UCB-Hill Campus Fire Risk Reduction Work
Standing Carbon and Removal Estimation
Strawberry Canyon, Frowning Ridge and Claremont Canyon Treatment Units
February 2016

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Purpose

Section 5.6 of the EBH EIS discusses potential Greenhouse Gas (GHG) emissions generated by the proposed and connected actions on the three treatment units. These emissions are associated with equipment and vehicles doing the actual work. Table 5.6-5 lists an estimated 863 CO2eT that would likely be generated over the ten year operating period for the three treatment areas combined. In addition, in Section 5.6.2.1, the GHG emission from decaying chipped material left on-site was estimated for the entire project area. As a proportion, the UCB treatment units are expected to generate approximately 230 metric tons CO2e/yr for ten years. (See Dense Area Removals below for more details on chipped material.) Therefore, the total estimated GHG emissions for the UCB treatment areas (including the chipped material) will be 3,165 CO2eT. That report states: "In conclusion, emissions of GHGs from the proposed and connected actions would be less than the draft quantification thresholds proposed by the CEC (California Energy Commission), and are considered less than significant from a global climate change standpoint" (EBH EIS p. 5.6-8).

The EIS analysis of potential GHG emissions do not account for the current standing forest carbon, and the reductions in stored carbon and carbon sequestration that will result from the proposed treatments. In Section 4.7, carbon sequestration for the entire 998 acre project area (UCB, EBRPD and City of Oakland) is estimated based on 10 plots. In order to better estimate standing carbon stocks on the three UCB units, a second inventory described below was performed using samples measured on the subject units.

Under the "no project" alternative analysis, the EBH EIS does not quantify the likely GHG emissions that may occur due to catastrophic wild fire. There has not been an assessment of the reduction in standing forest carbon following treatments, and the long-term impacts on CO^2 storage and sequestration on the project area.

For "Timber Harvest Plans" in California, where a commercial forest resource is managed for productive purposes, calculations of greenhouse gas emissions from forest management are required per PRC 4513, and tools are available on the Cal Fire website for this purpose.[In the current instance, where forest management is specifically intended to mitigate the risk of fire and will not result in logging of commercial tree species , the need for equivalent GHG quantification method is not clearly established. Nonetheless, this memorandum undertakes the exercise to understand GHG impacts of UC Berkeley's fire fuel reduction work as analyzed under the EBH EIS.

Methods

The standing carbon on the proposed UCB treatment areas was estimated using 12, 1/10 acre fixed radius plots. A five-class map of the project area was developed using existing vegetation maps provided by UCB from the EBH EIS and adjusted following field inspections by the Registered Professional Forester. These are referred to as "Dense Areas". Additional areas with scattered eucalyptus and pine will also be treated, but volumes in those areas were visually estimated due to high variability and low stocking. Non-treatment areas which include riparian zones, bay, oaks, maples and developed areas were also not sampled as they are not designated for treatment. However, visual estimates of tree stocking were made to permit estimates of their contribution to forest carbon storage and capture following treatments. Refer to Carbon Sampling Map. This sampling was treated as a stratified inventory. The project area was stratified into five cover classes:

- Eucalyptus dominated (sampled, DenseDense Area, to be treated)
- Monterey pine dominated (sampled, DenseDense Area, to be treated)
- Sparse (scattered small eucalyptus and pine, not sampled, to be treated)
- Riparian (contains bay, oak and maple and not to be treatment)
- Developed (cleared areas, buildings and other areas not to be treated)

All trees 6" DBH and larger were measured for diameter within slope-corrected circular plots 37.2' in diameter. A subset of trees within diameter classes was measured for height to be regressed on diameter. Plot centers were randomly positioned within mapped polygons in ArcGis. Plot waypoints were then uploaded to a GPS unit and plot centers were navigated to in the field, flagged in pink and measured.

Data Work-Up

The Forest Carbon calculator normally used for Timber Harvesting Plans and reviewed by Cal FIRE under CEQA only account for hardwoods and commercial conifer species. Consultations with Cal Fire, Felton and Sacramento confirm that they do not currently have a tool for use with the non-commercial species present on this project. Because our tree species are not commercial by Cal Fire definitions, we applied the same methods used in EIS Section 4.7.2 to calculate volumes, biomass and carbon content to the data collected on the treatment areas.

These data were then expanded from 1/10 to a full acre terms and reported in equivalent metric tons (CO2e). To calculate future carbon sequestration rates on the remaining native trees, a hardwood growth rate of 0.5 BA/ac/yr was applied which was based on growth data collected on site. This number should be considered conservative – growth rates may be higher over time.

Estimated Carbon Stocks

Tree covered Dense areas chipped contain an estimated 56,355 CO2eT on 155 acres. Native tree areas to be left untreated contain an estimated 1,150 CO2eT on 23 acres. Trees to be chipped in sparse areas contain an estimated 2,580 CO2eT on 86 acres. Grass and scrub to be left untreated in sparse areas contain an estimated 450 CO2eT on 86 acres (based on EIS Section 4.7.2.1.1).

Vegetation carbon on 20 untreated acres of developed areas is estimated at 1,000 CO2eT.

Total stocks for the entire 284 acre project area is estimated at 61,535 CO2eT.

As a check, the estimates provided in Table 4.7-3 of the EIS closely match these results when scaled down for size and vegetation type.

