Webinars on Agricultural and Cultivated Lands and Forests for CALAND Model Development

January 17, 2018: Topics for Discussion

Summary: The topics in this document derive from public comments received on the CALAND model and issues brought up by State Agency personnel and CALAND Technical Advisory Committee (TAC) members. These topics were discussed in the December 2017 TAC meeting. The table below summarizes current Berkeley Lab progress on these topics and related recommendations from the TAC, where applicable (see below for more information on the TAC).

Agenda for January 17 Webinars: The General Model Updates will be discussed at both the Agricultural and Cultivated Lands and the Forests webinars, while agricultural and forest-related topics will be the focus of each respective webinar. Topics will be prioritized for discussion based on participant survey at the beginning of each webinar on January 17, 2018.

More information on the CALAND TAC: The CALAND Technical Advisory Committee is made up of state government representatives and expert members of the public convened to inform development of CALAND. The TAC represents the collective knowledge of carbon sequestration and GHG emissions flux on natural and working lands across state agencies to provide ongoing technical input to the members of the Steering Committee to aid in the development of CALAND. The five public members of the TAC were selected in November 2017 following an application process.

#	*Discussion Topic*	*Proposed Follow-up*
GENERAL MODEL UPDATES		
1)	How are regional differences in the expected outcome from a given management practice modeled in CALAND?	The CALAND model operates in part using a suite of prescribed management practices or a business-as-usual scenario, and the outputs include aggregated carbon and greenhouse gas budgets at the regional scale. Each management practice has an input value(s) for its effect on carbon dynamics based on California-specific field data. The management practices are assigned to a specific amount of area within each of CALAND's land categories in scenario input files. Area-weighted carbon densities for each land type-ownership combination are aggregated within each of the nine regions. CALAND quantifies variability in regional-scale carbon and greenhouse gas outputs by running CALAND twice using the uncertainty range for initial carbon densities and/or carbon accumulation rates as input values. The uncertainty ranges for these inputs are included in the input files, and the model can be run using these range limits. Regions and ownerships are spatially explicit. Within the region and ownerships, amounts of land cover were determined from spatially explicit data (30m data were processed into land type categories). *TAC Recommendation: Current differentiation is sufficient for intended use of the model.*

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2)	Other models for land use change exist, including CalEEMod, Urban Footprint, and UPlan. Why doesn't CALAND use these models?	CALAND requires a statewide land use change model, and these other models are better suited to smaller scales. Some of these models include non-land based carbon (e.g., vehicle miles traveled) that are outside the scope of CALAND. *TAC Recommendation: TAC confirms Berkeley Lab's assessment of these alternative models.*
3)	CALAND needs to address high variation in carbon sequestration rates within regions and land use types before it can claim to produce outputs with certainty; certainty and error needs to be explicit.	Berkeley Lab agrees, and is examining the model's sensitivity to uncertain inputs. CALAND tracks uncertainties in carbon density and accumulation rates, and can use mean values or limits of the values. *TAC Recommendation: Continue with existing approach to sensitivity analysis.*
4)	The concept of "permanence" should be addressed at a high level.	Berkeley Lab agrees, and the assumptions with regards to permanence that are used in CALAND – of land cover type, impact of management, etc. – are informed by data. (Additional details on these assumptions in forestry/agriculture sections below.) *TAC Recommendation: "Permanence" is, at a high level, a policy issue that should be clearly addressed and defined, both in CALAND and for use in the Natural and Working Lands (NWL) Implementation Plan. The expected duration of impact, permanent or not, will have a significant impact on what can be expected from natural and working lands. The Implementation Plan should also describe how permanence will be monitored over time.*
AGRICULTURAL AND CULTIVATED LANDS		
5)	Some have suggested that limiting CALAND to observational data will limit ability of the model to adequately characterize baseline and scenario outcomes for the agricultural industry. Alternative modeling methods suggested using biogeochemical models such as DNDC, CENTURY, and COMET Farm and Planner. What are the pros and cons of different approaches to modeling?	CALAND's observational data sufficiently characterizes baseline and scenario outcomes because it is based on measurements of actual practices. Other mechanistic biogeochemical models can generate error when extrapolated to environmental conditions and systems of management for which they were not calibrated or validated. For our purposes, CALAND's approach may be most reliable. *TAC Recommendation: The TAC affirmed that alternative models such as DNDC, CENTURY, and COMET are not consistent with the scale needed by CALAND.*
6)	Some have stressed the need to include nitrogen cycling in agricultural land practices.	Berkeley Lab found that the contribution of nitrogen is well within the CO2eq benefit uncertainty range of COMET-Planner using Fresno County as a test case. Berkeley Lab is not sure if it makes sense to mix nitrogen model outputs with observation-based carbon data. However, Berkeley Lab will continue to explore ways to parameterize nitrogen emissions in CALAND. Based on the evidence, Berkeley Lab would likely need more reliable field data to become available to be able to include nitrogen. If

