California Air Resources Board
1001 I Street
Sacramento, CA 95814

January 14, 2017

Re: Comments on the California Natural and Working LANDs Carbon Model (CALAND), presented at the 2030 Target Scoping Plan public workshop on December 14, 2017
https://www.arb.ca.gov/cc/scopingplan/meetings/meetings.htm

Dear Air Resources Board Members:

On behalf of the Pesticide Action Network, and the statewide coalition Californians for Pesticide Reform, we thank you for the opportunity to comment on the C sequestration model presented at the December 14 public workshop.

We were quite pleased to see that the *Target Scoping Plan Concept Paper* recognizes that storage of C in natural and working lands (p.9) is one of the "most effective ways to remove GHGs from the atmosphere." We therefore fully support all four of the high-level objectives outlined on p.9 with special emphasis on #2 – increasing C storage in natural and working lands. Please see our July 8, 2016 comments on the Scoping Plan Concept Paper.

While we fully agree that it is vitally important to include management of working lands in calculations of actual and potential C sequestration, we are concerned that the model fails to adequately include agricultural practices that show *the greatest* C sequestration potential. We strongly urge ARB to update the model and go way beyond the simple inclusion of no-till and cover cropping to include multiple carbon farming agricultural practices, many of which we have identified below.

Not only do these regenerative, agroecological practices have great C sequestration potential, but they also are associated with reduced GHG emissions *and* function to best protect vital soil and water resources as well as other co-benefits ensuring a vibrant and competitive future for California's agricultural economy. These practices also protect agricultural communities from human health hazards associated with the chemical-dependent practices they replace. In fact, the elimination or dramatic reduction in the use of synthetic pesticides and fertilizers will protect vital soil biology — the engine of soil C sequestration.

Pesticide Action Network (PAN) North America is one of five regional centers worldwide representing hundreds of organizations in more than 90 countries. We work collectively around the globe and at the local and state level to push for public policies to better protect workers and the public from exposure to hazardous pesticides. We also work to promote the transition to a more just, environmentally sound and viable food and agriculture system. With offices in Oakland, CA we represent about 22,000 CA members. We are an active member of the 15-member California Caucus of the National Sustainable Agriculture Coalition (NSAC) based in Washington, D.C., and a founding member of the statewide coalition, Californians for Pesticide Reform (CPR), with a membership of more than 190 community-based organizations, representing hundreds of thousands of Californians across the state.

I. Practices associated with diverse, perennial carbon farming systems sequester the greatest quantities of carbon and should be reflected in ARB's C calculations

Carbon farming practices range from regenerative organic farming to agroforestry systems to well-managed pasture-land (e.g. rotational grazing and incorporation of diverse herbaceous and woody species in silvopasture systems). While not currently practiced at large scale in California, these various practices can and should be adopted by California farmers and ranchers, with state and federal programs incentivizing their adoption.

With greater adoption, organic, regenerative and other sustainable carbon farming practices *can reverse* the current trajectory of climate change

Much research in California and elsewhere support the contention that organic, regenerative[1], and other sustainable farming practices can contribute significant amounts of C to managed soils.[2] A well-referenced comprehensive analysis by Eric Toensmeier of carbon farming practices around the globe presents additional, solid, scientific evidence of the great potential for highly diverse agriculture to both mitigate *and reverse* the current trajectory of climate change. The data show that if implemented on a larger scale than currently practiced, regenerative agriculture — from tropical home gardens to temperate permaculture — could draw down more than 100 billion tons of C into the earth's soil.[3] Globally that's equal to 367 billion tons of carbon dioxide (CO_2), which would indeed bring us back from our current climate change tipping point.

Because it involves high levels of on-farm biodiversity, regenerative carbon farming produces lucrative combinations of food, fiber, building materials and biofuel. It also protects pollinators and wildlife habitat, improves soil quality and productivity, and protects water resources. For every 21 tons of C sequestered per hectare (2.5 acres), soil organic matter goes up about one percent, which in turn increases the soil's ability to hold water by 25,000 gallons.[4].

Agroforestry – described in *The Carbon Farming Solution* as an "intentional, intensive, integrated and interactive" system of farming that incorporates the cultivation and conservation of trees – offers the most robust version of regenerative carbon farming. Agroforestry sequesters by far the greatest amount of C at 10-40 times the best annual cropping or managed grazing systems.[5] In addition to C sequestration, agroforestry systems can reduce the need for fuel, nitrogen fertilizers (as trees capture nitrogen from the air and transfer it to the soil) and pesticides (by providing habitat for natural enemies of pest insects).

