ncasi

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March 16, 2012

Dr. Holly Stallworth
Designated Federal Officer (DFO)
SAB Staff Office
United States Environmental Protection Agency

Dear Dr. Stallworth:

Please accept the attached comments on the 3-9-12 Deliberative Draft of the SAB's Biogenic Carbon Emissions Panel.

I would appreciate an opportunity to present a three-minute summary of our comments during the Panel's teleconference on March 20.

Very truly yours,

[redacted]

Alan A. Lucier, Ph.D.

NCASI COMMENTS ON 3-9-12 DELIBERATIVE DRAFT OF THE SAB'S BIOGENIC CARBON EMISSIONS PANEL

General Comments on the Panel's Draft Report

The Panel's draft report includes several useful elements - most notably its observations and commentaries on (i) the critical roles of dynamic market forces in determining the effects of bioenergy facilities on terrestrial carbon stocks, and (ii) the great importance of temporal and spatial scales in carbon footprint models of bioenergy facilities. Unfortunately, the draft report generally fails to integrate its most useful elements in its principle findings and recommendations as presented in the Executive Summary's Recommendations for Revising BAF, Alternatives to BAF, and Conclusions. Examples of insufficient integration include:

1. The Panel recommends explicit consideration of the effects of temporal scale in biogenic carbon accounting but does not recommend consideration of equally important effects of spatial scale (and interactions of temporal and spatial scale).
2. The Panel's recommendation to consider decay rates of logging residues is inconsistent with the Panel's observation that time horizons on the order of 100 years are more relevant to EPA's carbon accounting objectives than the typically shorter time horizons of logging residue decay.
3. The Panel's recommendation to use an anticipated future baseline (AFB) approach for woody biomass is inconsistent with the Panel's own observations about the practical difficulties and uncertainties associated with use of AFBs such as the potentially overriding effects on forest carbon stocks of uncertain future trends in market forces and land use.

Some key concepts and recommendations in the Panel's draft report lack adequate scientific foundations. For example:

1. The Panel's draft report asserts an essential relationship between "carbon neutrality" and "additionality" (relative to an AFB) without defining either term and without offering a scientific rationale for the assertion that this ambiguous relationship somehow defines the only valid construct for biogenic carbon accounting. Indeed, the Panel's own draft report discusses alternative accounting constructs such as certification and modeling the global warming potential of biogenic emissions.
2. The Panel's recommendation to consider decay rates of logging residues appears to be supported by little more than the Panel's own *ad hoc* calculations and discussions. It does not appear that the Panel's recommendation is supported by substantive analysis of the costs, feasibility, practical significance, and policy implications of adjusting emission factors for decay rates of logging residues.

More clarity is needed regarding the draft accounting framework's intended uses and design elements.

We agree with the Panel that some additional clarification by EPA of potential applications and design elements would facilitate evaluation of the draft AF. It is clear, however, that the draft AF may have important applications in EPA's Clean Air Act Regulations for greenhouse gas emissions from stationary sources, including PSD and Title V permitting requirements. In this context, the agency's needs include a method consistent with legal requirements that is as accurate, practical, and objective as possible.

The Panel's draft report includes many comments about accuracy but fails to show that accuracy would be improved by adopting the Panel's recommendations. The draft report contains only a few comments

about practicality and legal requirements, and seems to overlook entirely EPA's need for an objective method that yields results that are consistent, reproducible, equitable, and understandable by diverse stakeholders. As discussed in greater detail below, an accounting method based on anticipated future baselines will not meet EPA's needs.

The Accounting Framework (AF) must consider characteristics of feedstock production systems at appropriate scales of time and space.

The Panel's draft report criticizes the draft AF for assigning a BAF of 0 to biomass usage in regions where forest carbon stocks are stable or increasing. According to the Panel, "This leads to the nonsensical conclusion that a ton of carbon emitted in one part of the country may be treated differently from a ton of carbon emitted elsewhere." The basis and implications of this harsh criticism are not clear in the Panel's report. The benefits of biomass energy with respect to greenhouse gas mitigation are generally understood to depend on whether biomass feedstock is being produced sustainably (IPCC 2007). Forest carbon stocks are increasing globally and at the national scale in the US, indicating that a default BAF of 0 is a reasonable accounting option.