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		Berkeley Lab finds it is not feasible to parameterize nitrogen emissions within CALAND due to data or time constraints, then they will address the implications of this in the model's results. *TAC Recommendation: TAC members suggested that focusing only on carbon-based emissions for the agricultural sector could be a detriment, and suggested discussing additional opportunities to address nitrogen in CALAND.*
7)	Some have noted the importance of including additional agricultural management practices in CALAND, such as composting on cultivated croplands, fertilizer use and management practices and reductions in nitrogen fertilizer use, manure on croplands, and a delineation between annual and perennial crops. Why are these practices important to the model outputs, and how might they be incorporated? Are there tradeoffs to including them?	CALAND currently includes a single soil conservation practice based on an average of field studies for cover cropping and no tillage. Berkeley Lab has quantified an uncertainty range for the benefits of these practices based on the measured variability of baseline carbon fluxes and carbon densities. Berkeley Lab has found that at the landscape to regional levels, the area of management (which needs to be quite large to make a noticeable difference) is a much larger factor than the estimated small differences between different management practices, and that there is a paucity of reliable data available to parameterize these practices. Thus, changing or expanding the agricultural practices may not lead to improvements in the model. Nonetheless, Berkeley Lab is still open to adding practices such as compost management on cultivated lands, and will continue to explore data to inform CALAND's potential approach for this. Berkeley Lab does not currently have plans to include manure application on croplands or other fertilizer management options because these practices are not included in the California Healthy Soils COMET Planner. Annual and perennial crops are addressed below in #8. Nitrogen emissions are addressed above in #6. *TAC Recommendation: Continue to discuss and review how additional agricultural management practices could feasibly be represented in the model.*
8)	Annual and perennial crops: (a) Some have suggested the importance of delineating between annual and perennial crops in land cover data. Why is this important to the model outputs, and how might it be done? Are there tradeoffs? Suggestions include delineating woody from non-woody crops, and using data from Landfire, Cropscape, DWR LandIQ for 2014, and (forthcoming) TNC. (b) Additionally, CALAND should address permanence related to woody crops.	(a) Currently, Berkeley Lab does not have plans to split out perennial/woody crops, as practices contributing to carbon benefits cannot be parameterized due to data limitations. Without parameterized practices, the effects on model outputs would likely be small. Additional woody crop area, however, may have an effect, but this land use change is largely unpredictable and highly dependent on permanence (see below). *TAC Recommendation: Continue to discuss how perennial crops are addressed in CALAND; gain input from the TAC and other stakeholders to see if there are feasible ways to represent them.* (b) Berkeley Lab will discuss how CALAND might be used to address orchards and other crops that may be tilled or replaced within 10 to 20 years (i.e. orchards, vineyards, and other woody crops); discussions will occur with TAC members via teleconference and in webinar discussions as needed. *TAC Recommendation: Incorporate additional definitions and qualifiers regarding whether orchards are considered permanent and how CALAND addresses cultivated lands that are tilled after 10 to 20 years.*

