REPORT REGARDING THE LEGAL AND SCIENTIFIC LEGITIMACY OF TREATING BIOMASS AS BIOGENICALLY CARBON NEUTRAL IN DRAFT CRCF METHODOLOGIES

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Introduction & Summary

This report for the World Wildlife Fund Europe and Fern analyzes the legal and scientific validity of the treatment of biogenic carbon as inherently carbon neutral in a variety of draft methodologies under the CRCF. Draft methodologies analyzed include those related to DACCs/BioCCS, to product storage and to biochar.[2]

Although the authors of these documents are to be credited with much, high quality work, all guidance documents build in the general assumption that biomass is carbon neutral. As used here and in general elsewhere, the term "carbon neutral" when applied to biomass means that the carbon dioxide emitted by burning or decomposing biomass is viewed as not adding carbon to the air, and consequently that the capture of biogenic carbon automatically represents a "removal," i.e., a carbon negative activity. Two theoretical examples highlight the implications:

- Under this approach, in theory,100 tons of carbon in wood could be harvested from a forest and 99 tons burned, thereby increasing carbon in the air by 99 tons, and yet the one ton of carbon stored in some way (whether through CCS or in buildings) would be counted as a removal and therefore a reduction in atmospheric carbon.

- A large fraction of Europe's cropland could be turned into energy crops, continuing Europe's scientifically demonstrated experience of outsourcing food production and deforestation, and yet the biomass taken up by these crops would be viewed as a full carbon gain regardless of the carbon losses from indirect land use chang to

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[2] Draft methodologies include the Draft technical specifications for the certification of permanent carbon removals through DACCS/BioCCS (October 1, 2024); Draft technical specifications for the certification of permanent carbon removals through biochar (October 10, 2024); and Draft Technical assessment of certification methodologies for long-term biogenic carbon storage in buildings (September 19, 2024).

replace food (or the carbon sequestration forgone by not allowing the land to return to forest).

Established science contradicts the treatment of biomass as inherently carbon neutral. In general, the methodologies considering biomass as carbon neutral treat the additional *use* of plants, i.e., of biomass, as synonymous with the additional *growth* of plants. The growth of plants removes carbon from the air, but additional uses of biomass do not by themselves remove more carbon from the air. They frequently involve just the diversion of biomass from one use to another, i.e., from forest to a building, or the diversion of land producing plants from one purpose to another, e.g., from food to energy, requiring that other land be used to replace the original use. Additional uses therefore do not by themselves remove more carbon from the air, and as in the examples above, often result in less overall carbon storage. (Although uses of biomass may or may not have lower emissions than alternative products, their emissions must be properly assessed so that they can be properly compared to alternative products.)

This accounting contradicts the requirement in the CRCFC that removals "shall be quantified in a relevant, conservative, accurate, complete, consistent, comparable and transparent manner, in accordance with the latest available scientific evidence." The apparent rationale used to justify this treatment of biogenic carbon is that doing so is consistent with the instruction in the CRCF that some "minimum" sustainability criteria must be based on Article 29 of the Renewable Energy Directive. But the provision that sets these RED criteria as one condition for removals under the CRCF do not write out of the directive the many additional obligations imposed by the CRCF, including to be scientifically accurate. This is explicit because the CRCF in two places requires the incorporation of "indirect land use change" into GHG accounting while accounting in the RED does not do so.

Overall, credible methodologies require the establishment of criteria for when biomass is truly "additional." That should mainly focus on the burning of pure wastes, or from more efficient use of existing biomass.

1. **Does the reference to RED sustainability criteria curtail the obligation to base carbon accounting on "the latest available scientific evidence" and to incorporate indirect land use change?**

The CFRC has explicit language regarding the accounting for carbon in biomass that makes it clear proper carbon accounting of biogenic carbon is indispensable. First and foremost, the CFRC instructs that the overall accounting be based on the best available science.

