



*Climate Action Network (CAN) is the world's largest network of civil society organisations working together to promote government action to address the climate crisis, with more than 1500 members in over 130 countries.*

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## Overview<sup>1</sup>

Bioenergy in various forms – including biofuels, woody biomass, and bioenergy with carbon capture and storage (or BECCS) – are growing in prominence as purported energy and climate solutions, both as a potential source of renewable energy, and as means for carbon sequestration. However, scaling up of bioenergy poses serious risks to biodiversity, to socio-economic well-being, and to the climate itself. In many cases, far from being a climate solution, bioenergy is a dangerous distraction that can harm the climate and be used by industry to delay urgent climate action.

Bioenergy is also a key feature of increasing calls for a new “bioeconomy”, set to gain increasing attention in the lead-up to and beyond COP30. While biomass is a scarce resource, the “bioeconomy” relies on it to serve huge and competing demands. With multiple interpretations of what the “bioeconomy” means, and a lack of clear definitions, extreme care is needed to ensure that the bioeconomy does not become a gateway for harmful bioenergy approaches.

This CAN position paper refutes the idea that bioenergy can be a universal and significant “climate solution”. With few exceptions, bioenergy can only play a marginal role, and its limited use must be stringently regulated and controlled to avoid harm.

## What is bioenergy?

In all forms of bioenergy, biological materials are burned with CO<sub>2</sub> emissions as an unavoidable byproduct. While different bioenergy technologies may have different impacts and risks, they are almost always problematic and risky, particularly at scale.

### Biofuels

Biofuels are derived from plants, algae or animal waste and can be both liquid and gaseous fuels. Most forms of biofuels pose significant risks and negative impacts for land, ecosystems and communities and the climate.

First-generation biofuels include ethanol and biodiesel made from food crops such as corn, vegetable oils, and sugar cane. Second-generation biofuels include biogas, including production of methane through anaerobic digestion of manure – often from intensive livestock systems,

biodiesel, and cellulosic ethanol derived from non-food biomass such as agricultural waste, wood, and algae.

While biofuels can be used for heating, industrial processes, and electricity generation, massive growth scenarios are proposed as climate responses, particularly for the transportation sector. In the International Energy Agency (IEA) Net Zero by 2050 roadmap, 'sustainable aviation fuels (SAF)' in the form of bio-kerosene (a type of liquid biofuel) represents 15% of the anticipated aviation fuel demand for 2030, and as high as 45% in 2050.<sup>2</sup> Brazil already mandates a 27% ethanol blend in gasoline with heavy reliance on sugarcane. The government intends to soon increase this to 30%, and already allows up to a 35% blend.<sup>3</sup>

## **Woody biomass based bioenergy**

Bioenergy from woody biomass includes both electricity and heat production from the burning of trees, shrubs, and roots, and can include wood from both natural forests and plantations.

Large-scale forest-based bioenergy requires large land areas with inherent impacts on local populations and ecosystem health. Using forests for bioenergy results in immediate CO<sub>2</sub> emissions, which may or may not be eventually absorbed by new trees.<sup>4</sup> Cutting of forests also releases large amounts of carbon stored in the soil.

Over the timescales available to avoid runaway climate change, burning wood can be even worse than burning fossil fuels, essentially because doing so creates more emissions for the same amount of energy and because of how long it takes for trees to grow back. Even in best best-case scenarios, such uptake of CO<sub>2</sub> takes decades or even centuries as trees grow slowly. This is clearly not compatible with a climate emergency where every addition of emissions over the next years and decades threatens to breach critical tipping points. Woody biomass bioenergy threatens the removal of standing forests as vital planetary carbon sinks on a huge scale at a critical time for the climate.

