination. October 19, 2009. Available here: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/triclopyr/analysis.pdf.

Additional Resources

- A report of best practices co-authored by UC IPM and the California Invasive Plant Council, which provides comprehensive descriptions of 21 commonly-used, non-chemical weed control techniques and of biological control agents for 18 weed species/species groups.[20]
- Herbicide applications can be expensive and there are concerns over environmental and health risks to the applicators as well as people living near the applications. Herbicides can target specific plants but don't alter fuel pattern immediately and there are short-term increases in fuel flammability.[21]
- Grazing can reduce the extent and severity of wildfire by reducing or creating patchy vegetation, which can reduce the continuity of fuel loads. East Bay Municipal Utility District has hired ranchers around San Francisco Bay for livestock grazing around San Francisco Bay. Goats have also been used around Menlo Park, Oakland, Los Altos, and Berkeley on foothill chaparral.[22]
- Alternative fuel treatments involve a number of strategies that don't involve herbicide use; these include: prescribed fire and mechanical thinning, these two strategies in combination, and expanded use of managed wildfire [23] [24] [25]
- In a study of stand-replacing fires (two decades after the fire) in the Sierra Nevada, herbicides used at study sites versus logged or untreated stands of fire-killed trees were found to result in extremely low shrub cover. Herbicide use significantly increased alien species richness and alien species cover (grass and forb) when compared with logged stands in all the areas combined. After herbicide treatment, which reduced shrub cover, alien grasses and forbs are stimulated to grow and this

[20] BMPs for Non-Chemical Weed Control, https://www.cal-ipc.org/resources/library/publications/non-chem/
[21] Nader G, Henkin Z, Smith E, Society for Range Management. Planned Herbivory in the Management of Wildfire Fuels. *Rangelands*. 2007;29(5). doi:10.2458/azu_rangelands_v29i5_nader
[22] *Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement*.; 2006. https://www.webpages.uidaho.edu/rx-grazing/handbook.htm
[23] Stephens SL, McIver JD, Boerner REJ, et al. The Effects of Forest Fuel-Reduction Treatments in the United States. *BioScience*. 2012;62(6):549-560. doi:10.1525/bio.2012.62.6.6
[24] Collins BM, Miller JD, Thode AE, Kelly M, van Wagtendonk JW, Stephens SL. Interactions Among Wildland Fires in a Long-Established Sierra Nevada Natural Fire Area. *Ecosystems*. 2009;12(1):114-128. doi:10.1007/s10021-008-9211-7
[25] Collins BM, Stephens SL. Stand-replacing patches within a 'mixed severity' fire regime: quantitative characterization using recent fires in a long-established natural fire area. *Landscape Ecol*. 2010;25(6):927-939. doi:10.1007/s10980-010-9470-5

creates highly flammable areas that may burn more frequently though less intensely than native plants.[26]

- *How the Indigenous practice of 'good fire' can help our forests thrive*[27]
- *With wildfires on the rise, indigenous fire management is poised to make a comeback*[28]
- These are the top pesticides used in the forestry sector according to the UC Davis Pesticide Use Reporting site[29]:

    - Glyphosate, Dimethylamine Salt (5972; 34494-04-7) 93,514 lbs
    - Glyphosate, Isopropylamine Salt (1855; 38641-94-0) 75,192 lbs
    - Imazapyr, Isopropylamine Salt (2257; 81510-83-0) 26,443 lbs
    - Hexazinone (1871; 51235-04-2) 14,105 lbs
    - Oxyfluorfen (1973; 42874-03-3) 13,388 lbs
    - Triclopyr, Butoxyethyl Ester (2170; 64700-56-7) 12,142 lbs

    These six pesticide active ingredients all have well-documented negative health and environmental consequences. Most notably Bayer - the manufacturer of glyphosate - has recently been ordered to pay three CA residents more than $100 million in damages after they developed cancer after using glyphosate or RoundUp.[30] Thousands of similar cases are currently going through the US court system.

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[26] McGinnis TW, Keeley JE, Stephens SL, Roller GB. Fuel buildup and potential fire behavior after stand-replacing fires, logging fire-killed trees and herbicide shrub removal in Sierra Nevada forests. *Forest Ecology and Management*. 2010;260(1):22-35. doi:10.1016/j.foreco.2010.03.026

[27] https://universityofcalifornia.edu/news/how-indigenous-practice-good-fire-can-help-our-forests-thrive

[28] https://grist.org/justice/with-wildfires-on-the-rise-indigenous-fire-management-is-poised-to-make-a-comeback/

[29] http://purwebgis.ucdavis.edu/PURwebGIS.html

[30] https://www.reuters.com/legal/government/bayer-presses-us-supreme-court-review-second-roundup-cancer-case-2022-03-21/