BRIEFING - October 2025

CrOP30

Why burning food for land-hungry biofuels is fueling the climate crisis

Summary

Biofuels are promoted as a climate-friendly fix for transport decarbonisation, but at what cost? T&E has commissioned groundbreaking research that assesses the consequences of the global biofuels boom, analysing projected volumes, land use, and emissions in key regions. Combined with our own analysis, this briefing highlights the serious risks of current international biofuels policies.

A global biofuels boom driven by national policies and international standards
Backed by government support, global biofuels use has grown seven-fold over two decades, reaching 4% of transport energy demand in 2023. Over 75% of production comes from the U.S., Brazil, and Europe, mainly for road transport as biodiesel, hydroprocessed oils, or ethanol.

Demand is set to rise 40% by 2030. On top of this, new IMO rules and sustainable aviation fuel targets will fuel further growth, with shipping alone potentially doubling today's global biofuels use in the 2030s.

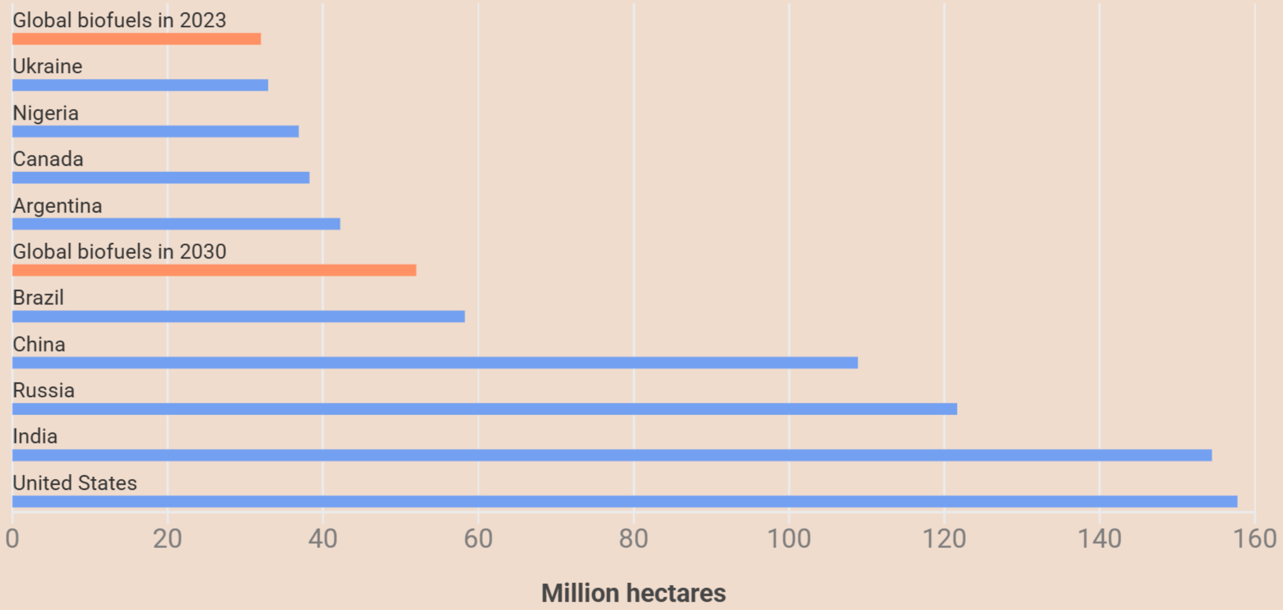
Land-hungry and high-emission crops still dominate biofuels demand
Despite growing promotion of advanced and waste biofuels as cleaner alternatives, over 90% of biofuels will still come from land-hungry food and feed crops by 2030. Canada, India, and Brazil are set to see the largest relative increases in first-generation biofuels, while the EU and UK will drive limited demand for advanced feedstocks. Altogether, by 2030 biofuels will require cropland the size of France, making them the sixth-largest country in terms of arable land currently used globally.

Cerulogy's analysis shows that when full supply chain and indirect land-use change (ILUC) impacts are included, biofuels emit 16% more CO_2 on average today than fossil fuels, with palm and soy-based fuels among the worst due to deforestation and peatland loss. By 2030, biofuels are projected to emit every year 70 $MtCO_2e$ more than the fossil fuels they replace, equivalent to the emissions of close to 30 million diesel cars. Alternatively, allowing current biofuel cropland to return to natural ecosystems could absorb over 400 $MtCO_2e$ annually, nearly double the direct emissions avoided from displacing fossil fuels with biofuels.