Yet, woody biomass-based bioenergy is heavily promoted and assumed in numerous climate models and energy plans.<sup>5</sup> For example, biomass already accounts for nearly 60% of the EU's renewable energy consumption, surpassing the combined contribution of wind and solar energy, with solid bioenergy (woody biomass) constituting nearly 70% of this.<sup>6</sup> Assessment for the new EU Renewable Energy Directive outlines a 'need' to further increase bioenergy use from 2030 to 2050 by an average of 69% (where harvested stemwood would stay at current (high) levels and wood from residues and fast-growing crops would increase).<sup>7, 8</sup>

Countries are also co-firing woody biomass with coal, claiming this as 'abatement' of coal power emissions. This is an accounting trick, since the emissions remain as high or higher than before fuel substitution. Indonesia, as one example, has mandated co-firing biomass with coal at all 57 government-owned power stations (107 generators), which will drive massive conversion of natural forests to monoculture tree plantations.<sup>9</sup> There is increasing pressure to halt this kind of accounting scam.<sup>10</sup>

## **Bioenergy with Carbon Capture and Storage (BECCS)**

BECCS is a form of carbon dioxide removal (CDR) geoengineering and combines two problematic technologies – bioenergy (generally from woody biomass) and Carbon Capture and Storage

(CCS). The idea is premised on massively scaling-up the supply of biomass (e.g. through vast tree plantations, collection of forest ‘residues’ or agriculture waste), burning this biomass in large numbers of bioenergy power plants, and through extensive new infrastructure in the form of unproven, expensive and risky CCS technology capturing the CO<sub>2</sub> emissions, transporting it and then injecting it underground.<sup>11</sup>

This would need to be done on a vast scale to have any theoretical hope of sequestering enough CO<sub>2</sub> to tangibly impact the global average temperature. In practice, impacts on forests and lost sequestration would hamper the assumed CO<sub>2</sub> removal, and any negative emissions, if they occur, would likely be decades into the future. Yet, the technology is presented as a major vehicle for carbon dioxide removal (CDR) – with assumptions in IPCC reports reaching 5-10 Gt CO<sub>2</sub> per year by 2050 and cumulative removals of 100-1000 Gt CO<sub>2</sub> by the end of the century.<sup>12</sup> While available land is very limited, the landmass required for such removals equals the size of sub-continent.<sup>13</sup> The CCS infrastructure would likely need to be on par with or surpass that of the current oil and gas infrastructure.

### **Other forms of Bioenergy**

There are also examples of bioenergy which, if not carried out at scale, and if done appropriately, may be at less risk of creating harmful and perverse effects. These can include smallholder farmers’ growing of jatropha along farm boundary hedges in a way that does not conflict with land use or access; smallholder farmers’ use of animal or human waste to harness small-scale methane for cooking; municipal harnessing of human and compost waste methane to fuel buses and cars.

CAN notes, however, that when these approaches are scaled up excessively, they can also create perverse incentives and harm – for example, the use of manure created by factory farming of livestock to create methane for energy use, thus giving the false appearance of “greening” and justifying a deeply damaging industry.

CAN further notes that while domestic firewood use does add to emissions, and has negative health, environmental and socioeconomic impacts, it is in many parts of the world a traditional form of bioenergy that is often the only option available for billions of people living in poverty. CAN recognises the importance of rapid scaling up of energy access and transition to the electrification of cooking and other effective alternatives. This is a neglected priority that directly affects the well-being of a large part of the world’s population, particularly affecting women, children, and rural communities, and must be immediately prioritised. This is a matter of development and well-being more than a climate concern.

## **Bioenergy concerns**

### **Threats to human rights and other socioeconomic harms**

Bioenergy already incurs significant harm to communities and individuals across the world. Further expansion risks worsening human rights violations, health impacts, armed conflict, and climate injustice to communities who have done little to cause climate change but are already experiencing climate impacts most severely:<sup>14, 15</sup>

- Conflicts over land are already prevalent, where more often than not, marginalised communities, smallholder farmers, Indigenous Peoples, and women are negatively

impacted, with their territories often falsely deemed 'marginal' or 'idle' in order to justify land grabs. The projected, vast expansion of bioenergy could have negative/disastrous impacts on the human rights and livelihoods of billions of people.<sup>16</sup>