"Permanent carbon removals, temporary carbon removals from carbon farming and carbon storage in products, soil emission reductions and associated GHG emissions shall be quantified in a relevant, conservative, accurate, complete,

consistent, comparable and transparent manner, *in accordance with the latest available scientific evidence*." (Article 4 (4).

This is most specific in Article 4, which governs quantification of removals. It sets out a formula for "net carbon removal benefit" that includes a critical source of emissions known as "GHGassociated," which are the emissions associated in generating removals. "GHGassociated" is defined as follows in identical language for both permanent and temporary removals (Article 4(1)(c) and 2(c)):

> "GHGassociated is the increase in direct and indirect greenhouse gas emissions, over the entire lifecycle of the activity which are due to its implementation, including indirect land use change. . . ."

"Indirect land use change" is a part of biogenic carbon accounting and means that biomass is not carbon neutral. It counts the emissions to replace food or wood production elsewhere, including foregone carbon sequestration, if the land that is currently producing them is diverted to bioenergy or some other use. And much additional language throughout the guidance emphasizes both that "indirect" emissions must be included and that the accounting must be conservative even at the risk of underestimating removals.[3]

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[3] Some examples in the CRCF include:

> "Carbon farming activities generally improve soil quality, which has a positive impact on soil resilience and productivity, but in some circumstances, it might also generate a decrease in food production and therefore lead to a carbon leakage effect from indirect land-use change, and the related indirect emissions should be taken into account." (Paragraph 9)
>
> Any carbon captured and stored by afforestation or soil emission reduction by a peatland re-wetting should outweigh the emissions from the machinery used to carry out the activity or the indirect land use change emissions that can be caused by carbon leakage. (Paragraph 9)
>
> Carbon removals and soil emission reductions, as well as the corresponding direct and indirect GHG emissions associated, should be quantified in a relevant, conservative, accurate, complete, consistent, transparent, and comparable manner. (Paragraph 10)
>
> Uncertainties in the quantification should be duly reported and accounted in a conservative manner in order to limit the risk of overestimating the quantity of CO2 removed from the atmosphere or of underestimating the quantity of direct and indirect GHG emissions generated by an activity. (Paragraph 10)
>
> This means that the methods used should result in conservative emission or removal estimates so that emissions are not underestimated and removals are not overestimated. (Paragraph 10a)

Although not discussed in the October draft methodologies document, the rationale offered for treating biomass as carbon neutral provided by the *Technical Assessment Paper on certification methodologies of permanent carbon removals* published in July 2024 is that the treatment of biogenic carbon is based on Article 29 of the European Commission's Renewable Energy Directive. This in turn is based on the following language in the CFRC:

> "The minimum sustainability requirements shall promote the sustainability of forest and agriculture biomass raw material in accordance with the sustainability and GHG saving criteria for biofuels, bioliquids and biomass fuels laid down in Article 29 of Directive (EU) 2018/2001." Article 7 (2).

In effect, the argument is that this language supersedes all the other language in the CFRC regarding carbon accounting quoted above. This treatment is not reasonable.

- First and most obviously, the calculation of greenhouse gas emissions under Article 29 of the RED does not include indirect land use change. This interpretation would therefore require that the Commission violate the explicit instruction that "GHGassociated" incorporate "*indirect land use change*."

- Second, this interpretation means that other language in the CRCF would have no effect and would in effect be cancelled. That is not reasonable. It is even more unreasonable as regards carbon accounting as the reference to the RED is in Article 7 regarding "sustainability" while the rules regarding carbon accounting are in Article 4. This RED provision interpretation would require that Article 7 cancels out core provisions of Article 4.

- Third, even Article 7 contains additional sustainability criteria beyond compliance with the RED, and even in paragraph 2, instructs additionally that "[t]he minimum sustainability requirements shall take into account the impacts both within and outside the Union and local conditions." This is another reference to the need to account for indirect land use change. If the RED sufficiently accounted for these effects, the reference to it alone would suffice, and this other sustainability language would have no meaning.

