

9/24/2018

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From: Madhu Khanna, Robert Abt, Dan Schrag, Ken Skog¹

Sent via email to carpenter.thomas@epa.gov

RE: Science Advisory Board (SAB) 8-29-18 Draft Report for Quality Review

We are members of the Biogenic Carbon Emissions Accounting Panel of the Science Advisory Board (SAB) that were appointed to review EPA's proposed *Frameworks for Assessing Biogenic CO₂ Emissions from Stationary Sources* in 2011 and 2014. The Panel wrote and unanimously approved a Panel Advisory Report that reviewed the 2014 Framework. The Chartered SAB did not approve the Panel's report and has developed its own version—the SAB Draft Report for Quality Review that we are discussing today. The SAB Draft Report introduces modifications to the Panel's Advisory Report by inserting text and excluding sections and figures without clearly demarcating their changes and attributing the portions carried over from the Panel's report. Most importantly, the SAB has modified key recommendations of the Panel. **The current SAB draft report is from the SAB, not the Panel, and it does NOT represent the views of the 18 biogenic emissions experts on the Panel. As a result, we, members of the Panel, do not agree with the recommendations and do not approve of the current draft report.** Below, we discuss our specific concerns.

I. CONCERNS WITH THE PROCESS

The SAB convened and reconvened a panel of scientists to evaluate EPA's proposed biogenic carbon emissions accounting framework. The Biogenic Carbon Emissions Accounting Panel (referred to as the "Panel" throughout this document) was created because the SAB did not have the required scientific expertise to review the framework proposed by EPA on this topic.² The resulting Panel included scientific experts in agronomy, silviculture, forestry, soil science, greenhouse gas (GHG) inventories and carbon accounting, engineering, economics, climate science, carbon cycle science, and policy design. See Table 1 for the list of panelists.

¹ The following Panel members provided helpful comments and suggestions in the drafting of this memorandum: Steven Rose, Jason Hill and Tristram West. However, the Panel members formally transmitting this memorandum are responsible for its content and communication.

² EPA SAB Office letter October 3, 2011 forming the SAB Biogenic Carbon Emissions Panel, <https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebProjectsCurrentBOARD/3235dac747c16fe985257da90053f252!OpenDocument&TableRow=2.1#2>.

Table 1. Biogenic Carbon Emissions Panel Convened by the SAB

CHAIR – Dr. Madhu Khanna, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign

PANEL MEMBERS

Dr. Robert Abt, Department of Forestry and Environmental Resources, North Carolina State University
Dr. Morton Barlaz, Civil, Construction, and Environmental Engineering, North Carolina State University
Dr. Marilyn Buford, Silviculture Research, USDA Forest Service
Dr. Richard Birdsey*, Climate, Fire, and Carbon Cycle Sciences, USDA Forest Service
Dr. Mark Harmon, College of Forestry, Oregon State University
Dr. Jason Hill, College of Food, Agricultural and Natural Resource Sciences, University of Minnesota
Dr. Stephen Kelley*, College of Natural Resources, North Carolina State University
Dr. Richard Nelson*, Kansas State University Center for Sustainable Energy
Dr. Lydia Olander*, Nicholas Institute for Environmental Policy Solutions, Duke University
Dr. John Reilly, Center for Environmental Policy Research, Massachusetts Institute of Technology
Dr. Charles Rice, Department of Agronomy, Soil Microbiology, Kansas State University
Dr. Steven Rose, Energy and Environmental Analysis, Electric Power Research Institute
Dr. Daniel Schrag, Earth and Planetary Sciences, Harvard University
Dr. Roger Sedjo, Center for Forest Economics and Policy Program, Resources for the Future
Dr. Ken Skog, Forest Products Laboratory, USDA Forest Service
Dr. Tristram West, Joint Global Change Research Institute, University of Maryland
Dr. Peter Woodbury, Department of Crop and Soil Sciences, Cornell University

* 1st Advisory panelist only

The Panel was formed in October 2011 and provided its first Advisory Report to EPA in September 2012. The Panel was then reconvened in November 2014 and provided its second Advisory Report to the SAB in March 2016 and a revised version in August 2017. Over the seven years, the Panel engaged in extensive deliberations and met over 30 times (in-person and virtually, in sub-groups and as a whole). ***The Panel provided expert consensus advice to EPA through*** two advisory reports (in 2012 and 2017) that represented the combined and unified science-based guidance from 18 scientific experts.