- As seen with earlier biofuel land grabs, bioenergy can have serious impacts on the right to food, as competition for land triggers rising food prices,<sup>17</sup>
- Plantations for bioenergy have a direct impact on water availability, and can lead to both conflict over water and water shortage, impacting the right to clean water and to sanitation.
- Both the burning of biomass (for cooking and heating in homes and as fuel in power plants) as well as processing of biomass (such as the production of wood pellets) cause air pollution and respiratory diseases, often in socially disadvantaged communities.<sup>18 19</sup>
- Bioenergy production, in combination with the generation of carbon credits, tends to compound the commodification of nature and drive local conflicts and land grabs. This puts Indigenous Peoples, communities, and individuals at risk of forced evictions, harming their right to adequate housing, among other potential human rights violations.
- The enormous construction of pipelines, storage facilities, and other infrastructure required for large-scale BECCS would introduce new, significant problems related to land annexation, risks of accidents (e.g. rupturing pipelines), and CO<sub>2</sub> leakage.<sup>20</sup>
- The subsidization of anaerobic digesters for biogas production may put producers of factory-farmed livestock at a competitive advantage, exacerbating inequalities and putting smallholder farmers at risk. This threatens not only livelihoods but also local economies and food security.

## **Biodiversity and environmental harm**

Bioenergy can have severe negative impacts on biodiversity and ecosystem health:

- Intensified and existing pressures on natural forests and biodiverse ecosystems, many of which are home to declining or rare species, as short-term logging and harvesting of biomass get incentivised, and forest plantations are promoted.<sup>21</sup>
- Further pressures to convert forests and biodiverse agriculture into monocultures of crops for biofuel production.<sup>22</sup>
- Threats to marine ecosystem health from large-scale algae farming for the production of biofuels.
- Increased pressure and incentives to apply artificial fertilisers to both croplands and forests in order to maximize yields for burning – with the risk of adverse effects on ecosystems and increased emissions from fertiliser production and application.
- Deforestation, weakening of ecosystem integrity, and depletion of nutrients as biomass is extracted for burning – both in terms of industrial practices and for household use for both heating and cooking.<sup>23</sup>
- Local environmental harms, public health risks, and public safety threats for communities near liquid biofuel refineries and biomass burning power plants.
- Environmental and health harm from the CCS component of BECCS, as pipelines, bioenergy power plants, and other infrastructure, impact habitats, cause risk for pipeline leakage and explosions, and generate massive toxic waste pollution from CO<sub>2</sub> scrubbing processes.

## Harm to the climate

Most bioenergy approaches risk harming the climate far more than mitigating climate change, for the following reasons:

- Liquid biofuels are usually portrayed as “carbon neutral” or low emissions. This is often wrong. In fact, over the course of their full life cycle, they can lead to higher GHG emissions than fossil fuels (known as the “carbon debt” of biofuels), due to the emissions released through production and application of synthetic fertilisers, deforestation, industrialised crop production and processing of crops into liquid biofuels.<sup>24</sup> Furthermore, there is significant variation in the reliability of biofuel Life Cycle Assessments (LCAs), as methodologies vary in their inclusion of direct and indirect land use change, non-CO<sub>2</sub> GHGs, soil carbon, and other factors.<sup>25</sup> This casts further doubt on claims of GHG reductions in biofuels.
- Turning crops into biofuels makes no sense in climate terms when that land could be used to grow food instead. Neither does it make sense to burn wood instead of restoring natural carbon sinks such as forests. The opportunity cost for any action must always be considered.<sup>26</sup>
- In animal agriculture, subsidizing the use of anaerobic digesters for biogas production could create perverse incentives to increase herd sizes, thus increasing emissions and often resulting in reduced space for animals (which also increases the risk of both established and novel zoonotic diseases).
- Misleading claims that woody biomass-based bioenergy is ‘carbon neutral’. Burning wood instantly releases carbon dioxide, whereas forest regrowth to sequester this carbon can take decades or centuries. Moreover, there is no guarantee that new trees will grow back or survive – there may be new land uses or forests may burn.<sup>27, 28</sup> The assumed carbon sequestration is then lost, which would mean a net *increase* of emissions..
- Cutting forests through clearcuts furthermore releases carbon stored in the soils, further adding to emissions.
- Standing, old forests are excellent stocks and sinks, which generally absorb more carbon than young forests, and are essential for biodiversity and resilience to climate disasters.<sup>29</sup> Promotion of bioenergy incentivises industry to cut such forests under false pretence of ‘climate action’.
- Even burning dead trees is likely to increase emissions over climate-relevant timescales, because if left in situ, they would take a long time to decay. The European Commission’s Joint Research Centre considers that burning ‘coarse woody debris’ (anything over 10 cm in diameter at the widest point) will likely increase emissions compared to fossil fuels for over 50 years.<sup>30</sup>
- Furthermore, even residues such as sawdust and black liquor from sawmills, as well as trunks, stumps, and branches, are generally better used for higher economic value chain purposes, such as chemical industry use or wood panel production, than for burning.
- Current accounting rules have created massive loopholes that result in increased emissions since the burning of biomass and biofuels are not counted as emissions (but rather buried in how countries report the change in land use). Countries are continuing to emit and, in essence, increasing their emissions from proliferating bioenergy while claiming and reporting climate progress.<sup>31</sup>
- Bioenergy projects can also involve the generation of carbon credits<sup>32</sup>, which are often inappropriately used to offset ongoing emissions. CAN categorically rejects all forms of