In short, the carbon accounting and other rules must fully meet all parts of the CRCF Regulation, including being "conservative," "comprehensive," and "in accordance with the latest available scientific evidence," and accounting for indirect effects.

2. Is wood carbon neutral?

The science is clear that additional uses of wood are not inherently carbon neutral and do not by themselves remove more carbon from the atmosphere. For example, taking

carbon that would otherwise be stored in a forest and using it in a product by itself does not create any more biomass. It instead transfers the carbon storage, so there is no additional removal just from such an action. As the IPCC has stated, "If bioenergy production is to generate a net reduction in emissions, it must do so by offsetting those emissions [from combustion of biomass] through *increased net carbon uptake of biota and soils".*[4]

In addition, typically in that process of harvesting and using wood, a substantial majority of the carbon that was once stored in trees is released into the atmosphere. This is due to decomposing slash and roots in the forest and from the high quantity of wood that is burned for energy in the process of making timber products or even wood pellets or wood chips (Peng et al. 2023) (citing FAO and other estimates) (T. Searchinger et al. 2018). Although trees regrow, they regrow slowly, and trees if unharvested would also continue to grow, so total carbon storage at least declines typically for many decades. During this time, warming increases causing damages and including damages that cannot be repaired by hypothetical negative emissions in the future (Möller et al. 2024).

The potential may exist for substitution benefits from replacing alternative products, such as concrete and steel, but that is a separate matter and does not make wood carbon neutral. Instead, the actual climate effects of each type of product need to be calculated and compared with the others, e.g., wood timber for construction versus concrete and steel. Estimates of emissions from wood should include losses of carbon that would have been stored in forests had the trees not been harvested. It is possible that the emissions from wood use can be less than those from alternative products – although the details matter – but that does not make wood use a removal; it just makes some wood use lower emitting than some alternatives.

Woody biomass from energy crops or other plantings on agricultural land are also not carbon neutral. Even if cropland were diverted from food production into energy crops, that does not necessarily or even generally mean a net removal of carbon from the atmosphere because this food should be and generally is replaced. As a result, other land must instead be used to grow the crops. That is precisely why the CRCF regulation requires incorporation of indirect land use change.

This common-sense viewpoint is the overwhelming view of scientists. In January 2018, roughly 800 scientists wrote a letter to the members of the European Parliament stating not only that most woody biomass is not carbon neutral but also that when used for energy, it is likely to increase emissions for decades to centuries "Placing an additional carbon load in the atmosphere for decades means permanent damages due to more rapid melting of glaciers and thawing of permafrost, and more packing of heat and acidity into the world's oceans." In February of 2021, more than 500 scientists made a similar point in

[4] IPCC AR5 WG III 11.13.4. GHG emission estimates of bioenergy production systems (2014).

a letter to President von der Leyen. (In an appendix, we cite some of the many papers calculating not just that wood is not carbon neutral but when used for bioenergy is likely to increase emissions for decades.) For specific or overall wood product use, studies find some wood products have higher and some lower emissions than non-wood alternatives depending on the details of growth, harvest and use, but even those studies finding lower emissions from wood products do not count wood as carbon neutral.[5] The European Academies Science Advisory Council has also repeatedly observed that forest biomass is not carbon neutral in a reasonable time (EASAC 2018).

In its 2021 *New EU Forest Strategy for 2030 (page 5),* the Commission has itself acknowledged that increased use of biomass for any bioeconomy use is not only not carbon neutral but will likely increase emissions for at least thirty years. [6] The Commission's Joint Research Center has similarly found not only that woody biomass is not carbon neutral but that use for bioenergy of any wood other than the smallest wood slash residues is likely to increase carbon in the atmosphere for such a period (Carmia et al. 2021). (For just some additional illustrative studies, see Appendix A.

In short, the treatment of biomass as carbon neutral – meaning that losses of biogenic carbon are ignored and any storage is treated as carbon negative – contradicts the mandate in the CRCF that GHG accounting be "comprehensive," and "in accordance with the latest available scientific evidence."

