May 3, 2022

Submitted through CARB submission portal to sp22-econ-health-ws

California Air Resources Board
1001 I Street, Sacramento, CA 95814

RE: 2022 Scoping Plan – Initial Results of Air Quality, Health, and Economic Analyses

To the California Air Resources Board:

The Center for Biological Diversity provides this input regarding the initial results from the air quality and health impacts and economic analyses, released at the April 20 workshop. The results released so far are general with little detail, providing only a summary of results. It is impossible to evaluate the health and economics modeling results at this point without being provided the underlying methods, model documentation, and detailed results. Our comments here are therefore necessarily general and focus on instances where the modeling assumptions appear to be faulty or unsubstantiated, and we recommend ways to make the modeling analyses as robust, science-based, and transparent as possible. We urge the California Air Resources Board to release the details of the modeling—the data inputs, detailed outputs, and the specific assumptions—in order to receive more detailed comments from the public and to modify the modeling and analysis as necessary, before selecting a preferred alternative.

Alternative 3 does not satisfy the needs of the state and does not meet the demands of the climate crisis.

CARB staff at the April 20 workshop indicated that they plan to recommend that the Board adopt Alternative 3. Alternative 3 would achieve carbon neutrality in 2045 and requires little action in the near term. As such, Alternative is entirely inadequate to the needs of the state and the demands of the climate crisis, and CARB must prioritize a more ambitious alternative that reaches carbon neutrality by 2035.

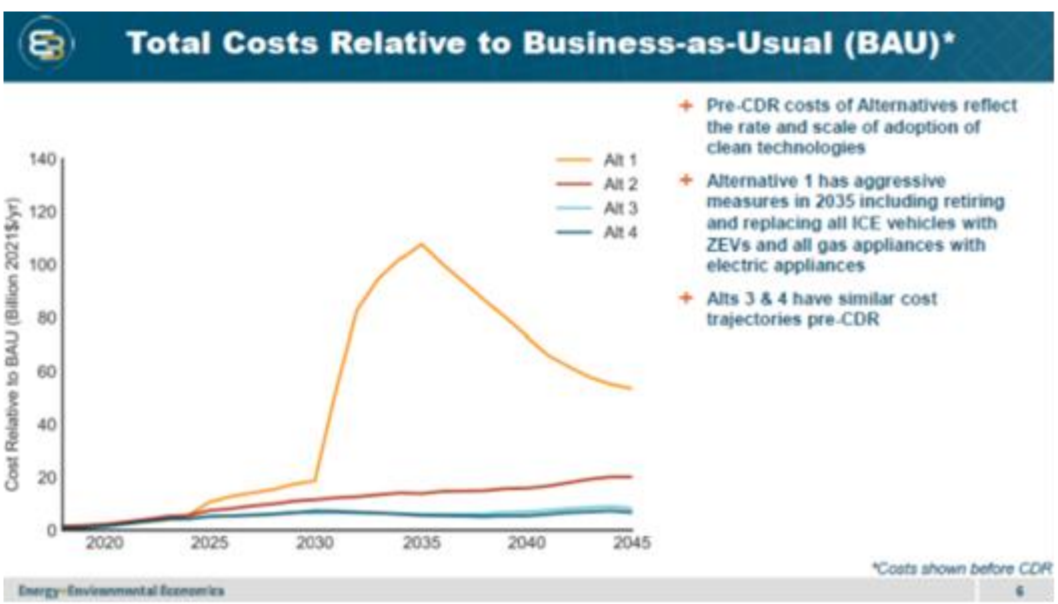
In addition, the costs associated with Alternative 1—the alternative intended to incorporate the specific objectives and recommendations submitted by environmental justice advocates—appear to be substantially and arbitrarily inflated through unnecessary assumptions. Specifically, the high costs estimated for Alternative 1 are largely driven by early retirement/buy-back programs for internal combustion vehicles and for household and commercial appliances, sold between 2023 and 2035. Buy-back programs seem like the most expensive option imaginable for achieving 100% electric vehicles and appliances by 2035, especially when there are twelve intervening years in which sales can be curtailed. A comparison to other options, such as earlier transition to ZEVs and electric appliances, would provide a more meaningful comparison of costs among the alternatives.