EPA's stated intent in developing its "regional approach" in the draft AF was to address concerns that national assessments might not detect reductions in forest carbon stocks attributable to bioenergy production at smaller scales. We agree with the Panel's observation that limitations of the AF's "regional approach" include (i) potential for observed trends in regional forest C stocks to be unrelated to biomass use, and (ii) dependence of BAF on temporal and spatial scales. The essence of the challenge presented to the Panel is to optimize or tradeoff these limitations among other considerations in order to obtain practical, cost-effective and sound regulations.

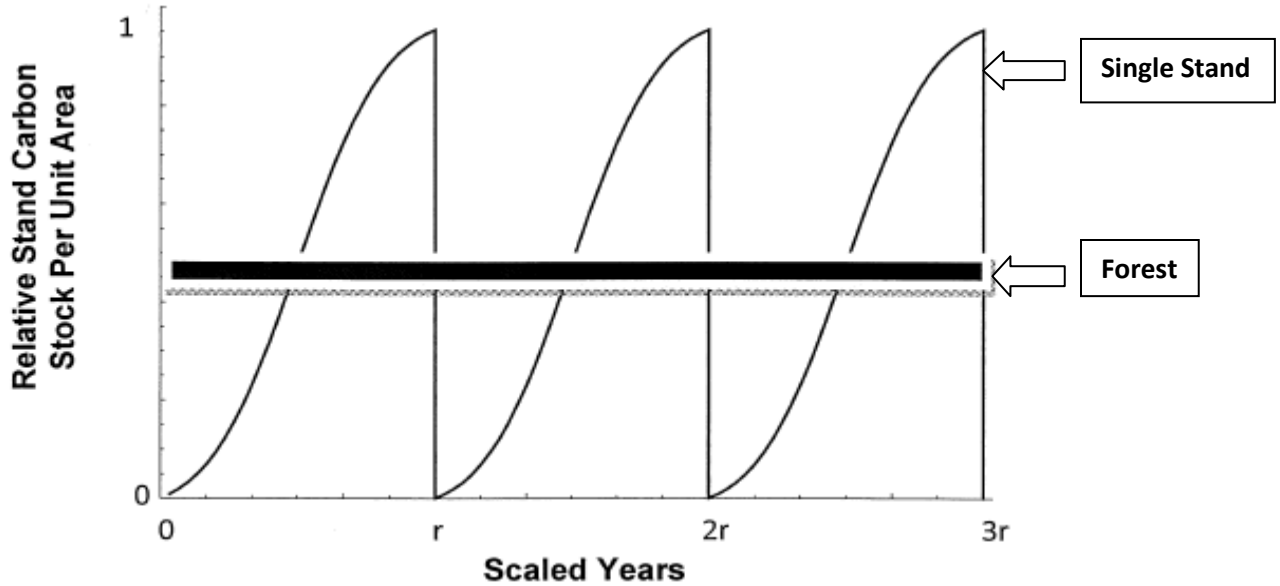
An implicit assumption in the AF's regional approach is that biogenic CO_2 emissions are approximately zero when biomass energy systems are not causing depletion of forest C stocks. This is clearly a simplification of a complex situation. In reality, bioenergy systems supported by sustainable forestry systems are substantially better than "carbon neutral" over the long term (Lippke et al. 2011). A key accounting issue is whether, where and how to measure any near-term depletion in forest carbon stocks that may be attributable to biomass energy systems and that may substantially reduce the long-term greenhouse gas mitigation benefits of biomass energy systems.

In its draft report, the Panel discusses at some length the critical importance of temporal scale in assessing the greenhouse gas mitigation benefits of biomass energy. Spatial scale is also critical, but the Panel's draft report merely criticizes the draft AF's treatment of spatial scale without providing substantial analysis and recommendations. At a minimum, the Panel should note in its report that carbon footprint models based on analyses of individual trees or stands have high potential to produce spurious results and are therefore not appropriate for use in EPA's accounting framework (Lucier 2010, Galik and Abt 2012).