Unfortunately, a few SAB members disagreed with the Panel's 2017 Advisory Report to EPA and argued for changes. The Panel had made numerous revisions requested by the SAB but was not able to satisfy these few SAB members. In August 2017, the EPA disbanded the Panel and the SAB took over the process and has now developed its own advisory report to EPA. **To be absolutely clear, the current draft advisory is from the SAB, not the Panel, and it does NOT represent the views of the 18 biogenic emissions experts on the Panel.**

The SAB developed their draft advisory report by selectively deleting and replacing key sections of the Panel's guidance, which meaningfully deviate from the Panel's expert and science-based guidance. The SAB changes are not clearly delineated or discussed. In particular, the rationale for SAB changes is not explained or justified scientifically.

The SAB's disbanding of the Panel and setting aside of the Panel's guidance to EPA has significant implications that undermine the overall role of scientific peer review in informing EPA:

1. It overrides and ignores the consensus opinion of 18 scientific experts on this topic.
2. It implies either that the scientific expertise represented on the Panel is not needed to effectively advise EPA on this topic or that the SAB believes it has greater expertise on biogenic emissions than the Panel for advising EPA on this topic.
3. It undermines transparency and scientific integrity by not clearly delineating edits to the Panel's report clearly and providing a rationale for differences from the Panel's guidance.
4. It confuses the public by providing a report that is internally inconsistent and inconsistent with the findings of 18 experts on the topic. For example, the figures in the 08/29/18 Draft are based on the definition of time horizon in the Panel's report while the time horizon is now being redefined as being based on a policy horizon. **The figures in the report no longer support the text that has been overlaid on the Panel's report and this makes the current advisory technically inconsistent.**
5. And, it has broader ramifications for the integrity of science and the objectivity of the SAB for advising the agency.

What would have been more appropriate for greater transparency and scientific integrity?

- Separate SAB opinion –The SAB should have expressed its views as a separate document from the Panel's advice. The document should have explained and defended its advice and positions relative to the Panel's. Separate SAB guidance and clearly presented SAB scientific arguments would have been constructive and informative for EPA and the public, facilitating more informed discussion and decisions. The SAB's current approach of selectively editing the Panel's document without appropriate attribution lacks transparency, introduces inconsistencies and misleads the public by not fully representing their counter-opinions and its justifications separately.
- Panel review of SAB opinion – The SAB should have asked the Panel to review and respond to the SAB's advice once documented. It is scientifically troubling that the SAB chose not to return to the Panel of experts for feedback on its proposed advice to EPA, and they even went so far as to disband the Panel. While Panel members can provide individual public comments today, this is very different from asking the Panel to discuss and respond as a group of experts to the SAB advice.

A better process is needed in the future

The SAB office needs to revise its process for Panel guidance. It is flawed. If the SAB decides it is appropriate to convene a panel of experts to provide guidance to EPA (because the SAB lacks the necessary set of expertise), then this deference to a panel for scientific guidance should be extended to the advice provided by the panel. A consensus opinion from a panel of relevant experts is extremely difficult to obtain and is a significant scientific statement of great value to the public and EPA. That should not be undermined by a few SAB members who might have a different opinion. The SAB's role in a quality review of the panel advice should be to assure that the panel has addressed charge questions and supported its advice in a technically sound manner as well as clearly communicated it. The quality review should not be a way for an SAB member to "join" the panel, and even more problematic have the power to set aside the panel's consensus because a few SAB members do not like it.

II. CHOICE OF TIME HORIZON FOR CALCULATING BAF

It is essential that BAF calculations be based on science and not be a function of the policy goals of the administration in office or specific policies. BAFs should be grounded in science and not be a policy lever. BAFs should simply inform policy evaluation and policy stringency decisions and not be based on a policy horizon.

A key modification to the Panel's Report made by the SAB in its 08/29/18 Draft Report is to change the recommendation for setting the time horizon for carbon accounting calculations. The SAB Draft recommends that the BAF calculation time horizon be the policy's time horizon. The Panel's recommendation, on the other hand, is that the BAF calculation time horizon should be policy independent and based on science to account for the expected effects on terrestrial carbon stocks (negative and positive) of using a biogenic feedstock.