offsetting, which are in essence ‘permits to pollute’.<sup>33</sup> Carbon credits generated from bioenergy projects tend to cause double harm – allowing emissions from the burning of bioenergy and continued emissions by the buyer of the offset.

- Co-firing biomass with coal as an alleged ‘abatement’ entrenches the use of coal whilst failing to reduce emissions and contributing to deforestation and forest degradation.
- The assumed storage of CO<sub>2</sub> for CCS/BECCS is often in old oil wells. Perversely, the pumping of CO<sub>2</sub> into these old wells can help the fossil fuel industry to extract remaining oil or gas (this is already pursued under the rubric of ‘Enhanced Oil/Gas Recovery’ (EOR)). Any storage of CO<sub>2</sub> would be rendered pointless and even cause net harm by the burning of the oil or gas released by the EOR.<sup>34</sup> This is completely absurd.
- Perhaps most significantly, the inclusion of bioenergy as a large share of countries’ and corporations’ climate targets leads to greenwashing and delayed action for real solutions.<sup>35</sup>

### **Exceptions that prove the rule**

CAN also recognises that there are exceptions that prove the rule, although there are only a very limited number of examples which are generally thought to avoid the issues raised above. One notable case here is sugar cane ethanol produced in Brazil, which, when produced on degraded former pasture land (which would otherwise act as a source of carbon emissions), can represent GHG reductions over a full life cycle when compared to fossil fuels.<sup>36</sup> For such practices to be acceptable overall, however, there needs to be clear socio-economic acceptability and no harmful environmental impacts.

The fact that such examples are indeed few and far between underlines this paper’s key point that bioenergy is almost always harmful, and must not be viewed as a climate panacea. Limited exceptional cases must never be used to justify the adoption of bioenergy as a global climate solution.

## **CAN Principles / Recommendations**

Given the inherent limitations of the various forms of bioenergy, their human rights, socio-economic and environmental risks, and not least their negative climate impacts, CAN concludes that bioenergy at scale is not a viable climate solution. Current projections and plans for bioenergy by governments and corporations constitute a severe dangerous distraction from the real solutions we must rapidly implement.

### **In light of this, CAN demands that:**

- Bioenergy must not be portrayed and promoted as a significant and universal climate solution. Any role that bioenergy can play will be inherently limited by climate, biodiversity, and socio-economic constraints, and thus peripheral to the necessary focus on ambitious climate transformation.
- Bioenergy approaches must not be used as a substitute or reason to delay real and urgent climate action, such as ending fossil and other carbon-emitting fuels. Bioenergy in its various forms cannot be central components for ambitious climate action.
- The practice of co-firing biomass with coal as an alleged form of abatement of coal power is not acceptable.