The importance of spatial scale can be illustrated using a simple model of sustainable forest management and the avoided fossil CO_2 emissions attributable to using 100% of harvested wood to produce energy (Figures 1 and 2). "Upstream emissions" (e.g., emissions associated with fuel production and transport) are ignored in the model for both wood and fossil fuels because upstream emissions for wood are typically less than or equal to upstream emissions from fossil fuels (Figure 3).

The model forest described in Figure 1 consists of many identical stands of trees. The growth of each stand is represented by a logistic model in which a maximum of 1 relative unit of carbon stock per unit area is achieved at rotation age (r). Each stand in the model forest has been managed for sustained yield for many years with harvest at rotation age. Cycles of growth, harvest and regrowth for a single stand are represented by the "saw tooth" pattern in Figure 1. Stands are well distributed among age classes such that the mean carbon stock for the forest as a whole (i.e., all stands combined) fluctuates within a narrow range represented by the horizontal black bar in the figure.

Figure 1



Annual harvest and growth are ongoing in the model forest at a rate of 1/r relative carbon units per unit area of forest. For this example, we assume that 100% of harvested wood is used to produce bioenergy that displaces fossil energy based on the delivery of the same amounts of energy in steam. This is clearly an extreme case relative to the usual situation in which a high percentage of harvested wood is used to produce higher-value renewable materials. Coal and natural gas are assumed to release 77% and 46%, respectively, of the carbon released in burning biomass per unit of steam output due to their higher combustion efficiencies relative to wood and, in the case of natural gas, the lower carbon content of the fuel per unit of energy content. The dashed line in Figure 2 represents CO_2 emissions from wood burning at point of combustion. These emissions are equal to the CO_2 removed from the atmosphere and sequestered by ongoing forest growth, so net biogenic emissions are zero (i.e., no change in average forest carbon stock as illustrated by the horizontal bar in Figure 1). The solid line represents avoided CO_2 emissions attributable to the model forest when the fuel displaced by wood energy is coal. The solid line with dots represents avoided CO_2 emissions attributable to the model forest when the fuel displaced by wood energy is natural gas. For any time zero, avoided fossil emissions attributable to ongoing forest management accumulate throughout the analysis period without delay. The rate at