The 08/29/18 SAB Draft Report promotes a scientifically-flawed choice of time horizon for calculating a BAF for reasons explained below.

1. **1. A policy horizon is not science-based as demonstrated by the variation in policy horizons across several recent federal policies.** For example, the American Clean Energy and Security Act had a 2050 horizon, while the Clean Power Plan had a 2030 time horizon. And, the Clean Energy Standard Act of 2012 had a 2035 horizon, while the U.S. Nationally Determined Contribution (NDC) GHG target was for 2025.
2. If a BAF is used for several policies that are implemented concurrently and these policies differ in their horizons, then a feedstock will have different BAFs depending on the policy under which it is regulated. Instead of a unique BAF for a feedstock that accounts for all its carbon impacts, the carbon impact of the feedstock will now depend on the policy under which it is being regulated. **Regulated entities will now be able to opportunistically choose which policy applies to which feedstock leading to problems of leakage.**
3. The Panel's Report showed that the harvesting of a long rotation feedstock for bioenergy could lead to positive and negative impacts over a period of time in the future after the harvesting occurred. **Use of a policy horizon that is shorter than the time horizon over which a steady state is achieved implies that any (positive or negative) carbon impacts that occur after that policy horizon are not relevant even though we know from climate science that they will have an impact on climate (e.g., Allen et al., 2009; Matthews et al., 2009).**
4. **There is no scientific argument cited in the SAB Draft Report to justify the view that selecting the time horizon for calculating a BAF to fit a policy horizon will ensure that policy targets within the policy horizon will be met.** As noted in the Panel's report "Policy concerns about climate change should be addressed through the selection of appropriate policies and policy targets for greenhouse gas reduction. The stringency of greenhouse gas reduction policy targets should not affect the methods and time-scale used

to calculate BAFs." This statement is inconsistent with scientific understanding of how the climate system functions. GHG policies are not designed to change today's climate, or even that of the next few decades. It is well known that climate change is a longer run problem and GHG policies today will affect climate for decades and centuries well beyond the policy's time horizon. Thus, policies with climate goals need to be concerned about potential GHG implications both within and beyond the policy's time horizon.

5. Use of a policy horizon makes the BAF subject to political manipulation based on the interests of stakeholders that are affected by the choice of BAF.
6. **The 08/29/18 SAB Draft promotes a policy-based time horizon, but this is inconsistent with science-based time horizons used in other climate change metrics.** The SAB Draft contends that "Policies designed to affect change in emissions or impacts in the short term will need to be evaluated over the short term, and thus, the relevant time-period for the BAF computation will be that same short term." Letter pg 2, lines 14-16. As noted above, this is inconsistent with climate science. It is also inconsistent with the calculation of other climate-related metrics. The following are examples of other scientific metrics that inform policy. In each case the calculation time horizon is determined by science alone, not the policy application or goal. It would be inappropriate to adjust the time horizons for these calculations in the manner proposed by the SAB for BAF calculations.
 - a. Social cost of carbon (SCC) metric: The social cost of carbon is an estimate of future economic damages to society from emitting a metric ton of carbon dioxide (CO₂). The estimates are used in regulatory analyses to value the expected benefits of CO₂ reductions associated with policies. The U.S. Government first developed estimates in 2010 and new estimates have been proposed recently by the current administration. The U.S. Government estimates are based on global modeling of potential climate damage effects of a unit of CO₂ for 300 years (to 2300). The multi-century calculation time horizon is designed to capture the very long atmospheric lifetime of CO₂ molecules and the even longer run inertia affects they can create for the global carbon cycle, the climate system, and sea levels. The same SCC estimates are used across agencies (EPA, DOE, DOT, etc.) and policies that vary substantially in terms of goals and time horizons. Computing the SCC with a decade or multi-decade time horizon, as the SAB Draft recommends, would be inappropriate, ignoring the effects of CO₂ that are expected well beyond any policy horizon.
 - b. CO₂-equivalent metrics: Currently, the EPA routinely uses a science-based metric of 100-year radiative forcing to characterize the impact of greenhouse gases and determine equivalence among non-CO₂ emissions, such as methane (CH₄) and nitrous oxide (N₂O). The emissions of non-CO₂ greenhouse gases are routinely reported in CO₂ equivalents where 1 tonne CO₂ equivalent is the radiative forcing caused by 1 tonne of CO₂ over 100 years. (USEPA 2018, pg ES-3). The metrics are based on climate science estimates of the radiative forcing effects of each non-CO₂ GHG over

100 years. This CO₂-eq metric is widely used in analysis of the impact of greenhouse gases and policies for addressing climate change. Using a 100-year period for comparing global warming potential for all greenhouse gases instead of a shorter policy horizon is the standard international convention adopted by EPA and the Intergovernmental Panel on Climate Change (IPCC). Using a policy-based horizon for BAFs would be a significant departure from the national and international convention for comparing different greenhouse gases.