- Countries and corporations must immediately revise their plans and targets and eliminate their reliance on biofuels, woody biomass, and BECCS, including in their NDCs. The resulting gap must be filled by environmentally and socially appropriate renewable energy and by reducing overconsumption. The gap cannot be covered by dangerous distractions such as geoengineering or other false solutions.
- Existing production and use of bioenergy from forest biomass, dedicated crop-based biofuels, and biomass from secondary wastes or residues (that can be used by local industries for bio-based products) must be phased out, including by ending subsidies, tax exemptions, and other incentives. This means strict enforcement of the cascading and waste hierarchy principles.
- The Bioeconomy concept must be clearly defined and restricted to not include reliance on and promotion of bioenergy, biofuels, or biomass (or indeed other harmful practices).
- The practice of offsetting must not be further legitimised and promoted. Bioenergy shall under no circumstances be connected with and fuelling offsetting practices.
- Bioenergy must not be included and relied upon as significant elements in climate and energy modelling. The heavy prominence of assumed, future use of BECCS in many of the IPCC's Integrated Assessment Models (IAMs) is not appropriate.
- The environmental, infrastructure and health costs and limitations of large-scale BECCS must be further documented and substantiated. It is well established that BECCS has essentially functioned as a 'black box' in IAMs, filling in the gaps in projected climate action to make climate targets look more easily achievable without radical, transformative action.
- Current accounting rules under UNFCCC and other regimes (e.g. IPCC, EU) must be overhauled to transparently count emissions from bioenergy in the location and sector where they take place.
- A rapid transition to people-centred and appropriate electrification of cooking must be prioritised, supported, and financed based on clear equity and climate justice principles, as a priority health and development imperative.

**In cases where bioenergy is still carried out, CAN demands that:**

- Any application of bioenergy be subject to independent environmental and human rights assessments that ensure the strictest application of human rights, rights of Indigenous Peoples, and other stringent safeguards throughout the supply chain, with meaningful community participation and respect for and implementation of Indigenous Peoples' right to Free, Prior and Informed Consent.
- Bioenergy approaches must in no way harm or threaten community and Indigenous Peoples' land rights.
- Use of material from natural forests for large-scale bioenergy be strictly banned in order to protect and safeguard biodiversity and ecosystem integrity.

<sup>1</sup> International Network for Sustainable Energy (INFORSE) INFORSE finds that biogas produced from mixture of organic waste streams is a useful form of renewable energy that both treat sludge and other waste streams and also produces renewable energy as long as the waste streams are from sustainable waste sources and production systems.

<sup>2</sup> IEA (2021) *Net Zero by 2050*, IEA, Paris <https://www.iea.org/reports/net-zero-by-2050> (p.136)

<sup>3</sup> Presidencia de Republica (2025) *Silveira: E30 to lower gasoline prices, free Brazil from importation*. <https://www.gov.br/secom/en/latest-news/2025/03/silveira-e30-to-lower-gasoline-prices-free-brazil-from-importation> (accessed 5 May 2025)

<sup>4</sup> The European Commission's Joint Research Council paper identified that the majority of forest biomass burned in the EU as a "lose-lose" outcome for climate and biodiversity, with 23 of 24 scenarios either leading to emissions from burning biomass exceeding emissions from burning fossil fuels in less than two decades, or posing a risk to biodiversity, or both.

Camia, A., Giuntoli, J., Jonsson, R., Robert, N., Cazzaniga, N. E. et al., (2021) *The use of woody biomass for energy production in the EU*, Publications Office. <https://data.europa.eu/doi/10.2760/831621>

On biogas from animal agriculture, see also: IATP and Changing Markets Foundation. (2022) *Emissions Impossible: How emissions from big meat and dairy are heating up the planet – Methane Edition • Changing Markets. Changing Markets*. <https://changingmarkets.org/report/emissions-impossible-how-emissions-from-big-meat-and-dairy-are-heating-up-the-planet-methane-edition/>

<sup>5</sup> See Bastable, Sophie (2024). *Burning Up the Biosphere: A Global Threat Map of Biomass Energy Development, 2024 update* <https://environmentalpaper.org/2024/11/burning-up-the-biosphere-a-global-threat-map-of-biomass-energy-development-2024-update/>

<sup>6</sup> See EU biomass portal: [https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomass\\_en](https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomass_en) and also:

IEA Bioenergy (2021) *Implementation of bioenergy in the European Union – 2021 update*. [https://www.ieabioenergy.com/wp-content/uploads/2021/11/CountryReport2021\\_EU28\\_final.pdf](https://www.ieabioenergy.com/wp-content/uploads/2021/11/CountryReport2021_EU28_final.pdf)

<sup>7</sup> European Commission (2021). *Impact Assessment Report accompanying the Proposal for a Directive of the European Parliament and the Council*. [https://eur-lex.europa.eu/resource.html?uri=cellar:0f87c682-e576-11eb-a1a5-01aa75ed71a1.0001.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:0f87c682-e576-11eb-a1a5-01aa75ed71a1.0001.02/DOC_1&format=PDF)