Figure 2

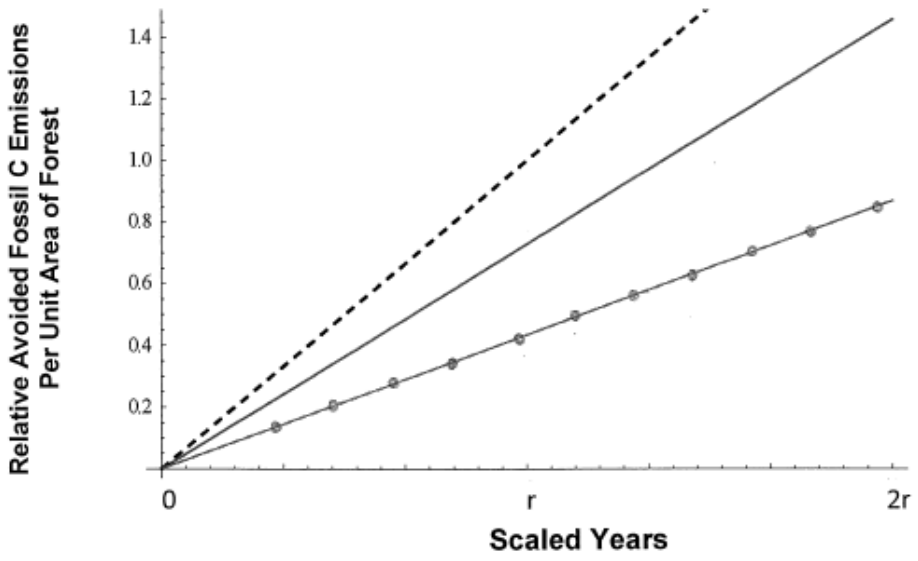
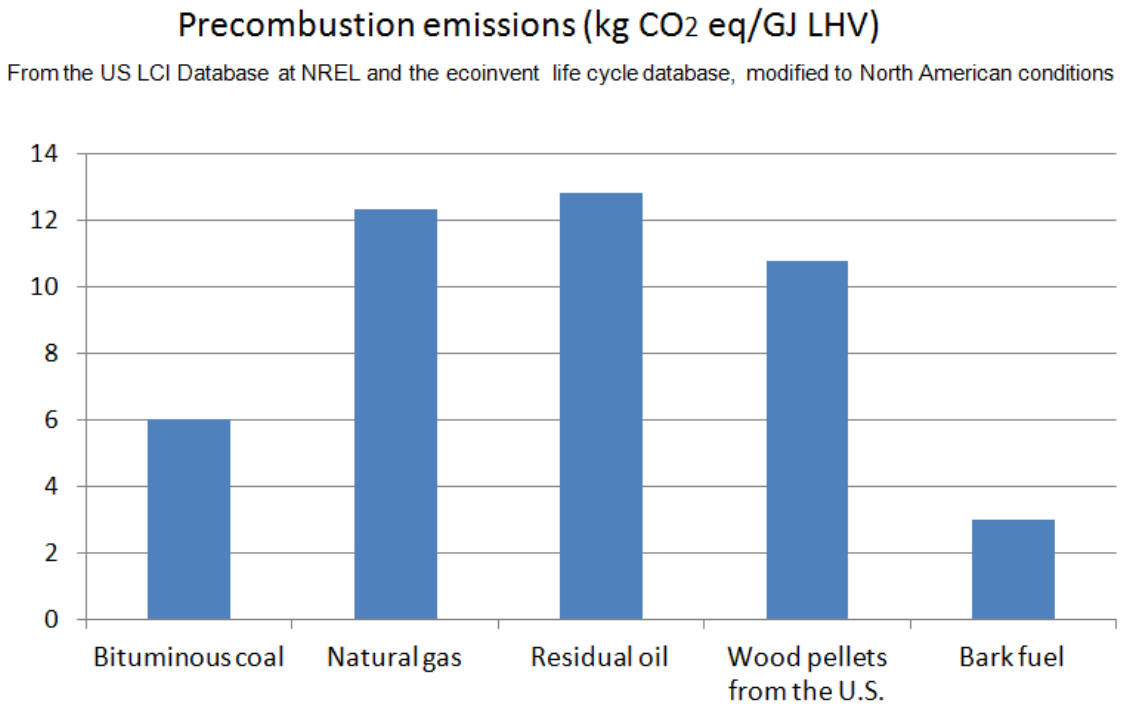


Figure 3



which avoided emissions accumulate is greater when wood displaces coal than when wood displaces gas.

Real forests are of course much more complex than the model described above in that they comprise many different kinds of stands managed for multiple objectives with multiple constraints. At the larger spatial scales most relevant to EPA's accounting objectives, forests are managed by diverse owners for diverse purposes. Nevertheless, carbon stocks in real forests can be stable or increasing for substantial periods of time as they have been in the United States for the past several decades.

The Panel's draft report includes useful discussion of a recent paper by Cherubini et al. (2011) that models the global warming potential (GWP_{bio}) of a "pulse" of biogenic carbon emissions attributable to harvesting a single stand of trees. This paper confirms that the greenhouse gas mitigation benefits of biomass energy attributable to single stand of trees decrease with increasing rotation period and increase with time horizon and stand growth rate.

In its future deliberations, the Panel should consider the reality that the spatial scales most relevant to EPA's carbon accounting objectives are much larger than a single stand. As shown in Figures 1 and 2 above, the "pulse" of biogenic CO_2 that the atmosphere "sees" at larger scales is zero when forest carbon stocks are stable. Therefore, the greenhouse gas mitigation benefits of biomass energy systems supported by sustainable forest management are substantially greater in both the near term and long term than indicated by single-stand models. Cherubini et al. (2011) note the importance of spatial scale in their paper.

