PACIFIC FOREST TRUST
Private Forests. Public Treasures.

October 30, 2017

Claire Jahns
California Natural Resources Agency
1416 Ninth Street, Suite 1311
Sacramento, CA 95814

Re: CALAND Model Development

Dear Claire,

Thank you for providing this opportunity to comment on the CALAND model development following from the October 13, 2017 workshop. We appreciate the effort to set quantitative climate goals for actions on Natural and Working Lands (NWLs). However, the model in its current form has a very limited utility towards this goal. Taking two time periods as measures of carbon stocks and seeking to set a trend of future carbon accumulations or releases requires integrating both natural processes that drive accumulation as well as decay rates—in addition to harvest—and incorporation of development patterns as well as simply urban growth projections. To our understanding, neither of these have been incorporated in the current approach.

There are critical issues that need to be resolved if the model is to help inform the NWL Implementation Plan or other state documents. While an observational model might work for other systems, extrapolating future changes in NWL carbon cycles based on only 10 years of data could lead to ecologically perverse model outputs stressing the unstable accumulation of carbon over achieving resilient, carbon-rich ecosystems. There is a tremendous body of research on ecological forest carbon dynamics and vegetation modeling—as well as a substantial body of research on development patterns—which could be used to build a more process-based model.[i]

We suggest that the next iteration of the CALAND model:

- Include a fire baseline so that the model does not encourage fire suppression or accelerate a lack of resilience,
- Include improved forest management—one of the most effective techniques to increase carbon stores at the necessary scale,
- Incorporate decay processes,
- Incorporate a stronger planning element to forecast locations of future population growth, especially in rural foothill and coastal forest zones,
- Shift the way in which land protection is accounted for to recognize that changes in land management can result from a protected status,
- Provide additional model transparency and access to the model itself, and
- Engage additional experts in ecological carbon dynamics.

Below, please see some additional detail on the specifics of these recommendations.

Sincerely,

Laurie Wayburn
President

A fire baseline should be included so that the model does not encourage fire suppression or accelerate a lack of resilience. As version two of the CALAND model now takes black carbon into account, it is important that the emissions from fires are placed in the appropriate ecological and historical context. There is a strong scientific consensus that California forests need more fire, not less,[ii] as they are currently in a "fire deficit."[iii] Restoring natural fire regimes to the landscape, with more frequent, low-intensity fires, will help create more resilient carbon stores in our forests.[iv] Actions to restore fire to the landscape – such as prescribed fire and managed natural ignitions – need to be contextualized in terms of a baseline of natural fire emissions rather than as additional carbon emissions.

Spatially explicit mapping of fires and their severity as is planned for version three will be an important step, but this should be layered onto a base map of historical fire regimes (e.g., see the fire return interval departure maps produced as part of the Forest Carbon Plan for each ecoregion). A much longer timeframe than the proposed business as usual scenario of 2001-2010 will need to be used to develop a fire baseline, given the last 100+ years of fire suppression. We suggest that historical fire regimes be used to develop a basis for the expected fire on the landscape.

CALAND should include improved forest management – one of the most effective techniques to increase carbon stores at the necessary scale. As the forest offset program has proven, improved forest management is one of the largest, most immediate, and most cost-effective opportunities to sequester carbon on natural and working lands. US forest offsets have sequestered over 60 $MMTCO_{2e}$ to date, the vast majority of which are improved forest management projects. Forest projects represent over 70% of the carbon offsets used in the Compliance and Early Action programs. Similarly, the implemented GGRF investments in Forest Health resulted in 2.5 $MMTCO_{2e}$ reduced with just $15 million invested, for an average cost of just $6/ton.[v] In light of the draft goals of achieving at least 15-20 $MMTCO_{2e}$ on NWLs by 2030, the state needs to properly and accurately account for the huge potential of our forests to store carbon beyond the offset program. We recommend that this essential practice, as well as all other GGRF activities on NWLs, be included in the model and that offset projects be tracked separately to avoid double-counting.

