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November 21, 2016

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Mary D. Nichols, Chair, and Members of the Board
Air Resources Board, California Environmental Protection Agency
1001 I Street, Sacramento, CA 95814

Re: Public Workshop on the 2030 Target Scoping Plan Update: Policy Scenarios, Natural and Working Lands, and Public Health Implications

Dear Chair Nichols, members of the California Air Resources Board, and staff:

The Center for Biological Diversity submits the following comments in response to the joint agency workshop hosted by the Air Resources Board (ARB) on November 7 regarding policy scenarios and associated reductions; the Natural and Working Lands (NWL) Sector, including carbon sequestration scenario modeling and ARB's NWL inventory; and public health implications of climate change and mitigation polices to inform development of the update to the State's AB 32 Scoping Plan to meet the 2030 target. The Center for Biological Diversity strongly supports the effort under way to develop the Scoping Plan Update.

In regard to the policy scenarios...

1. **The policy scenarios and economic analysis should include a Cap-and-No-Trade alternative and should address separate options for the disbursement of revenues under a carbon tax alternative.**

The Center strongly supports ARB's intention to expand the range of policy scenarios assessed in the modeling and economic analysis. In order to provide the most meaningful results, there will likely need to be a number of alternatives to cap-and-trade to best reflect the most realistic options currently available to California. In particular, we recommend that the "No Cap-and-Trade" alternative, which assumes that all reductions are achieved through direct regulation, should be expanded to include a both direct regulations and a declining cap for currently capped sectors. We also recommend that the carbon tax alternative be assessed as two separate alternatives; one that disburses revenues directly to households as dividends and one in which revenues are distributed by the legislature as under the current cap-and-trade program.

2. **The policy scenarios and economic analysis should include an alternative for Cap-and-Trade without offsets, and an alternative that allows for in-state offsets only**

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In order to provide the most meaningful results, we recommend that the modeling and economic analysis include an alternative for Cap-and-Trade without offsets, and an alternative that allows for in-state offsets only. This would allow us to better compare the co-benefits of in-state reductions against the benefits of interstate and international carbon trading.

In regard to the public health implications...

3. The Center appreciates the participation of the Department of Public Health, and we strongly support a more prominent inclusion of DPH—and public health implications and concerns—in the policy scenarios and the economic analysis, and in the development of the proposal.

4. The EJAC should be directly involved in the development of policy scenarios and the economic analysis, and in the development of the proposal.

We greatly appreciate the work and expertise of the Environmental Justice Advisory Committee, and we recommend that the EJAC take a more prominent role in the development of the policy scenarios and economic analysis. In particular, we would strongly encourage ARB to engage the EJAC prior to the development of a staff proposal and economic analysis, to ensure that the alternatives and analysis are fully incorporating the public health concerns and needs.

5. The public health benefits of direct reductions of co-pollutants should be evaluated explicitly and separately from the co-benefits of generalized reductions.

As mentioned in our previous comments in September on the Proposed Amendments to the California's Greenhouse Gas Cap-and-Trade Program Beyond 2020, we share the serious concerns also raised by others that preliminary data indicate that cap-and-trade appears to be prolonging, and in some cases exacerbating, environmental burdens borne by low-income communities and people of color. The alternatives analysis and economic analysis must incorporate this issue, as well as the converse of health benefits that can be realized through maximization and direction of direct reductions. And these possibilities should be analyzed separately from a more general treatment of the public health benefits of GHG reductions at the statewide scale.

In regard to natural and working lands...

6. The analysis of ecosystem carbon stocks and stock change over time must distinguish between anthropogenic and natural emissions in natural lands.

Fire is a natural and necessary component of forest ecosystems, with many critical functions for diversity and wildlife. It would be a misunderstanding of the science and nature of forest and fire dynamics to approach these emissions in the same context as those from smokestacks, bioenergy and pile burning, which are discretionary activities that occur under direct human control or, in the case of natural and working lands, the emissions associated with logging and livestock.