Chipping, Retention and Sequestration Estimations

Dense Area Chipping

In the 155 acre Dense Area there are an estimated 56,355 CO^2eT in the standing eucalyptus and pine that would be chipped and left on-site in this project. Retained native tree species in the Dense Area contain approximately 130 CO2eT, but are included in the total because the damage to these trees may be significant.

Chip depth estimates in the Draft Biological Assessment range from 4-24" over approximately 60 acres. Limitations on chip depth in Alameda Whipsnake Primary Constituent Elements (PCE) categories 1 and 2 are also identified. Chip decomposition will generate GHG emissions and are discussed in Section 5.6-7 of the EIS. For the UCB portion, 230 COeT/yr in GHG emissions are estimated for the first ten years of the project.

Native Tree Retention

Removal of trees in the Dense Areas will focus on non-native eucalyptus and Monterey pine, but healthy oak, bay, maple, and other native species will be retained where feasible. Because operation damage to the few, small native trees present in the Dense Areas is not known, they are not included in the forest carbon remaining. In addition, there are 23 acres of native trees (oaks, bay and riparian species) that will not be treated. Together these retained native species constitute an estimated 1,150 CO^2eT and will continue to grow and capture CO2.

Sub-areas

Portions of the Dense Areas are identified as "sub-areas", and will have eucalyptus and pines thinned and chipped with the intention of mitigating visual impacts. These sub-areas are located on the north end of the Strawberry Canyon unit (12.4 acre sub-area), and on the south end of the Claremont Canyon unit (9.7 acre sub-area). Because these areas will be subsequently treated in the ten-year maintenance plan, it is conservatively

assumed for the purpose of this analysis that they will be chipped and/or decline and die in a *relatively* short time, and should be accounted for as a *loss* of standing carbon on this project. These sub-area estimates are therefore included in the Dense Area carbon numbers above.

Sparse Areas

86 acres of Sparse Areas will have scattered eucalyptus and pine chipped to ensure these areas do not progress over time into undesirable tree stands, and to ensure AWS habitat goals are met. Stocking was visually estimated from air photos and field inspection at 30 CO^2eT/acre, which expands to less than 2,580 CO^2e tons.

Grass and scrub in the sparse areas add an additional 450 CO2eT. These will not be treated and will continue growing and capturing carbon.

Developed Areas

These areas will have a few hazard trees removed, but most of these areas are to be left untreated.

Carbon totals:

Current Standing	61,565 CO2eT
Post-treatment in chips	58,935 CO2eT
Emissions (equipment and chips)	3,156 CO2eT
Remaining in native vegetation	2,630 CO2eT

Sequestration Estimations for Remaining Tree Cover

Under the proposed 10-year follow-up maintenance plan, it will be assumed that only native trees will continue to be present remaining in the project area, and that (in the absence of loss from fire or other agents) they will be the only significant standing and sequestering carbon sinks into the future. No estimations of grass and shrub were made, but would be a minor component of the carbon totals.

On the 264 acres (excluding the 20 developed acres), immediately following the chipping of eucalyptus and pine as described above, the remaining native trees will contain an estimated 2,600 CO^2eT. Over time, this will increase to 10,560 in year 100.

The project area currently stores an estimated 61,565 CO^2eT. The proposed treatments will reduce this to approximately 59,000 CO2eT in post treatment chips and 2,630 CO2eT in standing live tree cover. Annual GHG emissions associated with equipment and chip decomposition over the next ten years totals 3,156 CO2eT. Remaining native trees will continue to grow and sequester carbon at a rate of ~530 CO2eT per decade thereafter.

In contrast, emissions from a stand-destroying wildfire would be as much as 50,000 CO2eT in a matter of hours.

This project will result in long term reductions in stored forest carbon and the rate of carbon sequestration. There will also be a temporary increase in GHG emissions from equipment use, and chip decomposition.

However, as noted in the EBH EIS: Another study reviewed actual thinning practices and resulting wildfire damage from 12 wildfires in California (North and Hurteau 2011). A key finding of this study was that the subsequent loss of trees in the untreated areas after the fire was out generated a greater loss of carbon to the atmosphere than the initial thinning practices and wildfire damage in the treated areas. Specifically, untreated sites averaged only 7.8 megagrams of carbon per hectare (Mg C/ha, equivalent to 3.2 metric tons per acre) left in live trees while treated sites averaged 100.5 Mg C/ha (40.7 Mt/acre) in live trees. In addition, 70% of the remaining total ecosystem carbon in the untreated forests shifted to decomposing stocks while only 19% of the carbon shifted to decomposing stocks in the treated forests (North and Hurteau 2011).

Limitations

This was not a sampling scheme designed to achieve a particular desired standard error term – rather it was a one-day effort to help characterize what carbon is standing, and permit an estimate of losses in standing and future sequestration of atmospheric carbon in the affected forest. A general rule is that at least 30 sample points be applied to allow for robust error calculations, but for the purpose of this project the methodology employed here was deemed sufficient.

UCB-PDM
Euc and Pine stands with plot locations

Oakland USGS quad
Portions San Antonio Rancho
(V & O Peralta)
2011 orthoimagery

2015 Plots
Units
Vegetation
Coniferous forest/Plantation
Developed/Disturbed/Landscaped
Eucalyptus Forest/Plantation
Oak-Bay Woodland/Forest
Riparian Woodland
Crossingsalbers1.shp

N

400 0 400 800 1200 1600 Feet