III. CHOICE OF BASELINE FOR ASSESSING THE BAF: REFERENCE POINT VS ANTICIPATED BASELINE

The 08/29/18 SAB Draft Report misconstrues the choice of baseline, as we explain below.

The Panel had strongly emphasized that determining additionality and attribution are essential components of science-based biogenic carbon accounting framework. As we had noted in our letter to the Administrator in our Advisory Report in 2012: “Estimating additionality, i.e., the extent to which forest stocks would have been growing or declining over time in the absence of harvest for bioenergy, is essential, as it is the crux of the question at hand. To do so requires an anticipated baseline approach.”

We had also noted in the Executive Summary of the 2012 Report that “The choice of a fixed reference point may be the simplest to execute, but it does not properly address the additionality question, i.e., the extent to which forest stocks would have been growing or declining over time in the absence of bioenergy. The agency’s use of a fixed reference point baseline implies that forest biomass emissions could be granted an exemption simply because of the location of a stationary facility is in an area where forest stocks are increasing”.

The 08/29/18 SAB Draft Report recommends using an adjusted reference point approach without providing any scientific justification to support its claim below: *“The reference point approach, if adjusted at regular intervals (e.g., every 5 to 10 years) to account for any additional regional sequestration, would address the SAB’s earlier concerns, allowing for the more direct establishment of a baseline while capturing additional increases in carbon stocks.”*

Figure 1 illustrates why an Updated Reference Point Baseline Approach will provide an incorrect measure of the additional emissions due to the use of bioenergy.

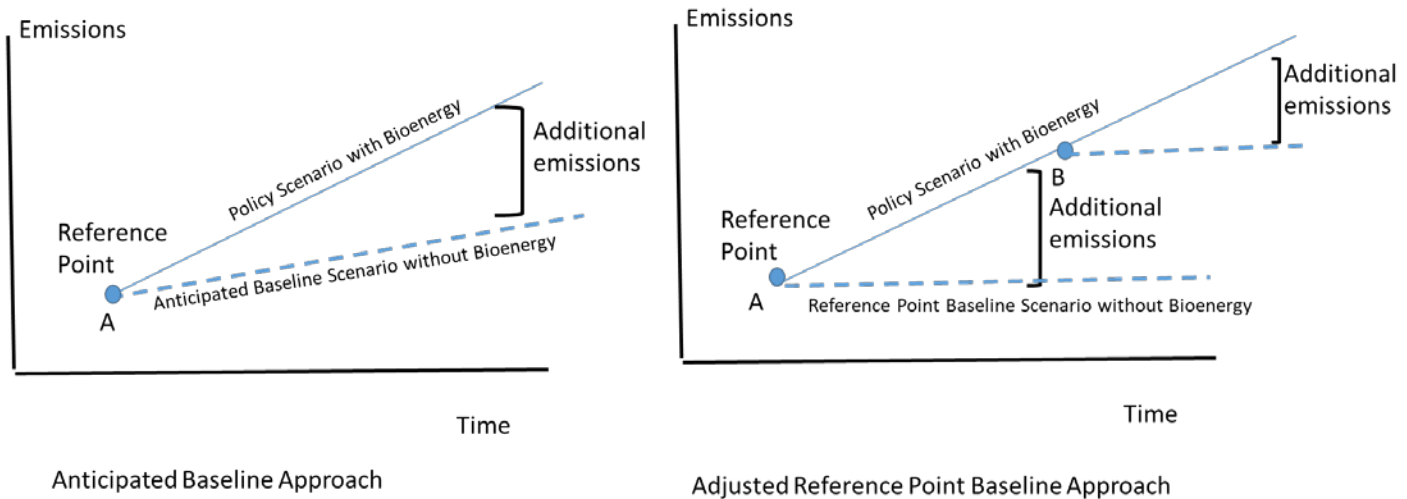


Figure 1: Comparing the Anticipated Baseline Approach with the Adjusted Reference Point Baseline Approach