California's forested landscapes evolved with fire over thousands of years. This pre-European, forested landscape was shaped by mixed-severity fire, with low, moderate, and high-severity fire types. Plant and animal species in the forest evolved with fire, and many of these plant and animal species depend on wildfires, including high-severity fires, to reproduce and grow. For instance, fire can help return nutrients from plant matter back to soil, the heat from fire is necessary to the germination of certain types of seeds, and the snags (dead trees) and early successional forests created by high-severity fire create habitat conditions that are beneficial to wildlife. Early successional forests created by high-severity fire support some of the highest levels of native biodiversity found in temperature conifer forests.

In comparison to the potential impacts of fire, the presentation was notably silent on the past and continuing carbon impacts of logging and cattle grazing. Logging has played a key role in creating the current forest conditions and growth rates through the long-term impacts of high-grading, clearcutting, and plantation forestry implemented expansively throughout much of the state for decades. Similarly, livestock grazing has had major impacts on vegetation, soil siltation, and hydrology, all of which continue to affect carbon sequestration and soil carbon across natural and working lands.

7. Adopt a consistent timeframe and scope for natural and working lands inventories.

To provide meaningful context for determining existing inventories, current trends, and potential future scenarios, the natural and working lands carbon inventories must adopt a consistent timeframe for analysis, with a temporal and geographical scope sufficiently large to include landscape-scale trends over the time periods relevant to land management decisions.

To offer one example, in the presentation on natural and working Lands, Resources' Claire Jahns described the "business as usual" scenario as "since, 2010, an explosion of extreme fire events." A characterization of fire events over a six-year period provides exceedingly little information in terms of current status or long-term trends. A look across several decades, taking into account weather, fire suppression, and forest management, is necessary to provide the context for determining baseline conditions and future scenarios.

For example, while climate change will almost certainly alter many forest processes, including fire behavior, in many ecosystems over the coming decades, the current body of science offers a complex range of projections for California forests. Notably, the majority of studies that have analyzed recent trends in fire severity and frequency in California forests have found no significant trends in these metrics. Studies that project trends in fire activity have no clear consensus on how climate change will affect fire behavior in California forests.

Nine studies have analyzed recent trends in fire severity in California's forests in terms of proportion, area, and/or patch size. Seven of nine studies found no significant trend in fire severity, including: Collins et al. 2009 (central Sierra Nevada), Dillon et al. 2011 (Northwest California), Hanson et al. 2009 (Klamath, southern Cascades), Hanson and Odion 2014 (Sierra Nevada, southern Cascades), Miller et al. 2012a (four Northwest CA forests), Odion et al. 2014 (eastern and western Sierra Nevada, eastern Cascades), and Schwind 2008 (California forests). The two studies that report an increasing trend in fire severity – Miller et al. 2009 and Miller and Safford 2012 (Sierra Nevada, southern Cascades) – were refuted by Hanson and Odion (2014) using a larger dataset.

Hanson and Odion (2014) conducted the first comprehensive assessment of fire intensity since 1984 in the Sierra Nevada using 100% of available fire intensity data, and found no increasing trend in terms of high-intensity fire proportion, area, mean patch size, or maximum patch size. Hanson and Odion (2014) reviewed the approach of Miller et al. (2009) and Miller and Safford (2012) for bias, due to the use of vegetation layers that post-date the fires being analyzed in those studies. Hanson and Odion (2014) found that there is a statistically significant bias in both studies ($p = 0.025$ and $p = 0.021$, respectively), the effect of which is to exclude relatively more conifer forest experiencing high-intensity fire in the earlier years of the time series, thus creating the erroneous appearance of an increasing trend in fire severity. Hanson and Odion (2014) also found that the regional fire severity data set used by Miller et al. (2009) and Miller and Safford (2012) disproportionately excluded fires in the earlier years of the time series, relative to the standard national fire severity data set (www.mtbs.gov) used in other fire severity trend studies, resulting in an additional bias which created, once again, the inaccurate appearance of relatively less high-severity fire in the earlier years, and relatively more in more recent years.

Three studies have analyzed recent trends in the number of fires in California's forests and have reported conflicting results for trends in fire frequency. Two studies found no trend in the number of fires -- Schwind (2008) and Syphard et al. (2007) -- while Westerling et al. (2006) reported evidence of an increasing number of fires.

Projection studies have generally not modeled trends in future fire frequency and severity. Instead most studies have projected changes in area burned and the probability of burning. There is no consensus among these studies on future fire activity.