ARB's modeling overstates the costs of transitioning to light-duty Zero Emissions Vehicles.

Alternative 1, the most ambitious scenario CARB analyzed, reaches 100% light-duty Zero Emissions Vehicles ("ZEV") sales by 2030 and includes the complete early retirement of internal combustion engine ("ICE") vehicles by 2035. Alternative 3 reaches 100% ZEV sales by 2035 and does not include an ICE vehicle retirement policy. While Alternative 1 would eliminate all ICE cars from the road by 2035, Alternative 3 would leave approximately 5 million ICE vehicles on the road *ten years later*, in 2045.[1]

The ambition of the 2030 ZEV sales target in Alternative 1 is laudable. Research shows that achieving 100% ZEV sales by 2035 is insufficient for California to reach carbon neutrality by 2045.[2] California can only meet its climate targets if all new cars and light-duty trucks sold in the state beyond 2030 produce zero emissions. The difference between reaching 100% ZEV sales in 2030 versus 2035 is 256 million tons of CO_2 — enough emissions savings to keep 140,000 football fields' worth of Arctic summer sea ice from vanishing. In 2045 emissions from a 2035 target would be 11 million tons of CO_2. But they would be near zero in 2045 with a "100% by 2030" requirement.[3]

Yet CARB burdened Alternative 1 with the further assumption that all ICE vehicles would be retired early with state financing, by 2035. This feature balloons the cost of Alternative 1 and makes the plan look all but infeasible, as the slide below from CARB's presentation shows. To be clear, the environmental justice community did not request that ICE vehicles be retired by 2035.



The figure above shows that Alternative 1 appears to be much more costly that the other Alternatives, but this is largely because of the ICE early retirement program.[4]

A more sensible approach would be to keep the 2030 100% ZEV sales target but drop the early retirement provision. An earlier ZEV sales target would bump up the date by which the last ICE vehicles are on the road. This captures the emissions benefits from an earlier transition without the added early retirement costs for millions of vehicles. Simply put, there will be fewer emission-spewing ICE vehicles on the road in future decades if the state stops selling them sooner. Had CARB modeled a 2030 100% ZEV sales target without the early retirement provisions, the costs would likely have been much closer to those of the other Alternatives. In the final Scoping Plan, CARB should analyze a more feasible strongest alternative that includes the benefits of an early transition to ZEVs without the high costs concerns of a mass ICE retirement program. We encourage CARB to incorporate both of these assumptions into both Alternative 3 and Alternative 1.

The analysis of the Natural and Working Lands sector relies on mistaken assumptions about wildfire.

(1) CARB on slide 5 of the NWL presentation cites two new studies to assert that forest biomass in the Sierra Nevada, southern Cascades, and Klamath region is much higher than historical conditions, and therefore that forests must be cut to achieve climate resilience. **This is not the consensus of current science, and CARB should not present it as such.** Instead, CARB must evaluate and acknowledge the large body of studies showing that the net effect of more than a century of industrial logging is a reduction in the total amount of biomass and forest carbon in California's forests; that logging and thinning—including that done under the premise of altering fire behavior—leads to a net increase of CO_2 emissions to the atmosphere, undermining the state's climate goals, as detailed in our April 4, 2022 comments; and that reducing logging levels and allowing cut forests to regrow—proforestation—while protecting communities with home hardening, can increase overall forest carbon storage.[1]

Specifically, numerous studies have concluded that forest biomass in California is much lower today than it was historically[2]—largely due to decades of past and current logging of large numbers of trees from public and private forests[3]—and therefore California's forests have much

[1] See *e.g.*, Law, B.E. et al., Land use strategies to mitigate climate change in carbon dense temperate forests, 115 PNAS 3663-3668 (2018), https://www.pnas.org/content/115/14/3663; Buotte, P.C. et al., Carbon sequestration and biodiversity co-benefits of preserving forests in the western United States, 30 Ecological Applications e02039 (2020); Moomaw, William R. et al., Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good, 2 Frontiers in Forests and Global Change (2019); Moomaw, William R. et al., Focus on the role of forests and soils in meeting climate change mitigation goals: summary, 15 Environmental Research Letters 045009 (2020).