First-generation biofuels also carry serious ecological costs, particularly in biodiversity hotspots like Brazil and Indonesia, where deforestation threatens local wildlife. Their water footprint is also high: driving 100 km on biofuels requires nearly 3,000 litres of freshwater on average, compared to just about twenty litres for producing solar electricity and using it in an electric car.

A farming superpower: global demand for biofuels would make it the 6th largest country in terms of arable land in 2030

Biofuels land needs vs largest countries in terms of arable land currently used



Source: T&E, based on Cerulogy (2024) and World Bank (2021) • Global biofuels demand based on adopted national policies, not accounting for potential additional shipping demand currently under discussion at the IMO. Land required for biofuels co-products is excluded.

Land-based biofuels, an inefficient solution

Just 3% of the land currently used for first-generation biofuels could produce the same amount of energy with solar panels. Thanks to the greater efficiency of electric vehicles over combustion engines, that small share of land could power close to a third of today's global car fleet. On top of higher emissions savings, direct electrification of road transport therefore appears as a more efficient climate solution, while leaving arable land for food production and natural restoration.

Applying the same logic, first-generation biofuels emerge as a harmful path for decarbonising aviation and shipping. They fail to deliver the emissions savings needed, while waste- and advanced-based biofuels will only meet a limited fraction of sectoral demand. In contrast, hydrogen-based fuels produced from renewable electricity offer a more sustainable and scalable alternative.

Recommendations

1. **Safeguard climate policy from first generation food and feed crop biofuels:** World leaders and relevant decision makers must ensure climate and energy plans maintain strong safeguards against destructive biofuel feedstocks. Weakening land use change accounting mechanisms to allow food and feed crop feedstocks to count as renewable risks legitimising biofuels that cause deforestation, biodiversity loss and have higher lifecycle emissions than fossil fuels. With COP30 set to take place in Brazil this year, the world's second largest producer of

biofuels, the conversation around biofuels as a renewable energy resource must not dilute these safeguards in favour of increasing the production and consumption of crop biofuels.

2. **Direct climate finance to better decarbonisation projects:** Financing mechanisms must adopt strict sustainability criteria excluding biofuel expansion and only fund projects with verifiable emissions cuts. Public funds should prioritise electrification, efficiency and truly sustainable alternatives, not false solutions.

3. **Protect climate governance from industry:** Decisionmakers should limit the influence of biofuel industry alliances in global energy and climate decisions. These groups include fossil fuel companies invested in deforestation-linked fuels. Decision-making at the IEA, UNFCCC and other bodies must be transparent, conflict-free and guided by independent science, not corporate agendas.

1. The worrying global biofuels boom

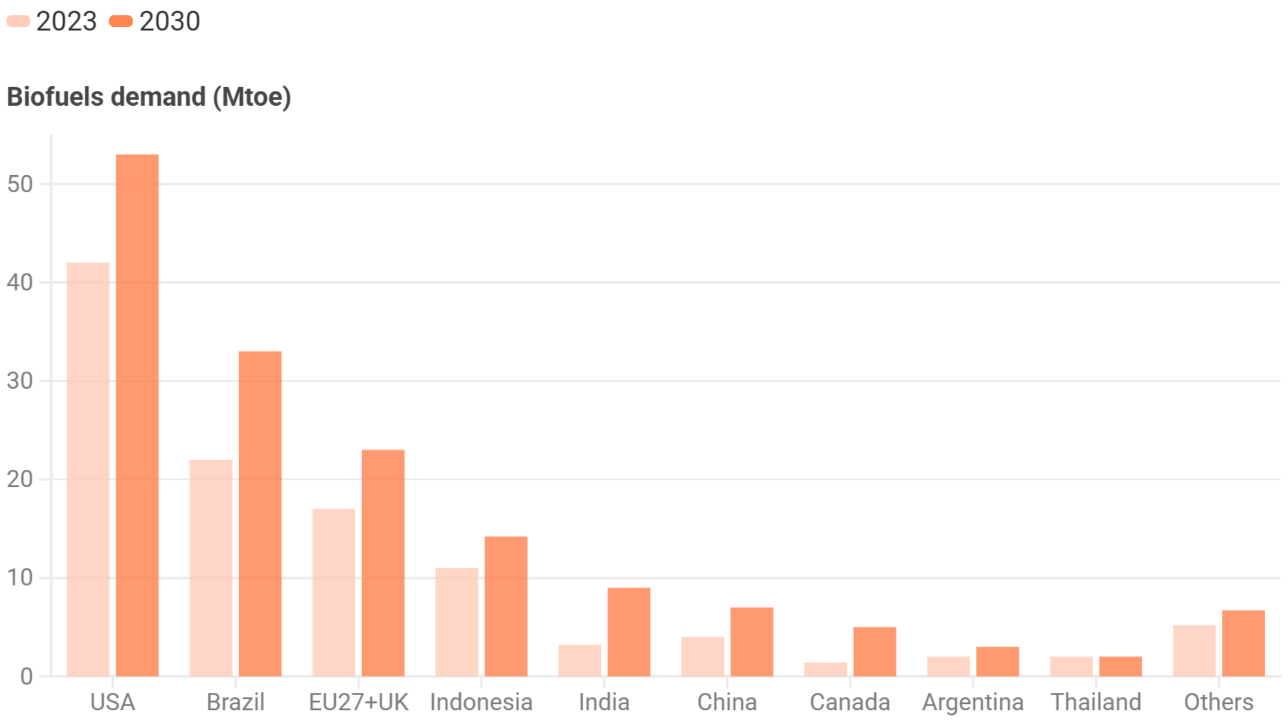
Using publicly available data, such as publications from the International Energy Agency and the Energy Institute, Cerulogy analysed global biofuels trends and modelled future demand based on existing biofuel mandates in the world's largest producing countries.