Of seven studies that have projected trends in area burned in California forests, four projected both increases and decreases in total area burned varying by region, including: Lenihan et al. 2003, Lenihan et al. 2008, Krawchuk et al. 2009, and Spracklen et al. 2009. One study projected an overall decrease in area burned (McKenzie et al. 2004), while two studies projected increases: Fried et al. 2004 in a small region in the Amador-El Dorado Sierra foothills and Westerling et al. 2011. The projected increases reported in Westerling et al. (2011) are relatively modest: median increases in area burned of 15% and 19% by 2020 relative to 1961-1990 under a lower (B1) and higher emissions scenario (A2) respectively, 21% and 23% by 2050, and 20% and 44% by 2085.

Three studies have projected changes in the probability of burning or the probability of a large fire occurring, and these studies have projected no change, increases, or decreases varying by region: Krawchuk and Moritz 2012, Moritz et al. 2012, and Westerling and Bryant 2008.

The studies empirically investigating the assumption that the most fire-suppressed forests are burning predominantly at high severity have consistently found that forest areas in California that have missed the largest number of fire return intervals are not burning at higher fire severity. Specifically, six empirical studies that have investigated this question found that the most long-unburned (most fire-suppressed) forests burned mostly at low/moderate-severity, and did not have higher proportions of high-severity fire than less fire-suppressed forests. Forests that were not fire suppressed (those that had not missed fire cycles, i.e., Condition Class 1, or "Fire Return Interval Departure" class 1) generally had levels of high-severity fire similar to, or higher than, those in the most fire-suppressed forests, as found by Odion et al. 2004, Odion and Hanson 2006, Odion and Hanson 2008, Odion et al. 2010, Miller et al. 2012a, van Wagtendonk et al. 2012.

8. Avoiding natural lands conversion and intensified use should be a focus of land use planning.

The Center strongly supports the draft goal stated on page 6 of the presentation on natural and working lands: "Pursue development and new infrastructure construction patterns that avoid greenfield development and increase protections on natural and working lands to reduce the rate of conversion to intensified uses." This objective should include the negative impacts of logging and livestock grazing. Furthermore, the analysis should look beyond "conversion" of working lands to include and accurately reflect the negative impacts of intensified uses on lands that remain forest, natural or working lands (for example, from intensified or increased logging or grazing).

9. Prescribed fire and the reintroduction of fire can and must be considered as options distinct from logging and thinning.

The presentation on Natural and Working Lands incorrectly presents prescribed fire solely in the context of "fuel reduction and prescribed burn treatments." In fact, prescribed fire and managed fire can and should be used independent of fuel reduction and logging in many circumstances.

10. The analysis of ecosystem carbon stocks and stock change over time should include emissions from land conversion.

The presentation on ecosystem carbon stocks, and stock change over time did not include land conversion or development in the list of activities leading to carbon emissions.

Perhaps this is because conversion and development are included under clearcutting and "other mechanical" but we recommend explicitly identifying conversion and development as a discrete category. The development of natural lands affects not only the existing carbon stocks but the potential for future carbon sequestration on a virtually permanent basis. Furthermore, including these impacts in the inventory seems crucial in achieving the stated goal of pursuing development and new infrastructure construction patterns that avoid greenfield development.

11. Natural and working lands should include desert areas.

The Center supports the point raised by others, including in the comments submitted by Defenders of Wildlife, that deserts should be included in natural and working lands. Development and degradation of desert areas have substantial carbon implications, and the protection and conservation of desert landscapes offers substantial GHG and mitigation benefits.

12. Fuels reduction leads to increased carbon emissions.

The presentation on forest management options focused heavily on fuel reduction treatments with the intention of reducing fire occurrence. This leads to a strong preference for policy options that promote logging, followed by the burning of woody materials removed from the forest for biomass energy production. However, studies that have specifically evaluated the carbon implications of this strategy have found that thinning results in increased carbon emissions to the atmosphere for many decades.

Three recently published studies of forests in the western United States suggest that emissions from removal and combustion of forest materials for bioenergy would exceed emissions from even high intensity fires, at least for some period of time. One study examined forest carbon responses to three different levels of fuel reduction treatments in 19 West Coast ecoregions containing 80 different forest types and different fire regimes (Hudiburg et al. 2011). In nearly all forest types, intensive harvest for bioenergy production resulted in net carbon emissions to the atmosphere, at least over the 20-year time frame of the study. Even lighter-touch fire prevention scenarios produced net carbon emissions in most ecoregions. The study shows that at present, across a wide range of ecosystems, thinning for fuels reduction and using the thinnings for bioenergy increases carbon dioxide concentrations, at least in the short term.