Monitoring trends in forest carbon stocks as proposed in the draft AF is a necessary first step in evaluations of the carbon footprint of bioenergy systems. This monitoring could be supplemented with assessments of factors contributing to empirical trends in carbon stocks. These factors include rates of biomass growth and harvest, rates of change in harvest, land use change, investments in forest productivity, natural disturbances, and landowner responses to economic incentives to produce wood and other forms of biomass. Forest sustainability assessments should be conducted by knowledgeable stakeholders inclusive of state and federal forestry agencies and should consider the reality that markets for wood provide important incentives for sustainable forest management and thus help keep forests on landscapes (Ince 2011).

<u>The inherent complexity and uncertainty associated with "anticipated future baselines" have not been adequately considered in the Panel's draft report</u>

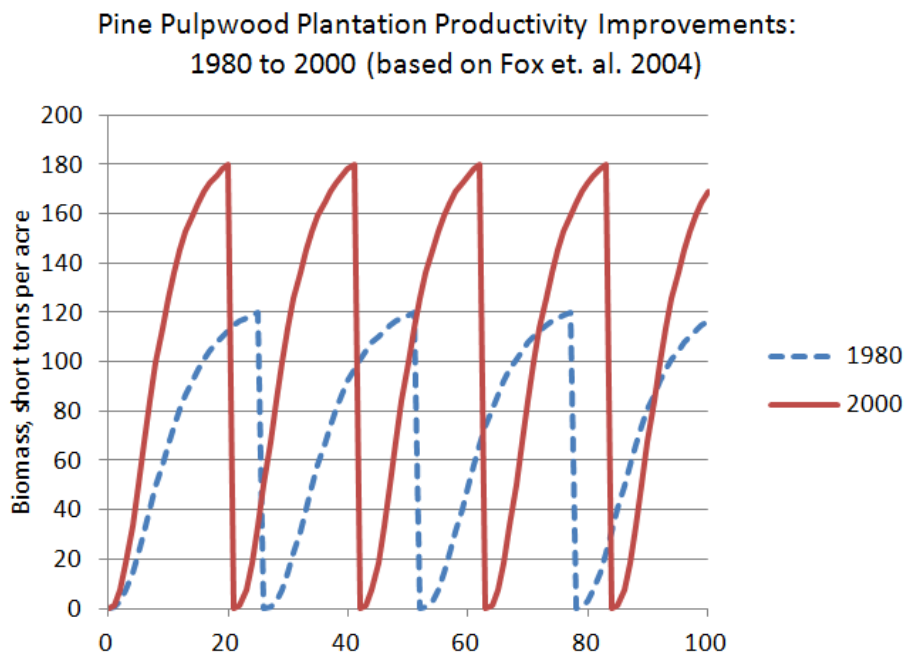
The Panel may wish to reconsider its criticism of the draft AF for using a reference point baseline. In expressing support for use of anticipated future baselines (i.e., counterfactual baselines), the Panel's draft report seems to ignore or understate the limitations of the models that would be required to implement an accounting system that uses such baselines.

One important limitation of anticipated future baselines is the impossibility of knowing the future. This is not a small problem. The errors that can be introduced are enormous and are completely dependent on assumptions. Consider, for instance, the following real-world example.

Fox et. al. (2004) have presented information indicating that rotation lengths on southern pine pulpwood plantations decreased from approximately 25 years to 20 years between 1980 and 2000. The

same source indicates that over the same period, the biomass yield at harvest on these plantations increased from approximately 120 to 180 short tons per acre. These improvements are illustrated in Figure 4.

Figure 4



Anticipated future baselines developed in 1980 that failed to take these improvements into account would have severely underestimated the benefits of continued use of the land for pulpwood production. If you assume that these improvements were implemented gradually over a landscape, ***you find that over just this twenty year period, an anticipated future baseline based on 1980 productivity would have understated the benefits associated with continued pulpwood production on this land by over 40%.*** The error becomes even larger over time.