1.1 A handful of biofuel superpowers

Supported by many countries as an alternative to fossil fuels, global biofuels consumption grew seven-fold over the past two decades, reaching around [4% of the transport energy demand in 2023](). Production remains concentrated, with the US, Brazil, and Europe accounting for over 75% of global output, nearly all of which powers road transport via biodiesel, hydroprocessed vegetable oil, or ethanol.

Cerulogy's analysis of adopted policies shows that global demand would increase by 40% by 2030, while additional biofuels uptake can be expected from international aviation and shipping standards. Meanwhile, leading producers are aligning through platforms like the Global Biofuels Alliance and the Biofuture Platform to push for wider biofuels adoption.

A few regions dominate global biofuel markets, with demand expected to rise 40% by 2030



Source: T&E, based on Cerulogy (2024) • Projected biofuels demand based on adopted national policies.

Biofuels and geopolitics: Trump's tariffs, Brazil's push and Italy's African plan

From the World Trade Organization's ruling supporting the EU's ban on palm oil biofuels against Indonesia and Malaysia, to anti-dumping measures targeting Argentina, Indonesia, or China, biofuels play a key role in many trade disputes. More recently, Trump's trade strategy reinforces the US status as a biofuel superpower. Key moves include tightening restrictions on foreign biofuel access to US fuel standards, alongside trade deals aimed at boosting US biofuel exports to markets like the UK, Japan, Indonesia, and potentially India and the EU.

Similarly, Brazil, the world's second-largest biofuel producer, is emerging as a major global advocate, pushing for the inclusion of its biofuels in international aviation and shipping standards, being a key member of the Global Biofuels Alliance, and securing new market access deals with China.

As a final example, Italy is also advancing its biofuels strategy, which mainly relies on expanding its feedstock sourcing through its national oil company, Eni. Alongside Eni's new biorefinery planned in Malaysia, the Mattei plan is positioning Italy as a central biofuel hub between the EU and African countries. Specific projects in Kenya or Congo are for instance aimed at scaling up biofuel feedstock production. However, several investigations have raised serious concerns over limited local benefits and potential threats to food security.