The graph on the left shows that the anticipated baseline approach measures additional emissions as the difference between the policy scenario with bioenergy and the reference scenario without bioenergy at any point in time. The Reference Point Approach measures additional emissions as the difference between the Policy Scenario and the reference point ‘A’. In this illustration, keeping the reference point fixed at ‘A’ would overestimate the additional emissions as compared to the Anticipated Baseline Approach.

The graph on the right shows that adjusting the reference point from ‘A’ to ‘B’ does not correct the basic flaw of the reference point approach. Additional emissions estimated relative to the updated reference point ‘B’ would now be an underestimate compared to estimates that would be obtained using the anticipated baseline.

IV. USING A SIMPLER MODEL INSTEAD OF A COMPLEX INTEGRATED MODEL TO ESTIMATE THE ANTICIPATED BASELINE

The 08/29/18 SAB Draft Report makes imprudent statements about modelling. The SAB says: “The more complex the model, the greater the dependence of outputs on input assumptions; thus, sensitivity and uncertainty analyses are needed to adequately interpret the results from complex models. Often, simple models are best.”

This statement implies that the reference point baseline approach may be both simpler and better which the SAB supports with a citation to Buchholz et al. (2014) which compares the predicted inventory generated from the USDA Forest Service Renewable Planning Act (RPA) models to observed inventory trends. Somehow the Buchholz (2014) article is interpreted to lend support to the SAB’s conclusion that: “*Given the challenges in predicting the future status of forest resources, anticipated future baselines might be best suited for planning and policy development, while constant reference baselines might be more appropriate for monitoring and regulatory frameworks.*” We do not see any conceptual relationship between the Buchholz (2014) article comparing predicted forest inventories with observed inventories and the SAB’s preference for a

reference point baseline. The SAB authors also note that “an anticipated future baseline might be warranted if there is confidence in predicting future pathways and identifying all relevant carbon pools and drivers” but “a constant reference approach might be preferable if uncertainty in GHG emission drivers, carbon pools and fluxes prevails”.

This argument is flawed for several reasons:

1. It is tempting to accept the “simpler is better” solution to a complicated problem. However, a simple model that misses key drivers of the market and behavioral response to a policy may simply provide a false sense of precision but an incorrect assessment. The criteria for model selection should not be the appearance of accuracy and precision in projections because it has a simple theory or few variables that can be measured with certainty. The criteria for selection should be that the model includes functionality and variables that are known to influence future conditions even though the degree of influence are uncertain and the value of the input variables may be uncertain. **The use of a simple model could be inaccurate and give a sense of false precision while a model with more complex theory and relevant variables would be arguably more accurate but less precise.** The second type of model would provide more accurate projections of the difference between a baseline and alternate scenario and an appropriate evaluation of all the sources of uncertainty in this difference.
2. The estimate of a BAF will depend not only on carbon science but also on the scale of market demand for a feedstock which depends, among other factors, on its competitiveness relative to other feedstocks. An integrated modeling approach is required to determine scale of demand for a feedstock, accompanying changes in the use of cropland and forestland, and to attribute additional emissions due to a particular feedstock.

The Panel’s report had therefore noted that “For the task at hand, estimating BAFs, we believe that an integrated modeling approach that captures economic and biophysical dynamics and interactions is appropriate to simulate the “with “and “without” demand scenarios to estimate the additional effect of bioenergy demand on CO₂ emissions. Additionally, given the temporal scale of these impacts, the potentially wide choice of crop-based and forest feedstocks and the spatial heterogeneity in their production conditions, the dynamic model would need to include both the agricultural and the forestry sectors, competition between land using activities, investment decisions that consider potential future returns (especially for slower growing, long rotation feedstocks), and a large number of spatially distinct production regions (while keeping the model tractable).”

The FASOM model used by EPA for its illustrative BAF estimates in the 2014 Framework has the above features. However, as the Panel noted, there is a need for more model validation, evaluation, justification, and sensitivity analysis to justify its use for estimating BAFs. It should be noted that the goal of the modeling for estimating BAFs is not to obtain a precise and accurate forecast of the future but to assess the *difference* between two scenarios. This would eliminate the effect of uncertainties that affect both the policy and the reference scenario in the same manner.