EPA and the SAB Panel should also consider the unintended consequences that a complex and uncertain baseline development process could have on the decisions of smaller parcel landowners on whether to leave land in forest or convert it to other uses. These land owners supply a significant fraction of the wood needed to produce the wood and paper products that not only meet societal needs but often displace far more carbon intensive products in commerce. The conversion of this land to non-forest uses would not only reduce these positive substitution benefits but would also result in the permanent loss of carbon from the converted forestland.

The development of anticipated future baselines involves assumptions for a huge number of parameters, besides productivity improvements, and there is uncertainty associated with each one. *The results of analyses based on anticipated future baselines are so dependent on assumptions, and the assumptions are so uncertain, that this alone should be adequate justification for disqualifying the anticipated future baseline accounting approach for biogenic CO_2 in the context of PSD and Title V permitting.* Moreover, it is difficult to imagine a process of selecting assumptions and anticipated future

baselines that would be sufficiently objective to alleviate concerns about fairness to diverse stakeholders.

A recent report (BERC 2012) claims to demonstrate the feasibility of using anticipated future baselines (AFBs) in biogenic carbon accounting. The BERC analysis has some positive attributes (e.g., considers a larger spatial scale than a single tree or stand) but does not substantiate its claim about AFBs. On the contrary, BERC's results are highly dependent on many debatable assumptions and models. For example, the magnitude and duration of carbon debts reported by BERC depend on an assumed anticipated future baseline, an assumed rate of increase in wood demand for bioenergy, and assumptions about responses of timber growers to the increasing demand. BERC's methods are complex and somewhat ambiguous (i.e., not described in detail). It appears that the entire increase in wood demand assumed by BERC "kicks in" during a single year and that BERC's model does not consider effects of increases in wood demand on economic incentives for landowner investments in sustainable forest management. It also appears that BERC's results are strongly affected by decisions about boundary conditions – e.g., increases in carbon stocks on forests designated by the authors as unavailable for harvest (or outside of wood procurement circles) were excluded from the analysis.

Forest biomass-based harvest and manufacturing residuals used for energy have clear GHG benefits

Management of logging residue is an integral part of sustainable forest management. In making residue management prescriptions, foresters consider many site-specific factors. In some cases, utilizing logging residues for energy is a cost-effective option for reducing greenhouse gas emissions, facilitating reforestation success and / or reducing wildfire risk. In most cases where utilization is economically feasible, residues are small-diameter materials such as tree tops and branches. Information in Smith and Heath (2002) indicates that small-diameter materials decay rapidly. For example, calculated half-lives of small-diameter residues from decay rates in Smith and Heath (2002) are less than 3 years in the South (a region that accounts for 60% of US wood production) and in the range of 2-17 years in other regions. Adjusting biogenic emission estimates for decay rates of logging residues would require costly tracking of feedstock supplies by facilities; have little or no practical significance with respect to emission estimates on time scales relevant to EPA's accounting objectives (e.g., 100 years); and discourage utilization of residues in cases where utilization would otherwise be a cost-effective option for mitigating greenhouse gas emissions and achieving sustainable forestry objectives.

In the case of manufacturing residuals used for energy, there is very little uncertainty about alternative scenarios and their impacts because these materials are either integral to manufacturing (e.g. in the case of black liquor solids) or incidental to manufacturing (e.g. in the case of bark and wood waste). If these materials had not been used for energy (and in the case of black liquor solids, to provide chemicals for pulping via the chemical recovery system) the carbon in these materials would return to the atmosphere "anyway", but without providing any benefit. They would either be burned without energy recovery, returning the carbon to the atmosphere immediately, or in some cases, placed in landfills where the carbon would be returned to the atmosphere over time, some if it in the form of methane, a greenhouse gas that is 25 times as potent as CO_2 over a 100-year time frame. *Even considering the relative efficiencies of using fossil fuels vs. biomass to generate usable energy, and considering the delayed emissions that might result from landfilling some of these materials, the GHG benefits of using these materials for energy (and chemicals in the case of black liquor solids) are clear.*