<sup>8</sup> See further details in: *Beyond Bioenergy – A civil society statement on EU Bioenergy policy*. [https://www.fern.org/fileadmin/uploads/fern/Documents/2025/Beyond\\_Bioenergy\\_CS0\\_Statement\\_2025.pdf](https://www.fern.org/fileadmin/uploads/fern/Documents/2025/Beyond_Bioenergy_CS0_Statement_2025.pdf)

<sup>9</sup> See: Putt, Peg (2024) *Cofiring is not abatement*. Biomass Action Network. [https://environmentalpaper.org/wp-content/uploads/2024/06/BAN-Briefing-Co-firing-is-not-abatement-final.pdf?utm\\_source=brevio&utm\\_campaign=Monthly Bulletin BAN&utm\\_medium=email](https://environmentalpaper.org/wp-content/uploads/2024/06/BAN-Briefing-Co-firing-is-not-abatement-final.pdf?utm_source=brevio&utm_campaign=Monthly Bulletin BAN&utm_medium=email)

and

Sairinen, Varpu (2023) *Co-firing with biomass in Indonesia: Debunking Emission Reduction Claims*. Environmental Paper Network. <file:///Co-firing with biomass in Indonesia/ Debunking Emission Reduction Claims>

<sup>10</sup> For example, the global corporate renewable energy initiative RE100 no longer allows its members to claim renewable energy electricity use from co-firing involving coal. <https://www.there100.org/our-work/news/co-firing-qas-re100s-technical-criteria-update-2025>

<sup>11</sup> ActionAid (2019) *BECCS: A dangerous distraction* <https://www.actionaidusa.org/wp-content/uploads/2019/06/BECCS-Explainer.pdf>

<sup>12</sup> IPCC (2018) Special Report on Global Warming of 1.5°C. [https://www.ipcc.ch/sr15/chapter/chapter-2/?utm\\_source=chatgpt.com](https://www.ipcc.ch/sr15/chapter/chapter-2/?utm_source=chatgpt.com)

IPCC (2022) *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* P.R. Shukla et al. Cambridge University Press, Cambridge, UK and New York, NY, USA <https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/>

<sup>13</sup> See for example the Land Gap Report (<https://landgap.org>), Dooley, K., Christiansen, K.L., Lund, J.F. *et al.* Over-reliance on land for carbon dioxide removal in net-zero climate pledges. *Nat Commun* **15**, 9118 (2024). <https://doi.org/10.1038/s41467-024-53466-0> and the IPCC Special Report on Climate Change and Land (<https://www.ipcc.ch/srccl/>).

<sup>14</sup> See for example the Biomass Action Network submission to the UN Special Rapporteur on Human Rights and Climate Change, signed by 84 organisations, outlining the human rights impacts of large-scale 'modern' biomass energy in various countries and throughout the supply chain: <https://environmentalpaper.org/wp-content/uploads/2025/05/BAN-Submission-to-UN-Special-Rapporteur-on-Human-Rights-and-Climate-Change-docx.pdf>

<sup>15</sup> See for example: Mondragón, H. (2007, December 5). *Colombia, caña de azúcar y palma aceitera. Biocombustibles y relaciones de dominación*. Biodiversidad en América Latina. <https://www.biodiversidadla.org/Documentos/Colombia-cana-de-azucar-y-palma-aceitera.-Biocombustibles-y-relaciones-de-dominacion>

Osorio Pérez, F. E. (2015). *Tramas entre paramilitarismo y palmicultura en Colombia. Memoria y sociedad: revista del Departamento de Historia y Geografía*, 19(39), 11. <https://doi.org/10.11144/javeriana.mys19-39.tppc>

<sup>16</sup> As an example, studies have shown in the Mato Grosso, Brazil nearly 40% of wood production was illegal in 2020, and 56% of illegal logging in protected areas occurred within indigenous territories [https://amazon.org.br/wp-content/uploads/2021/10/Simex\\_MT\\_Agosto2019-Julho2020.pdf](https://amazon.org.br/wp-content/uploads/2021/10/Simex_MT_Agosto2019-Julho2020.pdf)

<sup>17</sup> See for example Bos, Julie (2024) *Biofuel Blunders: Time to fix two decades of EU policies driving food insecurity*. Oxfam International <https://policy-practice.oxfam.org/resources/biofuel-blunders-time-to-fix-two-decades-of-eu-policies-driving-food-insecurity-621622/>

