3/15/17

Draft Forest Carbon Plan Comments
USDA Forest Service

Section 0

- Suggest clarifying definition of Forests early in the document.

Key Findings

- Where are these key findings from? The Plan? The Committee?
- First bullet regarding benefits to public and private – all other bullets are supported by Exec Summary text

Proposed Actions

- Proposed actions on pages 3-5 should match in order and # of "targets in the goals sections.
    - eg conversion easement is 3rd position in exec summary w/2 bullets, but in first position with 4 bullets on page 25
    - eg 2: meadows and reforestation are separate goals on page 27, but rolled up in exec summary
    - this is confusing. Suggest having goals consistently labeled and divided, and then also have methodologies to achieve EACH bulleted goal.
- Meadow targets don't match new meadow strategy (30k acres overall)

Section 1

- "Forests that provide for healthy watersheds and water supplies (quality, quantity, and infrastructure)."

Commented [WKL-1]: And other ecosystem services?

Section 2

- Section 2 and the Exec summary are repetitive. Recommend combining section 2 with section 6. Put goals and implementation of goals up front. Goals and implementations is the meat of the doc.
- Figure 1 - Note that this map includes chaparral wildlands - especially in Southern CA, this is what makes up a large amount of the "too frequent" fire areas. If this Plan wants to keep to only forested areas, this map may not be consistent.

Section 2.2

"Between 2003 and 2012, the US Southwest experienced a 1,266% increase in burned area compared to the period of 1973 – 1982."

- Why these dates? Makes it seem convenient.

- The increased percentage may seem to some like we're "catching up" in acreage behind burn schedule. It might be good to make a point that these fires' severity is uncharacteristic: the percent increase is in large, severe fires primarily – this is not "catching up."

Page 13

"From 2013 to 2014, there was a 300% increase in tree mortality in the Sierra Nevada due to insects and disease (885,000 dead trees to 3.3 million)."

- FS aerial survey numbers show 1.3 million in 2013 and 3.2 million in 2014 statewide for all mortality agents. This should be updated to current 2016 numbers. We have worked closely with Cal Fire on consistent numbers. The Task Force Mapping and Monitoring group should be consulted for these.
- We haven't typically provided data for 'Sierra Nevada' (outside of the high priority counties, which would be 363,000 (2013) and 1,356,000 (2014)) See bar graph for mortality increases by drought year : https://www.fs.usda.gov/Internet/FSE_MEDIA/fseprd525380.jpg and below

2010		3.1 million
2011		1.6 million
2012		1.8 million
2013		1.3 million
2014		3.2 million
2015		29 million
2016		62 million
Total		102 million

"Climate change impact modeling done in the 1990s began to predict a shift in distributions of vegetation types as climate change progressed. When comparing vegetation surveys for the Sierra Nevada region from the early 1900s to those of today, researchers are already seeing this shift occurring: vegetation is moving upslope (meaning some vegetative types are being found at higher elevations than in the past). As this shift continues, it will have significant implications for how our forests will look and function into the future. For example, with increased warming forests may be able to expand their range further upslope to areas where they could not survive previously, increasing the potential carbon pool but also potentially significantly negatively affecting water supply downstream by increasing evapotranspiration.

High-elevation tree species adapted narrowly to historical temperature ranges at those elevations will be particularly vulnerable to range contraction and extirpation. Forest management and restoration practices should be informed by the expected future changes, and should be robust over a wide range of plausible future climate change outcomes."

Commented [WKL-2]: And northward and to cooler aspects.

Commented [WKL-3]: Or species with longer times to reach maturity or reproductively maladapted to disruptions in disturbance regime. Ie, hampered ability to reproduce in quicker generations will limit the species' ability to migrate and adapt.

2.2.3

"Forest Health Impacts Associated with Insects and Disease

Historically, the most significant widespread effect on vegetation has been conifer mortality associated with bark beetles and severe moisture stress. Conifer mortality tends to increase when annual precipitation is less than about 80% of normal."

Commented [WKL-4]: Invasive species as well? These may have impacts on resiliency and ability to recover after disturbance.
Furthermore, there are new invasive pests and disease that are lowering carbon content in large portions of the state.

Commented [WKL-5]: cite

Page 16

"Vegetation management (thinning) is the most effective tool we have for reducing bark beetle-caused tree mortality. Thinning improves tree vigor, reduces a tree's susceptibility to bark beetles, and lowers the potential for severe fire. With drought projected at greater rates combined with warmer winters in a climate-altered future, the risk posed by insects, particularly native bark beetles, will likely increase if California's forests remain unhealthy and overcrowded, without treatment. Forest restoration has been demonstrated to attenuate outbreaks of bark beetles under current climate conditions and it provides the best opportunity to minimize outbreaks under a more strenuous climate."

Commented [WKL-6]: And introducing lower intensity fire

Commented [WKL-7]: What about other kinds of non-thinning treatments to deal with the threats to forested areas like oak woodland and riparian corridors from Sudden Oak Death, GSOB, and shothole borer?