To accurately incorporate improved forest management, the CALAND model needs to change the way that it deals with time. Currently, the model incorrectly assumes that the carbon impacts of a management activity all occur in the same year as that activity. This ecologically inaccurate assumption would be incompatible with the needing inclusion of improved forest management – which increases carbon stores over time by restoring more resilient and carbon-rich older stands with larger, older trees. The model should be parameterized to allow for increasing carbon densities over time on forest stands under improved management.

The model needs to incorporate decay and other forest processes that take time. The model currently assumes that decay following any harvest occurs at once, but ecological research has shown that some dead wood (particularly from larger, older trees) can take hundreds of years to completely decay.[vi] Thus, we suggest that decay rates be taken into account just as the temporary storage of carbon in wood products is accounted for.

Similarly, the time assumptions about thinning and other forest management activities are also problematic because the model currently assumes that the forest will experience *indefinitely* increased productivity after thinning or other fuels reductions. However, it depends whether a stand will subsequently be harvested in a decade or two under business as usual practices or whether the thinning shifts the stand towards older, larger trees. In the former case – the increased carbon uptake should only be presumed to occur for the amount of time before the stand is harvested. We understand that the model does not currently account for such stand dynamics, but the likely fate of a stand should be used to parameterize how such practices are taken into account in the model, such as by including this increased productivity for only a fixed amount of time. The possibility of additional thinning treatments or prescribed fire on the same stand 15 years down the road to maintain resilient conditions should likewise be accounted for.

As the model is intended to provide a carbon estimate of the impacts of different activities to inform the goals set forth in the Scoping Plan, we suggest that it is revised with a more accurate accounting for how these emissions play out over time.

Incorporate a stronger planning element to forecast locations of future population growth, especially in rural foothill and coastal forest zones. Development patterns are not as simple as an expanding urban growth rate. There are many impacts on carbon stores from development that occur in rural areas far from the urban growth boundaries. These impacts, which include conversion, fragmentation, and degradation, can substantially reduce carbon stores. We suggest that a spatially-explicit model of land development is used which includes these rural impacts and is linked to projected population dynamics.

CALAND should shift the way in which it accounts for land protection to recognize that changes in land management can result from a protected status. Modeling land protection as a reduction in the urban growth rate also misses many of the other implications of protecting land. For instance, the model assumes that the ownership boundaries remain constant. However, there should be a provision whereby private lands can be shifted into private conserved lands, as we know that conservation easements will be an important part of the state's climate strategy. For instance, the most recent CAL FIRE Forest Health grants will protect more than 28,285 acres.[vii]

Conservation easements can not only protect land from development but also secure permanent improvements in land management. For instance, the McCloud Dogwood Butte project undertaken by Hancock Timber Resource Group and Pacific Forest Trust conserved 20 square miles of well-managed productive private forest. This conserved working forest is not a forest offset project, yet its carbon stocks will double in just 50 years—removing 1.8 $MMTCO_{2e}$ from the atmosphere, equivalent to the annual emissions of 380,000 cars. The carbon stores on these newly protected lands need to be included in the model.

Further, restoration activities on non-protected private lands should also incorporate some level of risk that these lands will be developed or harvested. Currently, the model assumes that if a land type is restored, it is also protected. While it is wise to combine restoration and protection efforts, if this land has not truly been protected then there is no guarantee that it will not be developed or that management will change significantly. Changes in forest management, such as from uneven to even-aged management, can release significant carbon stocks. We recommend that a risk of conversation or change in management is incorporated on all properties that are not protected.

As modeling reduction of the urban growth rate does not fully take into account these effects of increased protection or risk of conversion, we suggest that land protection is modeled instead as a targeted increase in the amount of land under conservation easements. This would involve:

- Targeting a conservation goal (e.g., 50,000-100,000 acres per year conserved across all land types) and shifting these lands from private to private-protected land classes.
- Modeling a portion of these newly conserved lands under improved forest management conditions as described above.
- Assigning a risk of development (which can be based on the urban growth rate) to all non-protected lands, including those on which restoration activities occur. There should also be a risk of degradation based on business as usual harvest rates.

Shifting to this more accurate modeling of land protection will help the state take into account the benefits of conservation interventions on securing carbon stocks.