Considerations in modeling the use of roundwood for energy

For land that is already being managed for wood production, the situation is straightforward and we encourage EPA and the SAB Panel to recognize this in considering the carbon accounting needs for wood obtained under such circumstances. Although land owners might adjust age class distributions or harvest timing in response to market conditions, the management of land to produce wood for renewable materials with substantially higher value than biomass feedstock will limit the magnitude of potential stock increases and decreases. If the market for pulpwood is weak, some of this wood might be used for energy or land might be thinned and the remaining trees allowed to grow to produce saw timber, with relatively modest impacts on long-term forest carbons stocks. Ultimately, economic incentives to manage land sustainably to produce wood for future use help ensure that carbon stocks, especially over large areas of managed land, will be relatively stable.

Also to be considered is the possibility that, if the output of forests is devalued by imposition of a complex, costly and biomass-devaluing carbon accounting system, one potential anticipated future baseline is that the land will be converted to non-forest uses which provide the landowner with better returns than leaving the land in working forest. Converting land to non-forest uses usually involves the loss of considerable amounts of stored carbon. *Given this, it seems unnecessary and potentially counterproductive to require complex carbon accounting for wood that is being produced on sustainably managed land that is already being used for wood production.*

Concerns about "tipping-points" do not provide a reason to shift the focus away from the need to reduce long-term, ultimate levels of GHGs in the atmosphere

There has been considerable discussion in the Panel as to the significance of the trajectory of the emissions curve in the short- to intermediate-term compared to a focus on the long-term outcome, as reflected by the maximum radiative forcing expected in the future. Some have expressed concern that focusing on the long-term ignores the potential for increased emissions in the short- to intermediate-term to push the climate system over a "tipping point." There is considerable uncertainty (some would say, disagreement) regarding such tipping points, but even accepting that they exist, if they are triggered by radiative forcing levels below the long-term maximum that the global climate system sees, then these tipping points are going to be encountered. *The emissions curve trajectory in the short- to intermediate-term may affect the timing, but it is only by lowering the long-term maximum radiative forcing that these tipping points can be avoided. This suggests that the accounting approaches used in evaluating the significance of activities and policies should be focused on the long-term outcome. With this as a focal point for policy, it is clear that programs that discourage the use of wood-based fuels and other materials to displace more GHG-intensive alternatives are, in the long term, all cost and no benefit.*

It is important to keep in mind what IPCC concluded, after considerable study and discussion, about the mitigation benefits of forests

We readily acknowledge that biogenic carbon accounting can be a complex and contentious topic. It may be helpful, therefore, for the Panel and EPA to consider the IPCC's important conclusion that "*In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber, or energy from the forest, will generate the largest sustained mitigation benefit.*"

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Summary of NCASI Comments on Draft Report of the SAB's Biogenic Carbon Emissions Panel

