Comments on the Natural and Working Lands Implementation Plan
and development of the CALAND model

To:
California Air Resources Board
https://www.arb.ca.gov/lispub/comm2/bcsubform.php?listname=nwlplan-caland-ws&comm_period=1nwl@resources.ca.gov

From:
Louise Jackson, Emerita Professor and Extension Specialist
Department of Land, Air and Water Resources, University of California Davis
Lejackson@ucdavis.edu

Submitted online on October 27, 2017

After attending the public workshop on October 13 on the Natural and Working Lands Climate Change Implementation Plan and CALAND Model Development, and reading the documents released for the workshop, I was impressed by the cooperation among so many agencies to set a pathway forward for ambitious objectives for reducing greenhouse gas (GHG) emissions. This is an exciting and momentous time for recognizing the value of natural and working lands (NWL) in California.

These comments address three major concerns about CALAND:

1) The CALAND model is an important and significant effort to assess and project carbon-based GHG emissions statewide. While there are some issues that need more attention (see below), a major concern is how the CALAND model will be integrated with other available data and modeling tools to accurately project statewide emissions from NWL. Reduction of nitrous oxide (N_2O) and avoidance of emissions from vehicles and the built environment on NWL offer permanent solutions to meet the 2030 mitigation goal of at least 15-20 MMT of GHG emissions. The current emphasis on CALAND obscures the ways that these important mitigation strategies will be incorporated in the Implementation Plan. In the CALAND technical documentation and reports, there must be a discussion of the tradeoffs in managing for different types of GHG emissions. As an example, CALAND may show that urban forestry has higher rates of C sequestration than agricultural land, but conversion of agricultural land to urban forestry is associated with much higher vehicular GHG emissions, and thus would not be a net benefit for a land use change toward meeting the 2030 mitigation goal. This is the kind of issue that must be discussed in the CALAND reports.

2) Given the diversity of California's natural and agricultural ecosystems, it is not surprising that so much variation exists in CALAND's output for total, biomass, and soil carbon density (shown in panels 12-17 in the workshop handout by Di Vittorio et al.). The take-home message (panel 31) that 'CALAND provides robust estimates of the C and C-GHG effects of individual or multiple practices with respect to BAU' is probably too confident, and more information must be provided to convincingly support this statement. The rationale for making this claim must be explained scientifically, clearly addressing the high variation in C sequestration rates within regions and land use types.

Improving the context and information in the Technical Documentation (Version 2 (July, 2017)) is necessary to clearly describe CALAND's process and outputs. i) Insert a 'Background' section between the 'Summary' (page 3) and the 'Model Structure' (page 6) that provides context on emphasizing carbon emissions from NWL as an important GHG mitigation strategy in California, using scientific literature and government inventories. Provide a comparison with other sources of GHG emissions from NWL, including estimates of N_2O and avoided GHG emissions from vehicles and the built environment. Cite empirical and modeling studies that show the potential for carbon-based mitigation, and the ecosystems that are considered most effective for this purpose in California. With this background, the reader will better understand the reasons why CALAND was chosen as the main modeling effort for NWL. ii) The 'empirically-based, database' approach of CALAND seems valid given the difficulty in modeling carbon processes for so many different types of California ecosystems. On page 6, CALAND is said to rely 'on California-specific data from academic literature, state institutions, and state partner organizations', yet there are very few literature citations for these data. To justify using this approach across the State, more description of the input data and its sources is needed. iii) As an example, little quantitative information on input data is given in this document, e.g., on canopy or root carbon for different ecosystems. How were these data obtained across a region or a land use type, and which scientific publications were used? Give an example in the document to show how data from different kinds of forests or cultivated ecosystems were compiled and/or aggregated. iv) Is Appendix B a partial list of studies on mean net ecosystem carbon accumulation rates? Very few references are listed here, whereas many such studies exist in California. For example, only two references were given for 'Cultivated Land, non-Delta', yet this has been a vigorous research topic in California for the past decade. Does this Appendix imply that the same values are assigned to the entire State's cultivated lands, regardless of factors such as climate and soil type? v) In the 'Looking Ahead' section (page 29), there are clearly new and improved additions to CALAND coming forth for mapping and for ecosystem assessment. Is there actually time between now and Spring 2018 (when the draft Implementation Plan is due) to incorporate the USGS mechanistic ecosystem model for carbon accumulation, and growth and respiration (page 30)? Also, it is unclear what is meant by not being able to include 'permanent, non-anthropogenic land cover change' (page 30). Does this mean that it will not be possible to evaluate such shifts as from forest to shrubland; woodland to grassland; or rangeland to cropland? Perhaps the confusing issue is the definition of 'permanent, non-anthropogenic land cover change'. These types of changes are crucial for carbon sequestration, and exploratory estimates would be very useful for scenario building.

3) Suggestions were requested at the workshop for additional management practices to include in CALAND. In addition to the agricultural activities in Table 3 of the Technical Documentation (Version 2 (July, 2017)), other practices should be included: i) Compost is much more easily and ubiquitously applied on row crops than on rangeland in California. Thus, it is odd that only rangeland compost amendment is currently included. ii) Manure is also applied to cropland, especially in areas of dairy production. It builds soil organic matter, yet carbon sequestration tradeoffs with N_2O and CH_4 emissions must be considered. These tradeoffs need to be explained in the interpretation of CALAND's model outputs. iii) Annual and perennial crops should be distinguished for their potential in sequestering soil and biomass carbon. Orchards, vineyards, and alfalfa incur less soil disturbance and more consistent carbon inputs from roots and shoots than do annual row crops. Scientific literature on these practices is available for California, and collaboration with the COMET modelers could also provide useful information.

If CALAND continues to show no net benefits for C sequestration on cultivated lands, then farmers and other managers of agricultural land appear to have no way to contribute to the intervention-based goal for a decrease of 15-20 MMT by 2030. Yet agricultural practices do exist to meet this goal. As an example, decreasing the inputs of nitrogen fertilizer to high cash-value crops will provide permanent, effective, and rapid GHG mitigation benefits; releasing 1 kg of N_2O into the atmosphere is about equivalent to releasing 298 kg of carbon dioxide (CO_2). It may be beyond the capacity of CALAND to model the potential for decreasing N_2O emissions in agriculture, yet this limitation cannot be ignored in CALAND's reports. For example, a table could show each agricultural activity with CALAND's outputs for carbon-based GHG emissions, side-by-side with the estimated other types of emissions for that activity based on a literature review of California research. Rather than discourage the role of agriculture in GHG mitigation, CALAND should be oriented toward including other opportunities in the interpretation of its modeling results.