A second study similarly found that thinning forests to avoid high-severity fire could actually increase overall carbon emissions (Campbell et al. 2011). Because the probability of a fire on any given acre of forest is relatively low, forest managers must treat many more acres than will actually burn in order to get much of a benefit—removing more carbon during "thinning" than would be released in a fire. The study also found that over a succession of disturbance cycles, models predicting forest growth, mortality, decomposition and combustion showed more carbon storage in a low-frequency, high-intensity fire regime than in a high-frequency, low-intensity fire regime. The study concluded: "we found little credible evidence that such efforts [fuel-reduction treatments] have the added benefit of increasing terrestrial C stocks" and "more often, treatment would result in a reduction in C stocks over space and time."

A review by Law and Harmon (2011) concluded that "Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO_2 to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment."

Furthermore, scientific studies have found that old forests store up to ~10 times more carbon in biomass per unit ground area than young forests, and old forests continue to have large carbon stores for hundreds of years (Luyssaert et al. 2008, Hudiburg et al. 2009, Law 2014, Schulze et al. 2012). Older trees not only store large amounts of carbon but actively sequester larger amounts of carbon compared to smaller trees (Stephenson et al. 2014). Contrary to the conventional forestry assumption that older trees are less productive, the mass growth rate for most temperate and tropical tree species increases continuously with age, meaning the biggest trees sequester the most carbon (Stephenson et al. 2014). In western USA old-growth forest plots, trees greater than 100 cm in diameter comprised 6% of trees, yet contributed 33% of the annual forest mass growth (Stephenson et al. 2014). Current research also shows that high-severity fire areas generally store the highest levels of carbon, due to the combination of the carbon in snags, downed logs, and post-fire regenerating vegetation, including shrubs and trees (Keith et al. 2009, Powers et al. 2013).

Logging significantly reduces forest carbon storage. Harvest of live trees from the forest not only reduces current standing carbon stocks, but also reduces the forest's future rate of carbon sequestration, and its future carbon storage capacity, by removing trees that otherwise would have continued to grow and remove CO_2 from the atmosphere (Holtsmark 2012). Even if harvested biomass is substituted for fossil fuels, it can be decades or centuries before the harvested forest achieves the same CO_2 reductions that could be achieved by leaving the forest unharvested (depending on harvest intensity, frequency, and forest characteristics) (Searchinger et al. 2009, Hudiberg et al. 2011, Campbell et al. 2012, Mitchell et al. 2012). It takes more than 100 years (~125-130 years) to make up for carbon loss after a forest is logged (Harmon 2014, Law 2014).

13. Forest fires do not reduce forest carbon stocks to zero.

As discussed during the presentation on the analysis of ecosystem carbon stocks and stock change over time, it is not true that forest fires reduce forest carbon stocks to zero, as the analysis currently assumes. Indeed, only a small fraction of forest carbon stocks—the portion consumed as fine fuels during the fire—are emitted during a forest fire, even a high-severity fire. More carbon is emitted as the dead trees decompose but this is highly dependent on mortality levels, site characteristics, and the weather in following years, and the decomposition process can take decades. At the same time, the growth of surviving trees, understory, and regeneration continue to sequester carbon at the site and can outpace carbon emissions from decomposing trees. Furthermore, post-fire management, often in the form of salvage logging, can be responsible for liquidating far greater carbon stores and in much shorter time than can fire and decomposition.

The analysis of ecosystem carbon stocks and stock change over time currently assumes complete loss of forest carbon after fire, which is demonstrably untrue. While this is largely due to the heavy reliance on FIA data that provide a very limited view of forest dynamics, and partly due to the difficulty in modeling decomposition rates, these estimates will be much more useful to the analysis if they are revised to account for carbon stored in standing dead trees and the carbon impacts of salvage logging were reassigned to the activities of harvest, clearcutting, and thinning.

14. California's cap-and-trade program must account for the climate impacts of forest-sourced woody biomass in bioenergy production.