March 16, 2012

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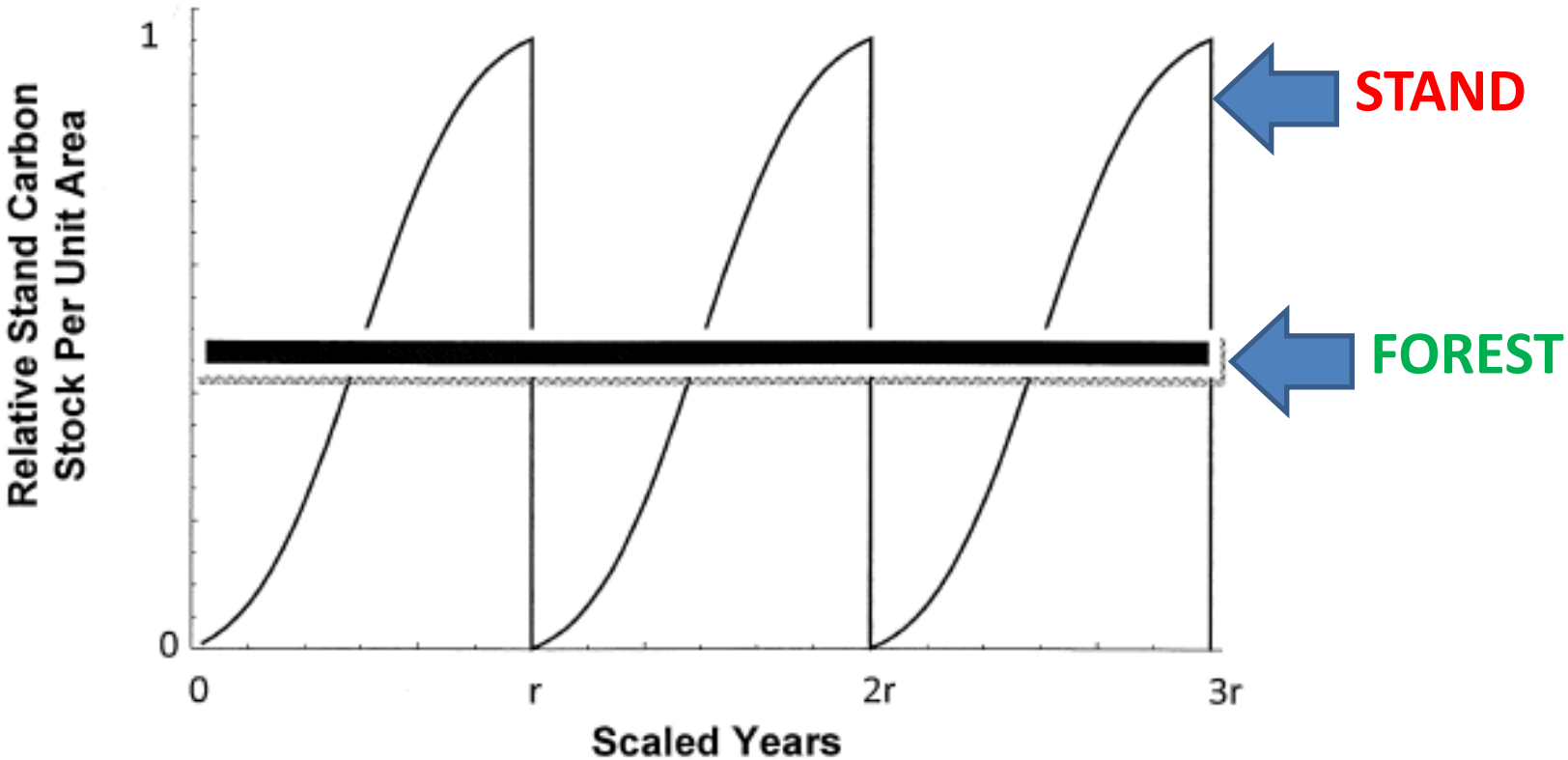
Scale

- Very useful discussion of ***temporal scale*** in the Panel's draft report.
  - Longer time horizons (e.g., 100 years) are more relevant to EPA's carbon accounting objectives than shorter time horizons.
- ***Spatial scale*** is also very important but is not addressed adequately in Panel's draft report.

Spatial Scale Also Important



Panel should reconsider merits of Adjusted Future Baselines (AFBs)

- Impossible to know the future.
- Attributes of AFB methods relative to reference point methods:
  - AFB requires more assumptions ✓
  - Accuracy better or worse with AFB?
  - Practicality worse with AFB ✓
  - Objectivity worse with AFB ✓

Panel should reconsider adjusting emissions for decay rates of logging residues

- "Logging residue" typically = tree tops & branches
  - Time horizon of decay typically much less than 100 years.
- Recommendation to adjust emissions for decay rates not supported by analysis of practical aspects:
  - Improvement in accuracy of emission estimates?
  - Feasibility and costs of measuring residues?
  - Potential to devalue logging residues and impose an undue constraint on forest management options?