Silvopasture systems greatly increase rates of C sequestration on pasture-land

Table 1 shows C sequestration rates for silvopasture systems that incorporate diverse herbaceous and woody species compared to degraded or improved pasture systems. The addition of trees to the pasture systems greatly increases rates of C sequestration.

Table 1. Carbon sequestration balanced against methane emissions

	Degraded pasture	**Improved pasture**	**Intensive silvopasture**	**Intensive silvopasture timber trees**
C sequestered	-1.0 t/ha	3.3 t/ha	17.0 t/ha	34.7 t/ha

CH_4 & NO_x emissions (CO_2 equiv.)	-2.3 t/ha	- 6.5 t/ha	8.2 t/ha	8.2 t/ha
Balance	-3.3 t/ha	-3.2 t/ha	8.8 t/ha	26.5 t/ha

Source: Toensmeier, 2016

II. ARB should promote adoption of climate-friendly cropland and grassland practices as part of California's general plans to lower greenhouse gas emissions *and* should incorporate those cropland and grassland practices with C sequestration potential into the agency's C calculations

The Natural Resource Conservation Service (NRCS) identifies many climate-friendly practices including those with C sequestration potential. A set of proposed climate-mitigating bundles, shown in Table 2, include GHG emission reduction and fossil fuel replacement practices as well.

Table 2. Proposed Climate Change Mitigation Bundles

A. Cropland

Carbon Sequestration

- CCR99 – Resource Conserving Crop Rotation
- CCR98 – Improved Resource Conserving Crop Rotation
- SQL04 – Use of cover crop mixes
- SQL10 – Crop management system where crop land acres were recently converted from CRP grass/legume cover or similar perennial vegetation
- SQL11 – Cover crop in orchards, vineyards, or other woody perennial
- SQL12 – Intensive cover cropping
- SQL18 – Soil health crop rotation
- SQL05 – Use of deep-rooted crops to break up soil compaction
- WQL22 – On farm composting of farm organic waste
- PLT20 – High residue cover crop or mixtures for weed suppression and soil health
- SOE05 – Intensive no-till (organic or non-organic systems)

Emissions Reductions

- AIR03 – Replace burning of prunings, removals, and other crop residues with non-burning alternatives
- AIR10 – Discontinue burning crop residue
- ENR12 – Use of legume cover crops as a nitrogen source
- WQL20 – Transition to organic cropping system
- WQL25 – Split applications of nitrogen based on a PSNT
- WQL29 – High level IPM to reduce pesticide environmental risk
- WQL30 – IPM for Organic farming
- WQL32 – Apply enhanced efficiency fertilizer products
- WQL33 – Use of non-chemical methods to kill cover crops

Fossil Fuel Substitution

- ENR01 – Fuel use reduction for field operations
- ENR10 – Using Nitrogen provided by legumes, animal manure and compost to supply 90 to 100 percent of the nitrogen needs

- ENR11 – Improving energy feedstock production using alley cropping systems with short rotation woody crops

B. Grassland

Carbon Sequestration

- PLT16 – Management-intensive rotational grazing
- SQL04 – Use of cover crop mixes
- ANM03 – Incorporate native grasses and/or legumes to 15% or more of herbage dry matter productivity
- ANM21 – Prairie restoration for grazing and wildlife habitat
- ANM29 – On farm forage based grazing system
- ANM37 – Prescriptive grazing management system for grazing lands
- SQL09 – Conversion of cropped land to grass-based agriculture
- SQL18 – Soil health crop rotation *(we encourage the creation of a pasture equivalent)*
- WQL22 – On farm composting of farm organic waste

Emissions Reductions

- ENR12 – Use of legume cover crops as a nitrogen source
- WQL18 – Nonchemical pest management for livestock
- WQL19 – Transition to organic grazing system
- WQL29 – High level IPM to reduce pesticide environmental risk
- WQL30 – IPM for Organic farming
- WQL32 – Apply enhanced efficiency fertilizer products
- ANM25- Stockpiling of forage to extend the grazing season (eliminating hay cutting reduces fuel use)
- ANM64 – Managing livestock parturition to coincide with forage availability (saves energy associated with hay production and harvest)