Page 17

"As described earlier, despite the extensive fire suppression efforts of the last decade or two, undesired fire burn area has increased significantly since the 1980s, as has fire severity. A recent study has attributed 55% of the increase in dry fuels to human-caused climate change, resulting in an increased burn area of 4.2 million acres between 1984 and 2015.[29] While California is experiencing the nascent effects of what climate change will bring later this century, the impacts are already significant and expected to get worse. In addition to the increasing dead pool fuel stocks and ladder fuels unhealthy forests often experience, wildfire activity is also tied to earlier spring snowmelt and warmer temperatures.[30] Using low, medium, and high emissions profiles for climate change predictions, burned area in California by 2085 is estimated to increase between 36% and 74%.[31] Regardless of emissions profile, most of the forested areas in Northern California are predicted to experience a growth in burned area by 2085 of over 100% above 1975 reference levels.[32]

Commented [WKL-8]: Again, this sounds like we are gaining ground toward where we want to be, according to FRID. Qualify the statement.

Commented [WKL-9]: Why 1975? Explain why this is not convenient or why this is an "average" baseline.

Like wildfire activity overall, fire severity has been increasing over the last few decades as demonstrated in the Moonlight, Chips, King, and Rim fires, for example."

Commented [WKL-10]: These are focused on Northern CA. Soberanes, Rough, Cedar, Station Fire are all larger than some mentioned here and from what I understand pretty intense.

Page 19

"A primary goal of the Forest Carbon Plan is to transfer carbon stocks from many small, fire-vulnerable trees into climate-resilient large trees."

Commented [WKL-11]: Might be good to clarify, because large trees aren't necessarily more resilient to insect outbreak

Page 24

"California's overarching climate goals for forests are to (a) secure them as resilient net sinks of carbon; minimize the GHG and black carbon emissions associated with management activities and wildfire events; and (c) employ management actions that deliver a full suite of ecosystem benefits to confer forest health. These goals will continue to complement broader, ambitious climate goals and support existing natural resources policies."

Commented [WKL-12]: Disturbance events. Includes insect outbreak and other disturbance agents, correct?

Section 3

- Recommend numbering each bulleted target so that they can be referred to in future sections, most notably the implementation and monitoring sections. Goal structure should be mirrored in exec summary, implementation, and monitoring sections.

Page 30-31, Section 3.2.3

3.2.3 Restore Ecosystem Health of Wildfire- and Pest-Impacted Areas through Reforestation

Commented [BE-F13]: Need to use consistent sources of data over similar timeframes. This paragraph also moves between NFS lands and all lands. Current version gets confusing to the reader and additional stats seem unnecessary for the goals and targets section.

"~~During the last decade, it is estimated that nearly 2.3 million acres of National Forest System Lands (or 4 million acres across all ownerships) have been affected by wildfire. Nearly 700,000 acres of these National Forest System Lands are classified as deforested, creating over 500,000 acres of planting need. Progress has been made to reestablish new forests, yet, given the effects of each year's new fires, over 270,000 acres of planned reforestation treatments remain as plans and have not been implemented.77 The 2010 FRAP Assessment report estimated 2.35 million acres are high priority for restoring wildfire impacted areas statewide. In addition, the acreage affected by the current mortality event, currently estimated at 7.7 million acres statewide, may be added to the deforested total.79.~~

The reestablishment of forests, for a variety of important natural and social reasons, will offer important ecosystem services. In order to make a significant reduction in USDA Forest Service Region 5 reforestation needs, an equally significant investment of human and financial resources will be needed. While natural regeneration will contribute to the solution, planting of desired tree species will also be needed. Progress has been made to reestablish new forests, yet, given the effects of new fires each year, over 270,000 acres of planned reforestation treatments remain as plans and have not been implemented. Both sources of seedlings will need fuel and competing vegetation reductions to increase the likelihood of success. Periodic future treatments, where allowed, can be implemented to facilitate a trend to create forest structures and compositions that will be resilient to the stressors anticipated in coming decades. Meeting the following ~~targets~~ USDA Forest Service goals and targets for nonfederal lands will address the situation:

- Eliminate the current USDA Forest Service Region 5 Reforestation Need balance by 2020 and sustain future treatments at levels where annual additions are matched by treatments. Maintain seed collection, storage, and seedling production capacities to meet anticipated needs. Identify suitable seed collection areas and maintain existing seed orchards, to support future needs. Utilize genetically improved planting stock, while matching seedling source to anticipated climates.
- On nonfederal lands, increase annual area reforested by 25% over the current level by 2030. To achieve this goal, continue to work cooperatively with the Natural Resource Conservation Service, USDA Forest Service, Forest Landowners of California, reforestation seedling growers, and other partners to increase funding for reforestation assistance on non-industrial private forest lands and the availability of appropriate seedlings for planting.

Commented [BE-F14]: What is the current level? To be consistent with the USFS goal, it would be useful to know the acres.

Note that there is another citation in the appendix citing need on 400,000 acres. Need to reconcile this figure so that it is consistent or explained with what is stated in this section."