[2] Fellows, A.W. and Goulden, M.L., Has fire suppression increased the amount of carbon stored in western U.S. forests?, 35 Geophysical Research Letters L12404 (2008); McIntyre, P.J. et al., Twentieth century shifts in forest structure in California: denser forests, smaller trees, and increased dominance of oaks, 112 PNAS 1458 (2015).

[3] For contemporary logging, Harris et al. (2016) estimated that in California forests, twice as much carbon is emitted due to logging than wildfire (*see* Harris, N.L. et al., Attribution of net carbon change by

less carbon than they once did.[4] For example, McIntyre et al. (2015) documented that forest biomass statewide in California declined substantially between the 1930s and 2000s, due largely to the loss of larger trees.[5]

Further, many current studies conclude that California's mixed-conifer and ponderosa pine forests had historically highly variable tree density, with many forests having *moderate to high tree densities* characterized by hundreds of seedlings, saplings and small trees per acre, several dozen or more mature/old trees per acre, and often dense shrub understories.[6] For example, using reconstructions of historical forest structure in Sierra mixed-conifer forests based on 1865-1885 survey data, Baker (2014) found that historical forests "were open and park-like in places, but generally dense, averaging 293 trees/ha" with smaller pines and oaks numerically dominant, indicative of a mixed-severity rather than low-severity fire regimes.[7] A spatially extensive assessment of US Forest Service forest survey data from 1910 and 1911 for central and southern Sierra Nevada ponderosa pine and mixed-conifer forests similarly found that forests historically had high variability in density and species composition, indicative of varied disturbance intensities and frequencies.[8] Forest understories were also highly variable, but were generally dense, with shrub cover averaging 34% and conifer seedling/sapling density averaging 837/ha within forested areas.[9] Baker and Williams (2018), which used General Land Office survey reconstructions from the late 1800s to evaluate historical fire regimes and forest structure in dry

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disturbance type across forest lands of the conterminous United States, 11 Carbon Balance and Management 24 (2016)). For historical logging levels in California, *see* Laudenslayer, W.F. and H.H. Darr, Historical effects of logging on the forests of the Cascade and Sierra Nevada Ranges of California, 26 Transactions of the Western Section of the Wildlife Society 12 (1990); Beesley, D., Reconstructing the landscape: an environmental history, 1820-1960, *In* Sierra Nevada Ecosystem Project: final report to Congress, Vol. II: Assessments and scientific basis for management options, Centers of Water and Wildland Resources, Davis, Calif. pp. 1-24 (1996) (In the Sierra Nevada, logging is estimated to have removed most (82%) of the historical acreage of old-growth mixed conifer forests, largely due to clear-cutting, high-grading of big trees, and other logging practices).

[4] Depro, B.M., et al., Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands, 255 Forest Ecology and Management 1122 (2008); Law, B.E. et al., Land use strategies to mitigate climate change in carbon dense temperate forests, 115 Proceedings of the National Academy of Sciences of the United States of America 3663 (2018); Erb, Karl-Heinz et al., Unexpectedly large impact of forest management and grazing on global vegetation biomass, 553 Nature 73 (2018); Hudiburg, Tara W. et al., Meeting GHG reduction targets requires accounting for all forest sector emissions, 14 Environmental Research Letters 095005 (2019).

[5] McIntyre, P.J. et al. (2015) at 1458, Figure 1a.

[6] Baker, W. L., and C. T. Hanson, Improving the use of early timber inventories in reconstructing historical dry forests and fire in the western United States, 8 Ecosphere e01935 (2017).

[7] Baker, W.L., Historical forest structure and fire in Sierran mixed-conifer forests reconstructed from General Land Office survey data, 5 Ecosphere 79 (2014).

[8] Hanson, C.T. and D.C. Odion, Historical forest conditions within the range of the Pacific fisher and spotted owl in the Central and Southern Sierra Nevada, California, USA, 36 Natural Areas Journal 8 (2016a); *See also* Hanson, C.T. and D.C. Odion, A response to Collins, Miller and Stephens, 36 Natural Areas Journal 238 (2016b).