3. Is the treatment of biogenic carbon from wood as carbon neutral consistent with LULUCF obligations?

The argument is sometimes made that use of biomass may be treated as carbon neutral by RED for energy use and in other implementing policies because LULUCF rules count losses of forest carbon. As addressed in the scientific letters, the opposite is true. The mere fact that national obligations incorporate forest carbon losses does not mean that incentives or obligations imposed on factories and other energy users can ignore proper carbon accounting. To the contrary, doing so leads to laws that promote behaviors that undermine EU carbon obligations.

As the EU's treaty obligations illustrate, laws work at different levels applicable to different actors, and laws applicable to each actor at each level must each get the accounting right to avoid conflict. This can be seen with diesel fuel. The EU has treaty

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[5] Example papers include Hudiburg et al. (2019), (Law et al. 2018), (Kalliokoski et al. 2020) (Oliver et al. (2014), (Skytt, Englund, and Jonsson 2021), (Chen et al. 2018),(Keith et al. (2014), and (Maierhofer et al. 2024).

[6] The report wrote: "As indicated in recent studies, in the short to medium term, i.e. until 2050, the potential additional benefits from harvested wood products and material substitution are unlikely to compensate for the reduction of the net forest sink associated with the increased harvesting." (European Commission 2021)

obligations to reduce its emissions, and they include emissions from burning of diesel fuel and petrol. But the fact that the EU must count and report these emissions to the UN does not mean it can properly treat diesel emissions as carbon neutral in its energy laws. If so, people will continue to burn or even burn more diesel and undermine the EU's treaty obligations. The same is true of land use and at country levels. The fact that countries report LULUC emissions from wood harvest does not mean the EU overall or each country can properly encourage more wood harvest as carbon neutral. Doing so will just increase national and EU-wide LULUCF emissions.

Increased wood use is already not just reducing Europe's carbon sink but is also undermining the EU's adopted LULUCF targets. The 2018 revision of the LULUCF Regulation establishes an overall binding target of 310 Mt CO_{2eq} of net terrestrial removals, i.e. carbon stored in terrestrial biomass, with specific targets for each Member State (MS). However, data reported to the UNFCCC show that the net removals in the EU27 LULUCF sector decreased from 347,553 to 236,402 Mt CO_{2eq} between 2013 and 2022, the last available year. An increase in wood harvesting is one of the main reasons for this decrease, and projections show that, if current management practices do not change, the forest carbon sink is going to decrease further (Korosuo et al. 2023). Bioenergy plays a major role in the reduction of carbon stored in forests: according to a JRC report, about half of the total wood harvested in the EU is directly or indirectly used for the production of energy (Cazzaniga, Jonsson, and Camia 2019). Accordingly, the Commission has acknowledged that increasing use of wood as part of the bioeconomy conflicts with the goals to achieve this sink.[7]

The proposed technical specifications will therefore inappropriately encourage activities that lead to reduced removals even within Europe and undermine the EU's climate commitments. Proper carbon accounting of wood use must factor in the effects on carbon storage in forests.

4. Is it appropriate to assign all emissions from wood bioenergy use to the energy production and not to the CCS even if emissions are viewed as carbon neutral for energy production?

One proposed rule in the draft technical specification is that when counting overall BECCS emissions, the emissions from biomass harvesting and use are assigned to the energy production alone. This leaves the carbon capture and storage (CCS) activity as a pure removal except for the emissions involved in generating the CCS.

[7] Commission staff working document impact assessment accompanying the document Communication from the Commission to the European parliament, the council, the European economic and social committee and the committee of the region Brussels, 17.9.2020 SWD(2020) 176 final (part ½), p. 117.