Section 4

- This section should be the biggest section, yet it is the smallest. Elaboration of the goals and How to achieve the goals is the most important added value of this document. As it is presented now, the Forest Carbon Plan is more a Forest Carbon Science Synthesis and Forest Carbon Status Report. The goals are very nicely crafted and organized, but very little is said on how to achieve them other than "regionalization". Would recommend at a minimum listing potential resources for each Goal: mechanisms, strategies, opportunities, programs, partnerships of how to implement EACH goal including EACH bulleted goal in Section 3. This will provide a menu of options to the regions to develop specific implementation plans for themselves. Otherwise very little guidance is provided.
- The funding sources of Reforestation box is a good start.
- Could also list current status related specifically to each goal – ie what is the current rate of reforestation, need gap and where did that data come from, why does that gap exist? Then how can we address filling that gap, what resources partners? What are barriers to bridging that gap and how can we measure success in achieving this goal (section 5).

Page 35, Section 4

- Note Tables are referred to in this section, yet they are not tables, could these be included as "Box" numbers also. This is confusing to the reader when searching for an associated Table. Table 3 and 4 are examples.
- Suggest below additions for factors guiding regional prioritization:
    - Opportunities to increase jobs and other community benefits
    - Areas to employ climate smart forest management strategies

Page 36, Section 4.1.1

- Table 3 reference is below, not above as stated in Plan.
- Table 3 – Recommend adding in Western Klamath Restoration Partnership in the Cohesive Strategy Projects examples. This project includes a strong involvement from the tribes and incorporates TEK. It is important to get this kind of collaborative noted. The USDA Forest Service and the Karuk Tribe are involved with a number of other partners.
- Any SoCal initiatives to list?
- Table 3 – Define NDRC, National Disaster Resiliency Competition
- Recommend including more information be included on Farm Bill tools. Good Neighbor Authority is included in this section, but not the other important tools that help us implement the Plan. Based on the number of public comments received thus far on implementation, recommend adding information on insect and disease designations, expedited NEPA opportunities for EAs and EISs and 3,000-acre CEs. Some of this is in other sections, but it is hard to find and is noteworthy for implementation of FCP goals.

Page 37, Section 4.1.2

- Use USDA Forest Service instead of U.S. Forest Service to be consistent.
- Table 4 – Are all the items under CAL FIRE, CAL FIRE led programs. May be worth double checking.
- Table 4 – Define NRCS earlier. It is spelled out later in the box.

Page 41, Section 4.2.2

- It does not seem like Section 4.2.2 fits under regulatory opportunities. If so, recommend explaining the connection in the text of the Plan.

Section 5

- Measuring progress should be against defined goals or vision statement and presented clearly against each goal/vision. Many of the goals have acreage or % targets that can be connected more explicitly than presented. These can and should be measured as part of a monitoring strategy of this Plan.

Page 46, Section 5.1.2

"The USDA Forest Service reports forest management and restoration activities through regional and national databases."

Section 6

Section 6.2

- This section seems to talk about disturbance factors to CA forests. If so, consider adding a short section on Fire and Forests to discuss a base level of needed and natural fire and how to distinguish that from catastrophic fire.

Page 50, Section 6.2.1

- Difficult to see the connection between the Section title, Ownership Patterns, and illegal marijuana production. The tie to forest carbon needs to be made. The same is true for forest conversion to vineyards. Need a citation here and additional text to explain relevance. These sentences seem out of place here.

Page 53, Section 6.2.2

- It would seem that this section has two goals: 1) to illustrate that climate driven species shift will affect the long term carbon stability and carbon productivity (sink vs source) of CA's forests. 2) Convey the role of CC in the increasing drought/fire regimes.
- Would be good to more explicitly draw forest plan goal relevant conclusions from each section rather than have them be compilations of carbon related statistics and research.

"Climate is a primary driver of the dynamics of forest and range ecosystems, especially the type, species, and productivity (including rates of carbon sequestration) of species. Future climate change scenarios predict increases in temperature, increases in atmospheric carbon dioxide concentrations and changes in the amount, form, and distribution of precipitation.[115] Altering these fundamental climate variables will result in changes in tree growth, in the range and distribution of species, and in disturbance regimes (e.g., wildfires, outbreaks of pests, invasive species). Relatively small changes in temperature and precipitation can affect reforestation success, growth, susceptibility to pests, and forest productivity. However, restoring forests to ~~healthier and~~ more resilient conditions will reduce their vulnerability to these changes."

Page 54-56, Section 6.2.3

- Would be good to link pests and diseases to how they affect forest carbon, the forest carbon plan and the forest carbon plan goals and implementation strategies.

"Some insects and diseases are found at varying levels throughout California while others are found predominantly in specific regions of the state. Table 9 lists the major pests in the state.

~~To recap from above, P~~per the USDA Forest Service's National Insect and Disease Forest Risk Assessment, 2013-2027124 , California is at risk of losing at least 25 percent of standing live forest due to insects and disease, over 5.7 million acres, or 12 percent, of the total forested area in the state.

Sudden oak death, a disease caused by the non-native *Phytophthora ramorum*, has been found in California since the mid-1990s. It has a host range of over 100 ~~one hundred~~ species but is most damaging and deadly to tanoaks and true oaks.