[9] Hanson and Odion (2016a) at 16.

ponderosa pine and dry mixed conifer in California, similarly found that California's dry forests had intermediate to high median tree density.[10] Recent studies by U.S. Forest Service scientists claiming that historical tree densities in western forests were much lower than they are today, left out of their assessments data on small tree density, and density of non-conifer trees like oaks. When this error was corrected by subsequent researchers, and these missing data were included, historical tree density was determined to be on average 7 times higher than claimed by the Forest Service in ponderosa pine forests, and 17 times higher in mixed-conifer forests.[11]

(2) The wildfire emissions modeling results presented by CARB that largely underpin the health and economics results must be corrected to account for well-documented over-estimation of forest wildfire emissions. As detailed in our prior comments on the NWL modeling, the RHESys model being used for forest and shrublands substantially over-estimates wildfire emissions by using unrealistic biomass combustion factors and under-representing the biomass stored in standing dead trees after fire.[12] Specifically, the LANDFIRE model used by RHESys classifies post-forest-fire vegetation categories as having less carbon than they actually do. First, the model does not account for the large stores of post-fire carbon persisting in killed trees and other unburned fuels.[13] In practice, the model effectively assumes that when trees are killed, they are vaporized immediately and all the carbon goes into atmosphere, which is demonstrably incorrect. Second, the model makes broad assumptions about changes in vegetation categories based on LANDFIRE satellite imagery (which the Inventory acknowledges leads to substantial vegetation category classification inaccuracy[14]) and the mean carbon density in each vegetation category. Significant wildfire emissions overestimates can occur when a mature forest that has high-intensity fire is reclassified as shrubland but still has large amounts of carbon stores in the snags and downed logs that are not counted.

CARB can correct for these flawed estimates by using empirical field data of forest carbon consumption based on actual wildfires.[15] Most recently, empirical research by Harmon et al. (2022) in California's Rim Fire and Creek Fire areas found that less than 2% of living tree

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[10] Baker, William L. and Mark A. Williams, Land surveys show regional variability of historical fire regimes and dry forest structure of the western United States, 28 Ecological Applications 294 (2018).

[11] Baker, W.L et al., Improving the use of early timber inventories in reconstructing historical dry forests and fire in the western United States: reply, 9 Ecosphere Article e02325 (2018).

[12] Stenzel, Jeffrey E. et al., Fixing a snag in carbon emissions estimates from wildfires, 25 Global Change Biology 3985 (2019), https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14716.

[13] California Air Resources Board, Technical Support Document for the Natural & Working Lands Inventory, December 2018 Draft, https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory_technical.pdf, at 19 ("The fire-attributed stock changes account only for carbon contained in live and dead pools associated with the post-fire (e.g. 2012) vegetation type, and have no memory of the previous vegetation type, i.e. they do not account for potential post-fire carbon persisting in unburned fuels or in killed trees.")

[14] California Air Resources Board, An Inventory of Ecosystem Carbon in California's Natural and Working Lands, 2018 Edition, https://ww3.arb.ca.gov/cc/inventory/pubs/nwl_inventory.pdf, at 47-48.

[15] Campbell, J., et al., Pyrogenic carbon emission from a large wildfire in Oregon, United States, 112 Journal of Geophysical Research Biogeosciences G04014 (2007).

biomass combusted.[16] Even in severe fire patches, the larger-size trees showed low combustion rates of less than 5% with most combustion coming from needles and small branches less than 2 centimeters in diameter. This study provides combustion rates for aboveground woody parts at multiple levels of organization (twigs, branches, trees, stands, and landscapes) and accounts for tree species, size, and fire severity in Ponderosa pine and mixed conifer-dominated forests of the Sierra Nevada. The review of forest carbon science by Law et al. (2022) similarly concluded that "[w]hile moderate to high severity fire can kill trees, most of the carbon remains in the forest as dead wood and it will take decades to centuries to decompose that wood." [17]

Thank you for your consideration of these comments.

Brian Nowicki
Center for Biological Diversity
(916) 201-6938
bnowicki@biologicaldiversity.org

[16] Harmon, M.E. et al., Combustion of Aboveground Wood from Live Trees in Mega-fires, CA, USA, 13 Forests 391 (2022), https://doi.org/10.3390/f13030391.

[17] Law, Beverly E., Moomaw, William R., Hudiburg, Tara W., Schlesinger, William H., Sterman, John D. and George Woodwell, The Status of Science on Forest Carbon Management to Mitigate Climate Change and Protect Water and Biodiversity (March 9, 2022).