This kind of segregation of emissions is not a generally sound approach because once there are economic rewards, the financial incentive to engage in one activity also affects the other. For example, if CCS becomes financially rewarding, it can encourage more combustion of biomass for energy, encouraging the emissions that companies are then financially rewarded for reducing. That is why the most common standard in lifecycle accounting is to use economic allocation or alternatively to estimate emissions of the whole enterprise. For example, the approach that should apply to CCS – whether from fossil fuels or biomass -- is simply to count the CCS portion as reduced emissions over the overall enterprise, e.g., reduced power plant emissions. If the CCS is cost-effective given Emission Trading System (ETS) carbon prices, it will be pursued.

Regardless, in this context, the proposed rule is perverse because under the RED and the ETS (the European Trading System), no biogenic emissions are counted from biomass energy generation despite the science and the physical reality. In effect, given this category of physically real but uncounted emissions, the proposed removals rule pushes emissions into that category so they too can then be ignored. In this context, crediting CCS removals heightens previous error, increasing the financial reward for an activity improperly viewed as carbon neutral by making it improperly viewed as carbon negative.

A financial accounting analogy may be use. Some parent companies, faced with the bankruptcy of an independently incorporated affiliate, may attempt to shift financial losses into the subsidiary. Because that affiliate is already bankrupt, doing so transfers losses from the parent company to creditors, but such accounting games do not reduce the total losses. In the same way, the proposed game of assigning biogenic carbon emissions to a separate part of the power generation enterprise where they are not counted does not alter the physical reality that these emissions occur.

In short, so long as the biogenic emissions are not actually counted and charged for emissions by the energy facility (either because of RED subsidies or the ETS or both), it is inaccurate to view biomass as carbon neutral for CCS removals.

5. **Is indirect land use change factored into emissions for energy crops and other biomass and would a reference to Annex VIII of the RED be legally and scientifically appropriate?**

No indirect land use change is factored into GHGassociated in the Technical Specifications.

In a July 5th *Technical Assessment Paper on certification methodologies of permanent carbon removals*, there is a suggestion that the accounting could use "provisional" indirect land use change emissions numbers in Annex VIII of the RED. These "provisional" numbers for crops were added long ago based on uses of the MIRAGE model by IFPRI in a 2011 report (Laborde 2011). These model numbers were never published in a peer review journal and the MIRAGE model appears to be no longer in use. However, these

numbers have no effect on compliance with renewable energy requirements in the RED, and they cannot be used for the CRCF because they are not consistent with the latest scientific evidence.

One straightforward reason these numbers cannot be used is that Annex VIII assigns no ILUC number to energy crops. In fact, the MIRAGE modeling did not assess energy crops. Logically, this decision must be wrong if energy crops are produced on cropland because the ILUC per hectare will be analogous to diverting food and feed crops. For example, if the energy crops are grown on land now producing rapeseed oil, they will cause the same displacement of rapeseed oil as if that oil itself were used for biofuels. (For energy crops, the per hectare ILUC is higher because not only the oil but the rapeseed cake is lost.) If there is an ILUC for food and feed crops, there must be an ILUC for energy crops grown on cropland otherwise used to produce food and feed crops.

It is possible that the "provisional" lack of ILUC for energy crops assumed they would not be grown on agricultural land, but if so, that cannot be used to assign an ILUC to energy crops that *are grown* on agricultural land.

Such an assumption would also be inconsistent with the European Commission's analysis for the Fit for 55 plan. Modeling for that plan projected that energy crops would replace roughly one fifth of European cropland (European Commission 2020)(Figure 80) as discussed in the main text and supplement of (T. Searchinger et al. 2022). There is also now an abundant scientific literature finding that reforestation and other reductions of cropland in Europe has led to outsourcing its food production and driving deforestation abroad to produce Europe's food, with both carbon and biodiversity losses elsewhere. (A partial list includes: (Cabernard, Pfister, and Hellweg 2024), (Pendrill et al. 2019), (T. Searchinger et al. 2022), (Chaudhary and Kastner 2016). The CRCF explicitly instructs that these effects outside of Europe must be considered.