There is usually a lag time between drought years and tree mortality, and the recent sharp rise in mortality reflects the cumulative impacts of the past four years of drought. Field data from the USDA Forest Service State and Private Forestry Aerial Detection Surveys in 2016 show elevated tree mortality associated with bark beetles primarily in the southern Sierra Nevada and in southern California mountains131132. As shown in Figure 7, tree mortality has also increased significantly in the northern Sierra Nevada from 2015 to 2016. High-level statistics from the ~~Forest Service~~ Aerial Detection Survey underscore the extent of the recent die-off:

- At least 102 million dead trees are associated with severe drought (see Figure 7), bark beetles, warmer temperatures change, based on 2010 to August 2016 surveys.
- From 2015 to August 2016 alone, 62 million trees have died, not including trees that died in fires, such as the Soberanes Fire.
- 7.7 million acres (2016) with some level of drought related tree mortality were mapped in California, starkly higher compared to about 871,220 acres in 2014. "

Commented [BE-F15]: Recommend using info from the attached talking points related to tree mortality. These are more current figures and are easy to understand. Recommend edits to first sentence of Box 5 to reflect the current figures.

Page 61:

"Repetition and maintenance of that fuels treatment is necessary to maintain the reduced fire risk."

Commented [WKL-16]: Or managed wildfire

Page 62, Section 6.3.1

"The carbon contained in a forest represents the accumulated carbon dioxide uptake and carbon sequestration in woody tissues and soils. The difference in the amount of biomass contained in a forest between two points in time represents the overall change in in-forest carbon stocks resulting from growth, mortality, harvest or other disturbances over time.

In this report, we rely primarily on FIA data for forest carbon statistics. These statistics have limitations, in that much of the FIA-based data available for analysis at this time does not fully reflect dramatic forest changes witnessed in recent years, in particular in the Sierra Nevada and Cascades. Uncharacteristic large, severe wildfire and unprecedented tree mortality has occurred during this period, resulting in significant changes that will not be fully reflected in the FIA data for a number of years, given the ten-year collection cycle currently in place.

As detailed below, data from the FIA Program was used to evaluate changes in biomass on private, state, and local ownership between 1991 and 1994 and 2007 and 2010, finding a net gain of 1.7 million metric tons (MMT) carbon per year.157 Similar data was used to evaluate National Forest System Lands between 2001 and 2006, and between 2007 and 2010, finding a net gain of 0.89 MMT carbon per year.

Although a net gain was shown, it should be noted that much of the data used for this evaluation were collected before California's current elevated tree mortality episode began, and recent research suggests that, during the drought, forest carbon stocks are destabilized, and that drought induced beetle mortality can transfer large portions of live above-ground carbon into the dead biomass pool that then serves as a protracted emission source due to decay158.

The following information on carbon storage in forests is based primarily on FIA Program data for California, which is collected by the FIA Program. Sources and methods meet Intergovernmental Panel on Climate Change (IPCC) guidelines for GHG inventory, and FIA Program products are used to fulfill federal national and international reporting obligations. This section provides summaries of estimates for carbon stocks in above- and below-ground carbon pools. Estimates for above-ground forest carbon include live trees, understory vegetation, down woody material and standing dead trees. Below-ground carbon pools include live and dead roots, and soil organic carbon. Carbon contained in wood products is also presented, based on results from McIver et al. (2015) and others.159

ARB also conducts periodic forest carbon accounting, using a mix of information resources including FIA data to inform its Natural and Working Lands Inventory. One way in which the ARB method differs from FIA data is that it also seeks to account for land carbon stocks and stock-change for nearly ~~forty~~ 40 IPCC reporting categories associated with forests and other lands, as well as emissions of GHG and black carbon from disturbance events. This approach provides additional information that is not captured as a part of the stock-based FIA approach that is relied upon on this section. ~~In this way,~~ An FIA-only inventory focuses on ~~is more concerned with~~ forest conditions, growth, and mortality and ~~if~~ forest carbon ~~is~~ gain~~ed or~~ and los~~t~~, while the ARB approach ~~is also interested~~ in~~cludes~~ *how* ~~it was~~carbon is gained or lost, which affects air quality and emission rates for GHGs, black carbon, and the exchange of carbon with the atmosphere (see Figures 9 and 10). Further discussion of various forest carbon inventory approaches are discussed in Appendix 1."

Page 64

"In the 2016 Legislative session, Senate Bill 859 (Dahle, Chapter 368, Statutes of 2016)160 was passed and signed into law. SB 859 directs ARB, in consultation with CNRA and CAL FIRE, to complete a standardized GHG inventory for natural and working lands, including forestlands, by the end of 2018. The bill also requires the state to provide a business-as-usual projection of emissions and carbon sequestration. While the Forest Carbon Plan uses the ~~Forest Inventory and Analysis~~FIA stock change data as its major information source on forest carbon, when completed, the new ARB-led inventory will serve as a useful data source going forward since it will address stocks, stock-change with attribution by process, and emissions.

Overall Carbon Inventory Statistics

~~California forest lands store and sequester carbon in above and below ground carbon pools.~~
According to data from the FIA Program covering 2005-2014161, California forests have substantial carbon storage of 1.29 billion MT carbon above ground and 873 MMT of carbon below ground

Commented [BE-F17]: No table below.

Commented [BE-F18]: Not sure if this is helpful when looking/comparing over 2 time periods. Recommend explaining or comparing similar timeframes of data.

Commented [BE-F19]: Already stated.

Commented [BE-F20]: This paragraph should be moved up to paragraph #2 if retained.