<sup>18</sup> See Health and Environment Alliance (2024). *New infographic on the health and climate threat from wood burning* <https://www.env-health.org/new-infographic-on-the-health-and-climate-threat-from-wood-burning/>

<sup>19</sup> See e.g. Davis, Sam. (2023). *Wood Pellets and Environmental Justice Communities*. Dogwood Alliance. <https://dogwoodalliance.org/2023/02/wood-pellets-and-environmental-justice-communities/>

<sup>20</sup> Land use conversion for BECCS is likely to take place in the Global South with many models assuming that the lowest productivity farmlands would be abandoned first – often impacting the only places where marginalised people are able to farm. See e.g:

McElwee, P. (2022) Advocating afforestation, betting on BECCS: land-based negative emissions technologies (NETs) and agrarian livelihoods in the global South. *The Journal of Peasant Studies*, 50(1), 185–214. <https://doi.org/10.1080/03066150.2022.2117032>

<sup>21</sup> See for example: Venier L.A., et al (2014) Effects of natural resource development on the terrestrial biodiversity of Canadian boreal forests. *Environmental Reviews*. **22**(4): 457-490. <https://doi.org/10.1139/er-2013-0075>

Anna Repo, et al. (2020) Forest bioenergy harvesting changes carbon balance and risks biodiversity in boreal forest landscapes. *Canadian Journal of Forest Research*. **50**(11): 1184-1193. <https://doi.org/10.1139/cjfr-2019-0284>

Cerullo, Gianluca et al. (2024). Conflicts and opportunities for commercial tree plantation expansion and biodiversity restoration across Brazil. *Global Change Biology*. Vol 30, Issue 3. <https://doi.org/10.1111/gcb.17208>

UUNECE and FAO (2023) *Data Brief 2023. Wood pellets and wood fuel*. <https://unece.org/sites/default/files/2024-02/2023-data-brief-we-20230205-for%20website.pdf>

Milman, Olivier et al (2024) US Forest Service failing to protect old growth trees from logging, critics say. *The Guardian* (1 Aug 2024). <https://www.theguardian.com/environment/article/2024/aug/01/us-forest-service-old-growth-trees-deforestation-logging>.

<sup>22</sup> See for example Moura, Ana (2022) *Biomassa: risco de apagão de oferta mobiliza setor florestal em MT*. <https://matogrosso.canalrural.com.br/agricultura/agronegocio/biomassa-risco-de-apagao-de-oferta-mobiliza-setor-florestal-em-mt/>

<sup>23</sup> See for example

Ranius, Thomas (2018). The effects of logging residue extraction for energy on ecosystem services and biodiversity: A synthesis. *Journal of Environmental Management*. Vol. 209, 1 March 2018  
<https://doi.org/10.1016/j.jenvman.2017.12.048>

<sup>24</sup> Fargione et al (2008) *Land clearing and the biofuel carbon debt* Science <https://pubmed.ncbi.nlm.nih.gov/18258862/>

<sup>25</sup> Jeswani et al (2020) *Environmental sustainability of biofuels: A review* <https://pmc.ncbi.nlm.nih.gov/articles/PMC7735313/>

<sup>26</sup> In the EU, forests and other vegetation regrowing on an area equivalent to what is currently used just for biofuel crops (5.3 Mha), could absorb 64.7 million tonnes of CO<sub>2</sub> from the atmosphere - nearly twice the officially reported net CO<sub>2</sub> savings from biofuels replacing fossil fuels (32.9 Mt of CO<sub>2</sub> eq).