3. In the case of U.S. forest carbon inventories, creating a quantitative reference point baseline is neither simple nor stable. Figure 2 (from Latta et al. 2018) below shows that not only is the

current forest carbon estimate subject to large uncertainties, but current and historical estimates shift as data and modeling methods evolve. Thus choice of a reference point is also subject to uncertainties and there is no assurance that baseline values will be measured precisely.

4. The assessment of the additional effects of bioenergy demand using the reference point approach is sensitive to the choice of the reference point. As an illustration, using the reference point approach and 2005 as the reference year, DeCicco et al. (2016) show that biogenic carbon uptake by corn for ethanol is only 37% of biogenic emissions due to ethanol production and consumption and that this makes corn ethanol 28% more carbon intensive than gasoline. De Kleine et al. (2017) show that using 2006 as the baseline reference year instead of 2005 would have changed the estimate obtained by DeCicco et al (2016) from 37% carbon offset to a 138% carbon offset which would make corn ethanol significantly less carbon intensive than gasoline.
5. Updating the reference year does not necessarily correct the problem of determining attribution and additivity. As noted by Gustavson et al. (2000), “.. the baseline cannot be subject to continual revision; it must have sufficient definition that the project is not continually measured against a weakly defined moving target.”

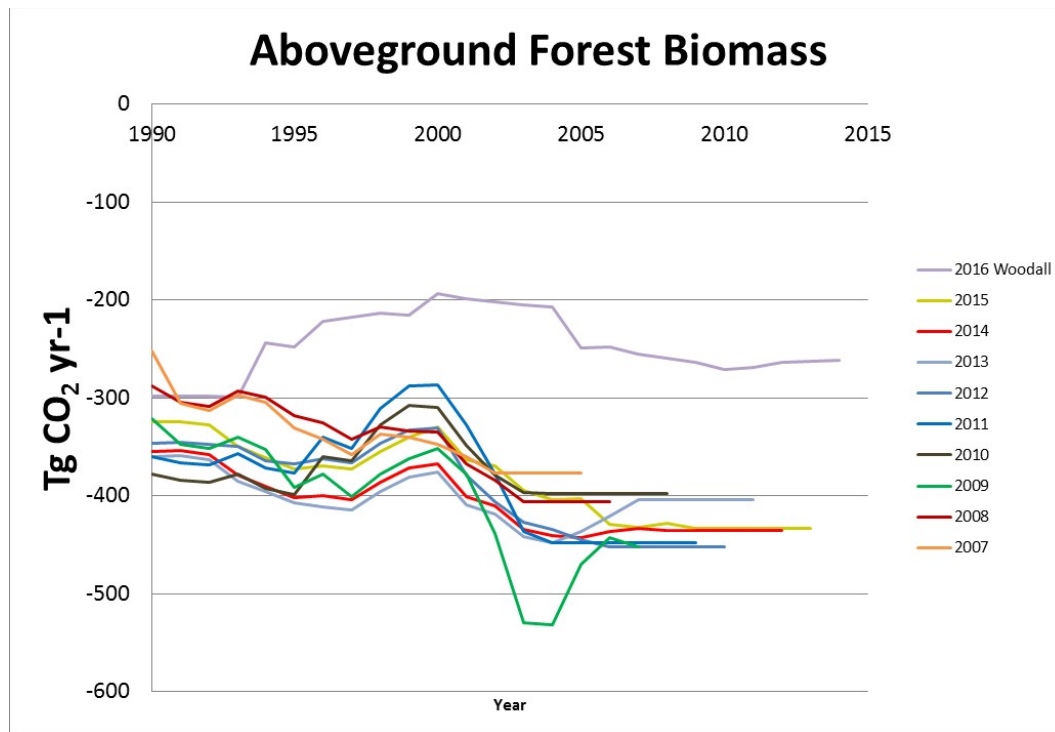


Figure 2: Estimates of Forest Carbon Stocks

Source: Latta et al., 2018

USEPA. 2015. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2013. U.S. Environmental Protection Agency, Office of Atmospheric Programs, EPA 430-R-14-003, Washington, D.C.

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