Commented [BE-F21]: Would help to briefly explain why FIA is used when ARB approach appears to offer more in the way this section is currently written.

(Table 8 and Figure 11), while sequestering 2.6 MMT carbon per year among private and public lands. See Appendix 1 for additional information on FIA Program data by ecological regions.

Table 8. Above- and Below- Ground Forest Carbon, 2014 (excludes harvested wood products; units in 1,000 metric tons of Carbon)."

Page 66, 6.3.2

- Round off the tons per acre figures used.

Page 66-69, 6.3.3

"The redwood and Douglas-fir forests concentrated in the North Coast and Klamath interior coast range ecoregions contain the highest forest carbon densities in the state (Figure 13). Redwood trees, compared to other large conifers, are largely resistant to native insects and diseases allowing them to be reliable and secure places for long-term carbon storage. The Sierra-Cascades ecoregion contains several large conifer species, which include ponderosa pine, sugar pine, Douglas-fir, incense cedar, white fir and giant sequoia. This region also contains one of the largest reserves of carbon in California forests~~., but~~ However, as detailed earlier, ~~is susceptible to several native insects and diseases such as the mountain pine beetle, fir engraver, white pine blister rust and dwarf mistletoe~~

~~, particularly where fire has been suppressed from the forests for decades. As detailed earlier, over the past several years,~~ drought stress combined with unhealthy forest conditions and bark beetles has killed millions of trees in the southern Sierra Nevada. These areas and other areas in the region that have been devastated by high severity fire are at strong risk to type-convert, where conditions are such that the forest may not be able to regrow and instead shrub or grassland would result. Conversion to shrub or grassland would have a significant impact on California's future carbon storage, since these land types contain 10% or less carbon per acre than forested acres.164 The forests and woodlands of the Central and South Coast Regions, which are comprised of several oak species such as coast live oak and blue oak along with smaller and shorter lived conifers such as Monterey pine, bishop pine and knob cone pine, generally contain lower forest carbon density than the Sierra. These pine species tend to have shorter lifespans than those in the Sierra and have adapted to higher severity stand replacement fire with serotinous cones. Some longer-living conifer species (e.g., redwood and Douglas-fir) are also present in this area in smaller numbers~~ as well~~. Further regional inventory information can be found in Table 9.

Regional variation in the state's forests is discussed in more depth in Appendix 3, "Regional Assessments."

Figure 13. Total forest carbon density for California (2000 to 2009) from FIA.

Table 9. Above and Below Ground Forest Carbon by Region, 2014 *(units = 1,000 metric tons of carbon)."*

Page 69-70

- Pages 69 and 70 incorrectly state: "McIver et al. (2015) estimated that 2.4 million metric tons of carbon was processed… in California in 2012." Table 10 and Figure 14 also attribute carbon masses to McIver et al. The McIver et al. 2015 publication does not report masses of carbon; it

Commented [BE-F22]: Confusing because this is not explained in the table this way.

Commented [BE-F23]: Text says 2005-2014

Commented [BE-F24]: The data used previously is from 2005-2014. The timeframes of the data sets used are not consistent throughout the document. Can the same timeframes be used? If not, may be worth explaining in the text.

Commented [BE-F25]: This table would be more useful if it was closer to Table 8 in the Plan so reader can easily compare related information.

reports board foot Scribner volumes of timber and cubic volumes of wood and bark. The conversions of those cubic volumes to metric tons of carbon were done by the authors of the Forest Carbon Plan or others – not by McIver et al. Please correct the way in which McIver et al. 2015 is cited, saying something like: "masses of carbon were derived from McIver et al. 2015."

- The Carbon Plan authors need to clearly explain how the masses of carbon were derived from the wood volumes and cite sources for the conversions (e.g., tons of carbon per million cubic feet [MMCF] of wood) that were used.
- It is suggested that Table 10 and Figure 14 be removed or replaced with a figure or table that more accurately accounts for the wood (excluding bark) harvested to make solid wood products, including lumber, veneer, posts and poles. The amount of that wood that became solid products and the mill residuals used for other products including composite board products should be indicated. Bark should be dealt with separately. We are willing to work with the Carbon Plan authors on these edits. See attached figure.
- For example, over 61% (149.6 of 243.7 MMCF) of wood volume harvested and delivered to sawmills, veneer plants, and other solid wood facilities ended up in finished GREEN lumber, veneer, posts, poles, and fiberboard products during 2012. The remaining wood material (mill residual) was used for a combination of internal energy, off-site biomass energy, landscaping/mulch, animal bedding, and other uses. Bark was used for on- and off-site biomass energy and landscaping/mulch material.
- Wood harvested specifically for biomass energy should be kept separate – similar to how the information is portrayed in Figure 6 (page 24) of McIver et al. 2015. Wood delivered to California's biomass energy sector from the forest largely came from logging slash, i.e. small or dead trees, tree limbs, tops, and otherwise unmerchantable parts of trees. Trees or logs suitable to make lumber, veneer, or other (higher value) products are rarely if ever used to make (lower value) biomass energy. The biomass energy sector is a major user of mill residuals (including bark), as indicated in McIver et al. 2015.
- Attributing carbon mass to "shrinkage," which is the loss of volume during the lumber drying process, incorrectly shows up as 29,484 metric tons of carbon in table 10 and figure 14. The water removed from wood during lumber drying does not contain carbon, and thus should not be represented in the carbon accounting of the harvest. The shrinkage volume should either be removed from the top line (bole wood into sawmills) or added to the bottom line (finished lumber) if attempting to account for carbon.
- Tables 10 and 11 appear to be reported in metric tons, but tables 9, 12, and 13 are reported in thousand metric tons. Keeping these tables in the same units (order of magnitude) would make direct comparisons of harvested carbon to stocks, growth, mortality, and removals much easier for readers. Elsewhere in the report metric tons of CO_2e (equivalent) are used, and in some places tons of carbon are used. More consistency on these units of measure throughout the report would be helpful.
- Are the "Growth" columns in tables 12 & 13 gross growth or net growth, is this live trees, growing stock trees, or what population of trees? Indicating where (page or table #) in the source document this information came from would be helpful, as would indicating if any manipulation/calculation was performed on the source information.
- Section 6.3.5 seems to use carbon (mass) and biomass interchangeably. Do Tables 12 & 13 represent (green or dry) biomass or do they represent masses of carbon? What was actually