In addition, in an undisputed paper, it was shown that the MIRAGE model results for ethanol shown in Annex VIII of the RED had a vastly lower ILUC because of projected reductions in food consumption. Some of this was reduction in food quantity. If crops are diverted to biofuels but not replaced, there is correspondingly lower indirect land use change. But without this reduction in food consumption quantity, the MIRAGE model would find that grain-based ethanol increases greenhouse gas emissions (T. D. Searchinger et al. 2015), Moreover, the MIRAGE model also estimates a vast reduction in food quality, with high value food crops particularly olives being replaced by expansion of wheat or corn. Without the reductions in both food quantity and quality, for example, the ILUC emission estimated by MIRAGE for wheat would have been 79 g/MJ (see both main text and supplement for T.D. Searchinger et al. 2015).

Assuming the model is accurate, any greenhouse gas reductions due to reductions in food consumption due to higher food prices would not be acceptable under the CRFC mandate. It requires that methodologies "take into account the need to contribute to

ensuring food security," and states, the "certification methodologies shall . . . (c) contribute to ensuring the Union's food security." Article 8(2a), p.16 similarly specifies that certification methodologies "should take into account the need to contribute to ensuring food security."

As discussed in some detail in the supplement to T.D. Searchinger et al. (2015), there are also other fundamental problems with the MIRAGE analysis. In effect, the analysis assumed a very large yield elasticity and a very low global land area elasticity that together guaranteed a low ILUC. As discussed in that paper, neither of these elasticities had an underlying economic basis.

Beyond these flaws, there is much new science. For example, researchers at the Potsdam Institute using the MagPie model found that ILUC for biofuels from high-yielding energy crops over 20 years would cause 138 grams CO_2/MJ emissions, substantially more than fossil emissions (Merfort et al. 2023).[8]

The unused, provisional ILUC numbers in Annex VIII of the RED are therefore not consistent with the requirements in the CRCF either to be conservative or consistent with the most recent science. The CRCF methodologies therefore either needs to engage in and develop a thorough and conservative process of estimating indirect land use change, or to be conservative, it needs to exclude biomass produced on existing agricultural land.

6. The failure to meet carbon sink requirements makes additional wood harvest in the EU "unsustainable demand."

One of the mandates of the CRCF is that the methodologies must "ensure the avoidance of unsustainable demand of biomass raw material." Article 8, par. 2a(g). This is a separate requirement from proper GHG accounting.

The LULUCF Regulation has established a target for the EU carbon sink of 310 million tons of CO_2 per year by 2030, which the EU is not meeting. The revised Renewable Energy Directive has furthermore introduced a requirement for consistency between EU Member States' biomass fuels production and that State's LULUCF target (Art.29, §7a & 7b). A natural reading of the law would be that any additional wood harvests in a country not meeting its target are unsustainable and biomass fuels not considered sustainable at least unless and until the European sink exceeds the designated level.

[8] The paper reported 92 gCO_2/MJ over 30 years, which converts to 138 using the 20-year period used by the EU to amortize land use change emissions. These are emissions from land use change alone and therefore exclude production emissions. Combustion emissions from fossil fuels are around 74 gCO_2/MJ. (Adding production emissions would increase both but probably more for energy crop biofuels.)

Moreover, if Europe cannot be a source of additional woody biomass, the CRCF provisions requiring that effects "outside the Union" under the CRCF (Article 7 [2]) imply that sourcing wood from outside Europe is also not an acceptable option.

Summary

The treatment of biomass as carbon neutral in the draft methodologies does not reflect legal or scientific requirements. Either the methodologies should develop and implement a proper accounting system for the reductions in terrestrial carbon storage caused directly or indirectly by biomass use or they should restrict crediting of biomass to waste sources that do not have potential to reduce terrestrial carbon storage.

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Appendix: Partial List of Papers Finding that Harvest of Wood for Bioenergy Increases Emissions for Decades to Centuries

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