Fossil Fuel Substitution

- ENR01 – Fuel use reduction for field operations
- ENR10 – Using Nitrogen provided by legumes, animal manure and compost to supply 90 to 100 percent of the nitrogen needs
- ENR11 – Improving energy feedstock production using alley cropping systems with short rotation woody crops

III. ARB should prioritize projects that combine multiple GHG-reducing practices on farms and ranches

Research indicates that the integration of *multiple* GHG-reducing practices on farms and ranches may be more effective at mitigating climate change than changing single, individual agricultural practices. For example, UC Davis research showed that reduced tillage combined with growing cover crops has greater ability to sequester C and increase yields than either practice alone.[6] It is the synergistic benefits of combined practices in a whole-farm context that hold the most promise for increased C sequestration in soils and reduced GHG emissions in agriculture.

We encourage ARB and its agency partners to prioritize projects that combine multiple practices and promote the use of integrated farming systems that work across multiple management areas including: water use/irrigation; off-farm inputs; energy use; crop choices and cropping patterns; and biodiversity.

IV. Implications for the broader Scoping Plan: ARB should incorporate the aforementioned carbon farming practices into its Scoping Plan analysis

It is appropriate that ARB promises to include, in their Scoping Plan analysis (p.17), estimates of impacts of land use both from business-as-usual practices as well as proposed policies. **However, we strongly encourage the Scoping Plan analysis to include additional carbon farming practices mentioned and referenced in these comments but not yet identified in ARB's proposed approaches.** To do so will require that the C models supporting ARB analyses include a variety of practices including those with the greatest C sequestration potential – whether or not they are currently in widespread use.

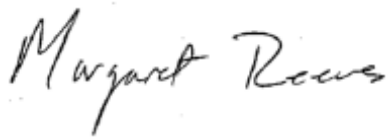
The lack of thorough on-the-ground verification of less-known practices[7], such as perennial grain crops, that show great C sequestration and/or GHG reduction potential based on published descriptions, should not be grounds for dismissal of those practices for inclusion in models or support under the Scoping Plan. This point supports ARB's stated intent to "encourage innovation and voluntary actions" (p.7) that may go beyond the limits of the Scoping Plan.

Conclusion

Both PAN and CPR see great potential for allocation of California's GHGR funds to bring great public health and economic benefits to CA rural communities, especially if those funds are allocated in support of those farming and ranching practices with the greatest potential to sequester C and provide other associated benefits. Therefore, we urge ARB to improve the C sequestration model, upon which policy decisions are made, by incorporating multiple C sequestration practices beyond cover crops and no-till, such as a diversity of perennials, continuous ground cover, crop rotations, and IPM emphasizing non-chemical pest control, among the other regenerative carbon farming practices outlined here.

We thank you for your attention.

Sincerely,



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[1] See Rodale Institute's definition of regenerative agriculture: http://newfarm.rodaleinstitute.org/features/0802/regenerative.shtml

2. a. Kroodsma, D.A. and C.B. Field. 2006. Carbon Sequestration in California Agriculture, 1980–2000. Ecological Applications, 16(5):1975–1985.
   b. Six, J., S.D. Frey, R.K. Thiet, and K.M. Batten. 2006. Bacterial and Fungal Contributions to Carbon Sequestration in Agroecosystems. Soil Sci. Soc. Am. J. 70:555-569.
   c. Kane, D. 2015. Carbon Sequestration Potential on Agricultural Lands: A Review of Current Science and Available Practices. National Sustainable Agriculture Coalition & Breakthrough Strategies and Solutions, LLC
   d. Mitchell, J.P., A. Shrestha, W.R. Horwath, R.J. Southard, N. Madden, J. Veenstra, and D.S. Munk. 2015. Tillage and Cover Cropping Affect Crop Yields and Soil Carbon in the San Joaquin Valley, California. Agron. J. 107:588-596.

3. Toensmeier, E. 2016. The Carbon Farming Solution. Chelsea Green Publishing, White River Junction, NY.

4. USDA NRCS California. Healthy Soil Offers Sustainable Solutions in a Changing World. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/newsroom/?cid=nrcseprd404721

[5] Toensmeier, E. 2016. Op.cit.

6. See: http://www.energy.ca.gov/2008publications/CEC-500-2008-039/CEC-500-2008-039.PDF And: Mitchell, J.P. et al. 2015. Tillage and cover cropping affect crop yields and soil carbon in the San Joaquin Valley, California. Agronomy Journal 102(2).

7. Toensmeier, E. 2016. Op.cit.