reported in Christensen et al. 2016 – biomass, carbon, or cubic volume? Was some sort of conversion done from biomass to carbon? What was that conversion?

- Do the carbon masses reported in tables 9, 11, 12 & 13 include bark? The information in Table 10 and figure 14 should be modified to represent wood-only, excluding bark. We can provide the Carbon Plan authors with the wood-only portions of harvest, products, and mill residues

Commented [KJM-26]: You will note that these comments are duplicative of the comments sent by Todd Morgan and Chelsea McIvers, the contractors who completed the research under FS research supervision.

We will gladly work with Todd and Chelsea to help make more appropriate statements about the end uses of harvested wood

Page 71, 6.3.4

- There is a lot of data and trends on wood products here, but it could benefit from a connection back to the Forest Carbon Plan, the Forest Carbon Plan Goals, and Implementation. It reads now like a science data dump, but the narrative is not structured to be tied or analyzed in the context of the Forest Carbon Plan specifically.

"Timber harvesting has been on the decline since the mid-1980s. McIver et al. (2015), estimated that timber harvesting in California was 1.4 billion board feet in 2012, and this represents a decline of 18 percent from 2006 (1.5 billion board feet) and a 36 percent decline from 2000 (1.9 billion board feet).169 During 2012, 83 percent of harvesting occurred on private timberlands, 14 percent on USDA Forest Service managed lands and three percent associated with other public lands. Nearly all of the wood from timber harvested was processed in California (i.e., 97 percent). The most recent data from the State Board of Equalization show that 1.591 billion board feet of timber was harvested in 2015, with 12.9 % of the harvest volume from public lands and the remaining amount from private lands.

Commented [BE-F27]: Recommend rounding on these types of numbers throughout the plan for easier reading. Provided some examples in comments and can provide additional locations for these types of edits if requested.

Commented [BE-F28]: Too many values from various sources from different years. The reader has to determine what stats are useful and relevant. Not all of the stats are needed here.

Commented [BE-F29]: Can the connection be made here between recent 2015 data and past years?

Discarded wood products decay over time back to the atmosphere, the process of which is dependent on the manner of disposal. In anaerobic environments, wood decay ceases after several decades, leaving a remainder carbon fraction that persists in solid form indefinitely. Using national and state mill efficiencies, wood product lifetimes and factors governing the fate of discarded wood products reported by Smith et al. (2006) and by Stewart and Nakamura (2012), respectively, Saah et al. estimated carbon losses to the atmosphere associated with each year's wood product cohort from 2001 to 2010, over 100-year timeframes (Table 11). Based on national factors, it was estimated that after 100 years, approximately 65 percent of wood product carbon would eventually be returned to the atmosphere. Using state-specific factors, the estimate was 61 percent. Using this approach, we estimate the ten-year average wood products in storage from 2001 to 2010 to range between 0.304 and 0.337 million metric tons of carbon per year. Long-term storage estimates from harvest activities on public lands ranges from 0.030 to 0.033 million metric tons of carbon per year, while private lands estimates range from 0.274 to 0.304 million metric tons of carbon per year from private land harvest activities."

Commented [BE-F30]: Explanation of the difference between these two sources is needed to show why they are both included in the Plan.

Commented [BE-F31]: For CA?

Commented [BE-F32]: Define who "we" is.

Commented [BE-F33]: Does not appear to be the best way to report this. Info can be rounded and in different units to match table or use same units throughout entire document.

Page 72, 6.3.5

"Using data from FIA Program reports, changes in biomass on private, state, and local ownership were evaluated between 1991 and 1994 and 2007 and 2010.171 And USDA Forest Service managed lands were evaluated between 2001 and 2006 and 2007 and 2010.

Tables 12 and 13 present the net change in biomass volume over time, by ownership category. The change in biomass volume on any given forested acre is a function of the gains from growth on live trees minus the losses from mortality and harvest. The net increase in live tree carbon stocks from the early 1990s to the late 2000s for private, state and local lands was estimated at 1.7 MMT carbon per year (Table 12)172. For federal forestlands, the net increase in carbon stocks for the decade starting in 2001 was 0.9 million metric tons of carbon per year (Table 13). In comparing rates of sequestration between

Commented [BE-F34]: Table is not in the same unit for metric tons of C. It is confusing to go between MMT and thousand MT of carbon per year in text and tables. Recommend consistency so reader can easily follow text and associated tables.