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9)	CALAND currently does not model riparian restoration, but there is strong interest in including it as a standalone practice. How might this be done?	Berkeley Lab may be able to explore the potential impact of riparian restoration if woodland restoration is added as a practice in CALAND. Studies show that agricultural riparian zones develop into carbon stores similar to CALAND's woodland. CALAND experiments can be done using woodland restoration as a proxy for riparian restoration, i.e., convert grassland land type acreage to woodland. *TAC Recommendation: Berkeley Lab should review options to model riparian restoration, including the California Department of Conservation's CREEC tool.*
FOREST LANDS		
10)	How is permanence or assumed change evidenced in the model, regarding: (a) Forest land cover type? (b) Permanence of treatment effect?	(a) Regarding permanence of forest cover, CALAND assumes that forests regenerate after fire and clearcut, and so the land type remains forested. There are no data to show that forests do not regenerate on a timespan relative to the forest's lifecycle, such that one could make a reliable prediction to the contrary. *TAC Recommendation: It will be important to elaborate on the policy elements of this assumption in the NWL Implementation Plan.* (b) Regarding repeat thinning, CALAND assumes that the carbon exchange benefits of this treatment last for 30 years, with continued management required to maintain benefits beyond that period. *TAC Recommendation: A 20-year treatment period may be more appropriate for some forest types. Berkeley Lab will consider this as an additional or alternative interval.*
11)	Carbon outcomes (for forests) are inherently site-specific and depend on a range of factors.	CALAND is not intended to provide site-specific carbon or GHG budget analysis; it is intended to estimate aggregated carbon costs/benefits of landscape to regional scale management suites. The TAC recognized the necessity of operating at a more generalized scale, and suggested being very clear that CALAND is not a project-level carbon accounting tool, so it is neither intended to give site-specific GHG budget analysis nor serve as a site-specific inventory/ accounting tool. *TAC Recommendation: The CALAND description, and the NWL Implementation Plan, should clearly and repeatedly acknowledge that CALAND is not a project-level carbon accounting tool, so it is neither intended to give site-specific GHG budget analysis nor serve as a site-specific inventory/ accounting tool.*
12)	Urban forestry seems to have constant carbon density – how does this relate to tree canopy, and should it be regionally uniform or vary?	CALAND currently uses a single carbon density value for urban trees and one average carbon accumulation value. *TAC Recommendation: CARB will analyze its urban forest canopy data to assess the value in differentiating carbon density at a finer, regionalized scale. Berkeley Lab will evaluate the cost-benefit of regionalizing all urban forest data based on additional CARB analysis and report back to TAC on decision. Berkeley Lab will also follow up with CAL FIRE on CAL FIRE and UC Davis studies.*

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13)	The period used to model the BAU projection is too short to capture variation in wildfire frequency and intensity, development patterns, etc.	The BAU land use/cover change is being updated to draw from data going back to 1970. The BAU wildfire data is being updated with data from California's Fourth Climate Change Research Assessment that is based on the historical record dating back to the 1950, and currently uses 2000-2015 annual average burn area. *TAC Recommendation: TAC affirmed the planned approach to the land use/cover change BAU timeline, but recommends examining more recent (post-2015) wildfire data based on concerns that historical fire patterns are insufficient predictors of future fire patterns. Berkeley Lab will review additional, post-2015 wildfire data and incorporate as feasible more current baseline data for fire.*
14)	Does CALAND include decay processes?	CALAND includes decay processes, although treatment is not uniform: wood products decay over time, while loss/decay due to management activities and land cover change is modeled to occur in the first year, post-activity. *TAC Recommendation: Consider the feasibility of modeling decay uniformly across utilization pathways. Berkeley Lab will review the "AB 1504 California Forest Ecosystem and Harvested Wood Product Carbon Inventory 2006-2015," and compare this report with current CALAND methods for decay processes.*
15)	CALAND currently does not model improved forest management, but there is strong interest in including this as a forest management practice. How might this be done?	TAC members suggested that the currently modeled practices are fairly exhaustive and may be able to be used to model "improved forest management". TAC members suggested that this activity, i.e., what is deemed an improvement, would need to be broken out by forest type to be worthwhile. *TAC Recommendation: Berkeley Lab shall define "improved forest management" and look at what is available and recorded for the offset protocol, including: preservation, reduced harvest, going from clear cut to partial cut, and extending rotation periods. If feasible, they will include a percentage increase in the length of the rotation period.*
16)	Some have suggested that CALAND model additional forestry practices, including fuel breaks, selection logging, and salvage logging. Why is this important to the model outputs, and how might it be done? Are there tradeoffs?	Berkeley Lab shall review CAL FIRE and U.S. Forest Service data that may be useful to determine the pros and cons of including additional practices in CALAND. *TAC Recommendation: Berkeley Lab shall review how climate change and higher rates of mortality may require additional forestry practices at higher levels than in the past, and how this may impact CALAND. For example, salvage logging may become more of a factor in future scenarios for CALAND.*