See: Transport and Environment and Oxfam (2023). *Biofuels: An obstacle to real climate solutions*  
[https://www.transportenvironment.org/uploads/files/202303\\_IFEU-Study\\_TE\\_Briefing\\_EN\\_2024-04-29-153303\\_muae.pdf](https://www.transportenvironment.org/uploads/files/202303_IFEU-Study_TE_Briefing_EN_2024-04-29-153303_muae.pdf)

<sup>27</sup> See concerns from scientists at The European Academies' Science Advisory Council (EASAC) around the 'carbon payback' period of biomass being decades to hundreds of years <https://easac.eu/publications/details/commentary-on-forest-bioenergy-and-carbon-neutrality>

<sup>28</sup> See letter to the EU parliament from nearly 800 scientists, including multiple IPCC lead authors and winners of the US medal of science and Nobel prize: [https://wwfeu.awsassets.panda.org/downloads/update\\_800\\_signatures\\_scientist\\_letter\\_on\\_eu\\_forest\\_biomass.pdf](https://wwfeu.awsassets.panda.org/downloads/update_800_signatures_scientist_letter_on_eu_forest_biomass.pdf)

<sup>29</sup> See more detail about how continued deforestation, expansion of agriculture/timber production and ecosystem degradation is shrinking forest carbon sinks and in some cases turning them into sources : Piyu Ke et al. (2024) Low latency carbon budget analysis reveals a large decline of the land carbon sink in 2023, *National Science Review*, Volume 11, Issue 12, December 2024, nwae367, <https://doi.org/10.1093/nsr/nwae367> <https://academic.oup.com/nsr/article/11/12/nwae367/7831648>

<sup>30</sup> European Commission: Joint Research Centre (2020) *The use of woody biomass for energy production in the EU*. Publications Office of the European Union, Luxembourg [https://data.europa.eu/doi/10.2760/831621\\_JRC122719](https://data.europa.eu/doi/10.2760/831621_JRC122719).

<sup>31</sup> For a review of the present IPCC carbon mass flow approach and proposal for a change in the reporting and accounting methods that has the potential to address this national GHG emissions reporting issue, see Pulles, T et al. (2022). CO<sub>2</sub> emissions from biomass combustion Accounting of CO<sub>2</sub> emissions from biomass under the UNFCCC. *Carbon Management* 13(1), 181–189. <https://doi.org/10.1080/17583004.2022.2067456>

Bastable, Sophie (2023) How UNFCCC carbon accounting has created a biomass delusion and is contributing to climate change and global inequity. Environmental Paper Network (22 Nov 2023). <https://environmentalpaper.org/2023/11/how-unfccc-carbon-accounting-has-created-a-biomass-delusion-and-is-contributing-to-climate-change-and-global-inequity/>

<sup>32</sup> Certain carbon crediting methodologies under the CDM as well as under private standards in the voluntary carbon market are related to bioenergy.

UNFCC (2022, December) CDM Methodology Booklet, fourteenth edition, [https://cdm.unfccc.int/methodologies/documentation/2303/230426\\_BLS23047\\_CDM\\_booklet\\_v04.pdf](https://cdm.unfccc.int/methodologies/documentation/2303/230426_BLS23047_CDM_booklet_v04.pdf);

Barbara K Haya, Tyler Bernard, Aline Abayo, Xinyun Rong, Ivy S So, Micah Elias. (2025, March). Voluntary Registry Offsets Database v2025-02, Berkeley Carbon Trading Project, University of California, Berkeley, <https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database>

<sup>33</sup> See CAN's position on offsets: [https://climatenetwork.org/wp-content/uploads/2022/11/CAN-Positon\\_Carbon-offsetting\\_Nov-2022.pdf](https://climatenetwork.org/wp-content/uploads/2022/11/CAN-Positon_Carbon-offsetting_Nov-2022.pdf)

<sup>34</sup> Enhanced Oil Recovery (OER) leads to more emissions as more CO<sub>2</sub> is brought up for burning than is stored (ignoring all other factors). See for example estimates of a very conservative 1.2 factor increase of emissions in: Edwards, Ryan (2018). Infrastructure to enable deployment of carbon capture, utilization, and storage in the United States. *PNAS*, vol. 115, no. 38 <https://www.pnas.org/doi/epdf/10.1073/pnas.1806504115>

<sup>35</sup> Technologies like BECCS could reduce the perceived need to take real action to reduce emissions ("Mitigation deterrence"). See for example McLaren, D. (2020) Quantifying the potential scale of mitigation deterrence from greenhouse gas removal techniques. *Climatic Change* 162, 2411–2428 (2020). <https://doi.org/10.1007/s10584-020-02732-3>

<sup>36</sup> See, for instance, <https://www.teses.usp.br/teses/disponiveis/11/11140/tde-19102017-141335/pt-br.php>