Commented [BE-F35]: Explanation of different in dates for different ownership needed. Why the difference between early 1990s and early 2000s. Can these different date ranges still be compared?

Commented [BE-F36]: Recommend consistency in reporting MMT in one description and million metric tons in another.

nonfederal and federal forestlands, note that while nonfederal sequestration rates were 1.9 times those of federal lands, the area of nonfederal forestlands is just 73% the area of federal forestlands. Factors contributing to this difference include the relatively higher growing capacity of much of the nonfederal lands and the different management ~~behavior~~ of these two broad ownership classes. For the time periods in these analyses, growth exceeded mortality and removal for all ownerships except for USDA Forest Service reserved lands. On reserved lands mortality outpaced growth, a pattern that is consistent with more recent FIA Program inventories, which indicates that, although the difference was small, these lands were net sources of GHGs to the atmosphere. Combined, the net change in in-forest carbon stocks was estimated at 2.6 million metric tons of carbon per year across all forest lands (excluding wood products)."

Commented [BE-F37]: See previous comment.

Commented [BE-F38]: Citation needed.

Commented [BE-F39]: See previous comment on unit description. Recommend review of entire Plan for this.

Page 75, 6.5

- The discussion of the presented FIA data and analysis would be interesting to focus on how this dis-aggregation of change analysis by ownership/land type affects the Forest Carbon Plan Goals and Implementation – does this mean that the goals can be focused on certain types of lands or species compositions? How does this change the (non-elaborated) strategies and mechanisms on how to achieve those goals?

"Based on FIA Program data, tree mortality from forest health-related causes results in substantial declines in forest carbon. Tree mortality rates appear to be highest on federal forest lands in reserve (e.g., wilderness) lands, where mortality is slightly outpacing growth."

Page 75, 6.6

Forest fragmentation through urbanization, conversion for agriculture, or other large scale or cumulative small-scale land use changes can negatively impact forest health. Isolated and disconnected forest stands often have less diversity and resilience to changing conditions.

Commented [BE-F40]: Include explanation of how this is connected or affects forest carbon. This same explanation is needed in 6.6.1 on WUI.

Commented [KJM-41R40]: Assume this is related to the goal 3.1 but not explicit. Also seems to be at odds with text on page 49 "extent of forestland has remained stable"

6.6.1

- How does this WUI analysis affect the Forest Carbon Plan? Which goals can working in the WUI accomplish most effectively? What challenges to FCP goals does the WUI present in a unique way?
- If all this discussion and science synthesis about various aspects of forest management are brought in here, they need to address how they relate not only to forest carbon, but specifically the forest carbon plan, its goals and implementation.

Page 78-79, 6.6.2

- This section needs some citations to support the information included. Are there any citations that can be added?

"Diminished stream flow as a consequence of this activity adversely impacts state and federally listed salmon and steelhead as well as amphibians and other sensitive species. Grow sites themselves can become dumping grounds for trash and human waste, severely degrading habitat. The sites can pose significant risks to human safety, as people ~~: hikers, hunters, and anglers~~ may stumble upon armed growers and other defenses.

The 2015-16 budget bill provided an additional $7.7 million to expand these efforts. Further, the passage of Proposition 64 in the November 2016 election will provide additional resources to clean up abandoned sites, and the potential price depression as a result of legal marijuana provision could potentially contribute to a significant reduction in illegal forest-based grow sites. "

Commented [BE-F42]: Seems like speculation unless there is a source to cite here. Recommend deletion unless there is a citation for this information.

Section 7

- This section seems like an afterthought, it is not integrated into the larger document. Understanding the differences between urban forests and wildland forests in CA, it seems odd that the goals are not all together. Suggest moving urban forestry goals to last section of wildand forest goals and urban forestry context to a new section 6.8 with other forest contexts

Section 7.3

- I would love to see these suggested management actions for the wildland forests, expounded on resources/tools/partners to achieve, and further organized by which goal they primarily assist to accomplish.

Section 8

Page 87, 8.0

- This section is not consistent in describing the various co-benefits. Recommend presenting the same type of information under each sub-section/co-benefit described. Some sub-sections just describe the co-benefit, while others describe the effects to the co-benefit from severe wildfire. All of the co-benefits would be affected by severe wildfire or other lack of management. Recommend describing this upfront in the introduction and deleting the detailed descriptions of how the co-benefit could be affected. This could really help shorten up this section and focus on the co-benefit, rather than the long descriptions of the effects of severe fire, which have already been detailed multiple other places throughout the document.
- The discussion and note that carbon is one of many benefits is important, but this is not a state forest action plan. A forest carbon plan so should remain focused on that. Would recommend to keep the opening and closing sections of this and deleting the rest. Alternatively one could also highlight the main forest co-benefits in a brief description, with a discussion on any targeted areas where forest carbon, the FCP and goals, is or can be perceived at odds with other co-benefits (air quality), and how to approach that balancing.