Additionally, the business as usual scenario needs, as the technical appendix and modelers have noted, to shift away from a land cover change to a land use change model. The carbon impacts of fire, which is typically a temporary conversion of land state, are quite different from permanent conversions to development and other land uses. We suggest moving to a land use change assessment which will more accurately depict what has been occurring on the landscape. It is also important to look at *gross* instead of *net* changes in land use. Fire suppression, and the subsequent conifer encroachment in oak woodlands, has shifted many woodlands to forestland (using a 10% canopy cover definition) and shrub-steppe lands have become encroached with juniper. This artificially inflates the amount of forestland, which is problematic because the carbon stores of the lost forests are likely to be much greater than the shrub or woodlands turned into forests.

A scalar mismatch exists between the model and the intervention-based approach, limiting the model's utility in assessing interventions. While the goals for the NWL implementation plan are intervention-based, the model takes a more sectoral approach to estimating carbon fluxes across the entire landscape. The overall picture of the carbon fluxes and stores on natural lands and their impact on atmospheric carbon sequestration is useful in the context of meeting the state's climate goals and is what the model is attempting to quantify. However, this approach where interventions are assumed to affect the entirety of a forest land type is not well suited to assess the carbon impact of different interventions. The reality of how interventions occur on the landscape—at a forest stand level—is not well represented in the model's structure. While the model encompasses many different land ownerships, it will be important to disaggregate the carbon gains from actions on state and private lands—where the state has authority—and federal lands.

Provide additional model transparency and access to the model itself.
We appreciate the efforts to describe assumptions, model inputs, and outputs in this technical appendix. However, we would also like to see the equations and embodied assumptions in the model itself. We strongly suggest that drafts of the excel and R code for the model itself are released with an accompanying user guide and description so that these functions can be critically examined by stakeholders, experts, scientists, and the public. To ease comparison between different practices, land types, and ownerships, the results for each management intervention should be disaggregated and presented in terms of the annual carbon gain/losses per acre, the number of acres on which such an activity is possible across the state, and how long that carbon impact is expected to persist.

Engaging additional experts in ecological carbon dynamics could improve the model.
While we appreciate the creation of a technical committee for the CALAND process, we respectfully suggest that the model would also benefit from engaging some of the recognized academic experts in the field of modeling terrestrial carbon dynamics in an additional expert review committee. There are a number of leading researchers on these issues who should be engaged in reviewing and refining the model. We suggest reaching out to some of the following experts:

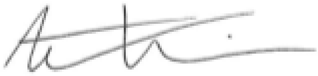
- Dr. Beverly Law, Professor of Global Change Biology & Terrestrial Systems Science in the Department of Forest Ecosystems & Society at Oregon State University.
- Dr. Mark Harmon, Professor Emeritus in the Department of Forest Ecosystems & Society at Oregon State University.
- Dr. Tara Hudiburg, Assistant Professor in the Department of Forest, Rangeland and Fire Sciences at the University of Idaho
- Dr. Chris Fields, Perry L. McCarty Director, Stanford Woods Institute for the Environment at Stanford University

Given these academics' involvement in other similar efforts around the country and world, engaging them in the CALAND modeling will help with consistency and exchange of common approaches. For example, Dr. Law also sits on the Oregon Forest Carbon Task Force and has been intimately involved in quantification and modeling efforts for Oregon's forest climate effort. Engaging her in the development of CALAND will help ensure consistent assumptions are being applied in our adjacent jurisdictions.

We encourage some funding be made available to engage recognized experts such as those mentioned above. While the Technical Advisory Committee is expected to serve without compensation, busy academics are unlikely to be able to engage in a meaningful way without funding. In the interest of developing the best possible model, we urge you to use some of the $600,000 available for contracts to solicit their engagement.

Thank you for considering these recommendations. If you have any questions about these suggestions, please contact me at (415) 561-0700 x 13 or ahalperin@pacificforest.org .

Sincerely,



Abby Halperin
Policy Associate

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[v] California Climate Investments, 2017 Annual Report. http://bit.ly/2017CCIannualreport

[vi] Oregon State University. "200-year Experiment Changes Face Of Forest Management." ScienceDaily, 21 August 2005. <www.sciencedaily.com/releases/2005/08/050819123757.htm>.

[vii] http://calfire.ca.gov/communications/downloads/newsreleases/2017/2017_Grants_GHG.pdf

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