Any policy to promote the use of forest-sourced biomass for bioenergy production must fully account for the emissions and climate change consequences associated with those activities. In order to develop a program that makes sense within the forest carbon and GHG emissions contexts, biomass uses must be compared not only to alternative "waste diversion" options but to the full spectrum of alternative fates, including the carbon sequestration and storage associated with living and growing trees and forests.

Woody biomass combustion is not carbon-neutral, as acknowledged by numerous scientific studies (see, e.g., Searchinger et al. 2009, Repo et al. 2010, Brandão et al. 2013), the IPCC,[1] and the EPA.[2] Measured at the smokestack, replacing fossil fuels with biomass actually *increases* CO_2 emissions.[3] Notably, a recent study found that the climate impact per unit of CO_2

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[1] IPCC Task Force on National Greenhouse Gas Inventories, Frequently Asked Questions, at http://www.ipcc-nggip.iges.or.jp/faq/faq.html (last visited November 21, 2016) (Q2-10).
[2] U.S. EPA, Accounting Framework for Biogenic CO2 Emissions from Stationary Sources 11-12 (Sept. 2011) ("The IPCC . . . eschewed any statements indicating that its decision to account for biomass CO2 emissions in the Land-Use Sector rather than the Energy Sector was intended to signal that bioenergy truly has no impacton atmospheric CO2 concentrations."); see also Deferral for CO2 Emissions from Bioenergy and Other Biogenic Sources Under the Prevention of Significant Deterioration (PSD) and Title V Programs, 76 Fed. Reg. 43,490, 43,498 (July 20, 2011); Science Advisory Board Review of EPA's Accounting Framework for Biogenic CO2 Emissions from Stationary Sources 7 (Sept. 28, 2012) at 3.
[3] Typical CO2 emission rates for facilities:
Gas combined cycle 883 lb CO2/MWh
Gas steam turbine 1,218 lb CO2/MWh
Coal steam turbine 2,086 lb/CO2/MWh
Biomass steam turbine 3,029 lb CO2/MWh

emitted seems to be even higher for the combustion of slow-growing biomass than for the combustion of fossil carbon in a 100-year time frame (Holtsmark 2013). The warming effect from biomass CO_2 can continue for decades or even centuries depending on the feedstock. Multiple studies have shown that it can take a very long time for new biomass growth to recapture the carbon emitted by combustion, even where fossil fuel displacement is assumed, and even where "waste" materials like timber harvest residuals are used for fuel (Repo et al. 2010, Manomet Center for Conservation Sciences 2010, McKechnie et al. 2011, Mitchell et al. 2012, Schulze et al. 2012). One study, using realistic assumptions about repeat bioenergy harvests of woody biomass, concluded that the resulting atmospheric emissions increase may even be permanent (Holtsmark 2012).

In addition to producing large amounts of CO_2, biomass energy generation can result in significant emissions of other pollutants that worsen climate change and harm human health, such as black carbon. Many biomass emissions can exceed those of coal-fired power plants even after application of best available control technology.

Studies have found that global greenhouse gas emissions must peak by 2020 and drop sharply thereafter in order to preserve a likely chance of keeping global warming below 2°C — a level at which serious impacts will still occur (UNEP 2013). California's climate goals, as reflected in AB 32 and applicable executive orders (S-3-05 and B-30-15) also call for increasingly steep reductions in emissions over the next three decades. Yet the science shows this is precisely the time period during which biomass emissions released today will increase atmospheric CO_2 levels. The next Scoping Plan will explicitly address the goal of reducing emissions 40 percent below 1990 levels by 2030. At a time when we need to reduce emissions dramatically in the short term and keep them down, California forest policy should not be promoting biomass burning that will exacerbate climate change.

Conclusion

Thank you for your consideration of these comments and recommendations. We look forward to working with the Air Resources Board and all parties in the development of the Scoping Plan Update.

Sincerely,

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Sources: EIA, Electric Power Annual, 2009: Carbon Dioxide Uncontrolled Emission Factors. Efficiency values used to calculate emissions from fossil fuel facilities calculated using EIA heat rate data. (http://www.eia.gov/cneaf/electricity/epa/epat5p4.html); biopower efficiency value is 24%, a standard industry value.