Page 88, 8.1.1

"Uncharacteristically large and severe wildfires can, likewise, negatively affect access and support. Forests impacted by high severity events, such as wildfire or insect outbreaks, can be dangerous for recreation as falling trees are a hazard. These conditions can close trails and campgrounds for extended periods. Similarly, recreational demand can significantly decline if most of the canopy has been removed. Smoke impacts on recreational activities were common during the King Fire, with an Ironman Triathlon in the Lake Tahoe area canceled due to health concerns.[217] More research needs to be done on how megafires impact tourist decisions, both to specific areas near the fire and the state as a whole."

Commented [BE-F43]: A citation to support this statement is needed. Region 5 has not stated that this is known on NFS lands. Need to check to make sure there is science or surveys to support this statement.

Page 88-89, 8.1.2

"It is important to landowners and local communities that markets for this woody biomass be developed to help defray the costs associated with forest restoration ~~done for carbon and/or wildfire protection,~~ or ~~with the purpose of~~ for any other co-benefit listed in this section.

The market for this product is being developed, but it holds some promise – and numerous co-benefits in its own application – for rural communities and for the state of California as a whole. "

Commented [BE-F44]: And many others….

Commented [BE-F45]: Please clarify.

Page 90, Box 8

- Acronyms need to be spelled out, use same units as throughout the rest of Plan, and edit added numbers in first sentence.

Page 96, 8.5

~~The absence of management is not a regulatory mandate, but is rather a result of insufficient budgets or a preference on the part of managers to avoid potential negative effects or legal challenges. The result of this is an absence of positive effects, as well as the unintended loss of many of the resources the regulations aim to protect.~~

Commented [BE-F46]: Recommend deletion.

Page 97

- the botanical names in the sidebar on pg 97 should be italicized

Page 99, 8.7

- Recommend reorganizing paragraphs in this section so introduction and description paragraphs are together and upfront and then the resilience and importance of this go next. As it, the information flips back and forth.

Formatted: Font: 11 pt, No underline

"Between 1985 and 1999, the annual cost for federal firefighting exceeded $600 million only twice. Between 2012 and 2015, federal agencies spent no less than $1.6 billion each year on firefighting. In 2015, costs surpassed $2 billion for the first time.[270] The USDA Forest Service, which accounts for about 70 percent of these federal costs, spent 16 percent of its 1995 appropriated budget on firefighting; in 2015, firefighting accounted for more than 50 percent.[271] Fire suppression has increasingly come at the expense of other programs, including fuel and vegetation management and forest restoration due to fire borrowing (See Section 4.1.2)."

Page 100-101, 8.8

"The approach and co-benefits outlined here describe generalized forest ~~needs and~~ benefits as a whole; more specific details on approaches in each region can be found in the regional section in this document.

There is often a time lag between forest management actions and their effects on net carbon storage. Not only does the living forest system require time to adjust and stabilize following dramatic disturbance (often up to five years), but carbon benefits of forest management actions can be years, and even decades, in the making. "

Commented [BE-F47]: Cite.

Page 103-106, 9.0

- Recommend referring back to previous sections in the Plan in this section where information/citations are exactly the same as already referenced. The duplicative information lengthens the Plan and gets confusing because the reader has to look back at similar information

already read to see if it is in fact the same. Six paragraphs in this section can be edited/deleted and referenced instead. Specifics can be shared if needed.

Section 9

- Suggest reorganizing this section to be the implementation text for bulleted goals associated with Goal 3.3 (Biomass). Some of this is background which is similar to above CA forest Context comments on questioning the relevance in a Forest Carbon Plan vs Forest Science Synthesis, but, there are much stronger recommendations for certain partners or resources in this section than others, which seem appropriate for implementation.

9.2 and 9.3

- information on woody biomass should be referred to in co-benefits section so reader easily knows where to turn for more information.

Page 106

"Extracting low-value biomass from the forest through thinning and fuel reduction projects promotes growth of higher-value, larger and more fire-resistant trees~~, which also tend to provide more wildlife benefits~~."

Commented [BE-F48]: Recommend adding in relation to forest carbon.

Section 10

- I think this section can be integrated into the implementation section. Many of the things listed here are tools or enabling factors towards achieving specific goals outlined. Recommend making those connections explicit with goals as defined.
- Recommend adding:
    - Change how Forest service fire suppression is funded

Page 114, 10.1

- Fire MOU is not state legislation or regulation so seems out of place in this section. This MOU is referenced elsewhere in the document already and can be added to if needed with the information presented here.

- Section 10.2 bullet on SB 859 is a repeat. Suggest shortening to 1 sentence and referencing elsewhere in document.

Section 11

- This should be organized by the same structure as the goals so it can easily be cross referenced.
- Suggest also having a section on barriers and challenges to implementing the goals of the Forest Carbon Plan as defined. They are sprinkled throughout in context sections, but not explicitly linked to the plan and the activities it proposes, which are not well defined themselves (Implementation).

11.2

"Better information on genetic and species selection of tree planting stock that can best thrive and be most productive (carbon) under changing climate conditions."

11.4

- Develop a better understanding of what a baseline amount of fire and carbon emissions that is associated with health forests is

11.5

- Develop public education/outreach tools on the benefits of forest carbon and how they relate to management treatments, forest restoration, and climate change.