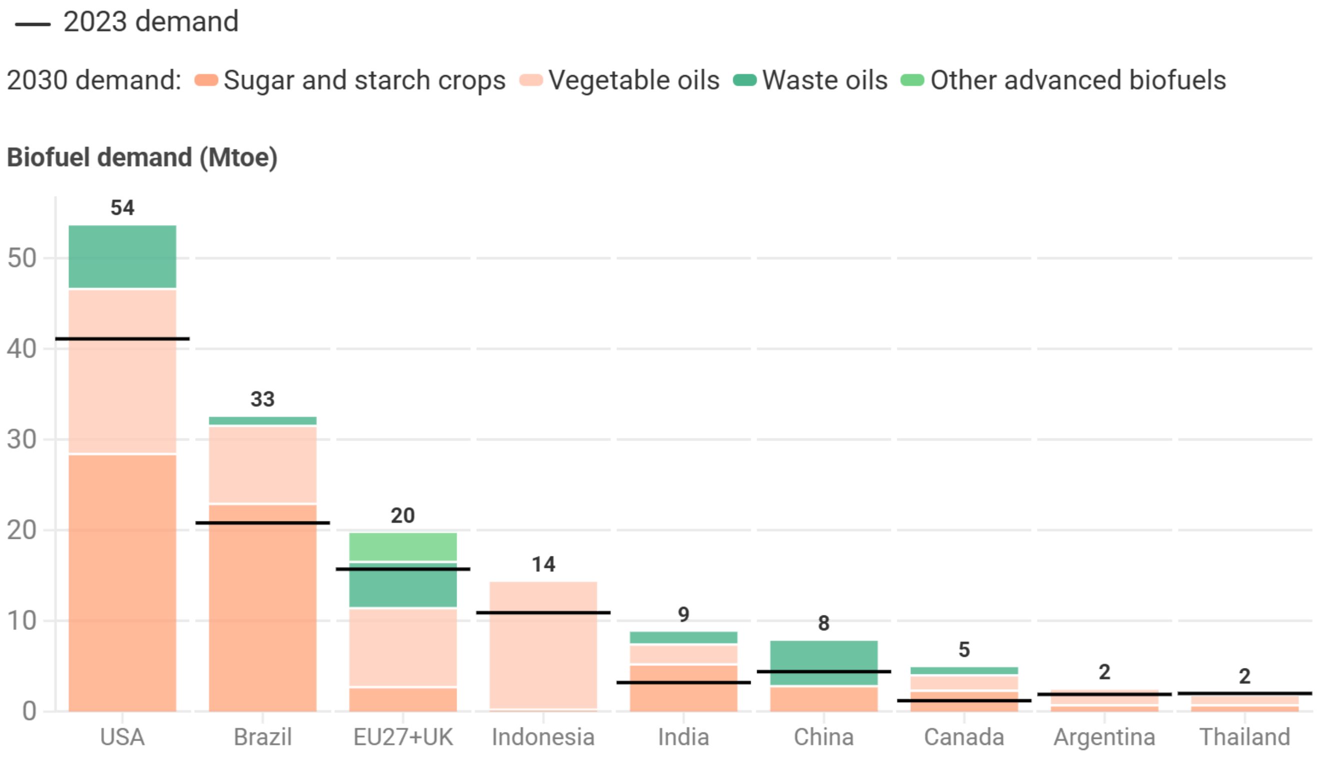
1.2 Future supply still tied to damaging crops

Today's biofuels still heavily depend on food and feed crops. Cerulogy's analysis shows that corn and sugarcane ethanol made up close to half of global biofuels in 2023. Next in line were palm and soybean oils, widely used to produce biodiesel and HVO.

In the US alone, around 130 million tonnes of corn were used for ethanol production, equivalent to one third of the country's total corn harvest in 2023. That same year, biofuels consumed a fifth of the world's vegetable oil supply, comparable to 100 million bottles of edible oil being burned as fuel every day.

While waste and advanced biofuels are advertised as a cleaner alternative to first-generation biofuels, Cerulogy's assessment of today's biofuels policies indicates that their uptake will remain very limited with still more than 90% of feedstocks expected to be based on food and feed crops by 2030. With some of the strongest incentives globally to shift toward second-generation biofuels, the EU and UK are expected to lead the world demand for these advanced feedstocks. Canada, India, and Brazil are projected to see the largest increases in first-generation biofuels: quadrupling, tripling, and growing by 50% respectively.

Biofuels will boom by 2030, but 90% will still be based on food and feed crops under current policies



Source: T&E, based on Cerulogy (2024)

2. Worrying environmental consequences

2.1 Biofuels, a whole lot of land

Driven by the EU Renewable Energy Directive and the US Renewable Fuel Standard, crop-based biofuels have expanded significantly over the past two decades, bringing with them high land-use demands, as already shown by studies in Europe and the US. In their study, Cerulogy estimated that global biofuels supply required 32 million hectares in 2023[1], equivalent to the size of Italy in arable, fertile land.

As a result of the forecasted global boom, land used for crop-based biofuels could surge by 60% by 2030 under current national mandates. That would push total land dedicated to biofuels to 52 million hectares, an area the size of France. This would place biofuels among the top six global users of arable land. And this doesn't even include the additional demand from international aviation and shipping now under discussion.

[1] Excluding crop co-products, such as soybean meal used in the animal feed industry.

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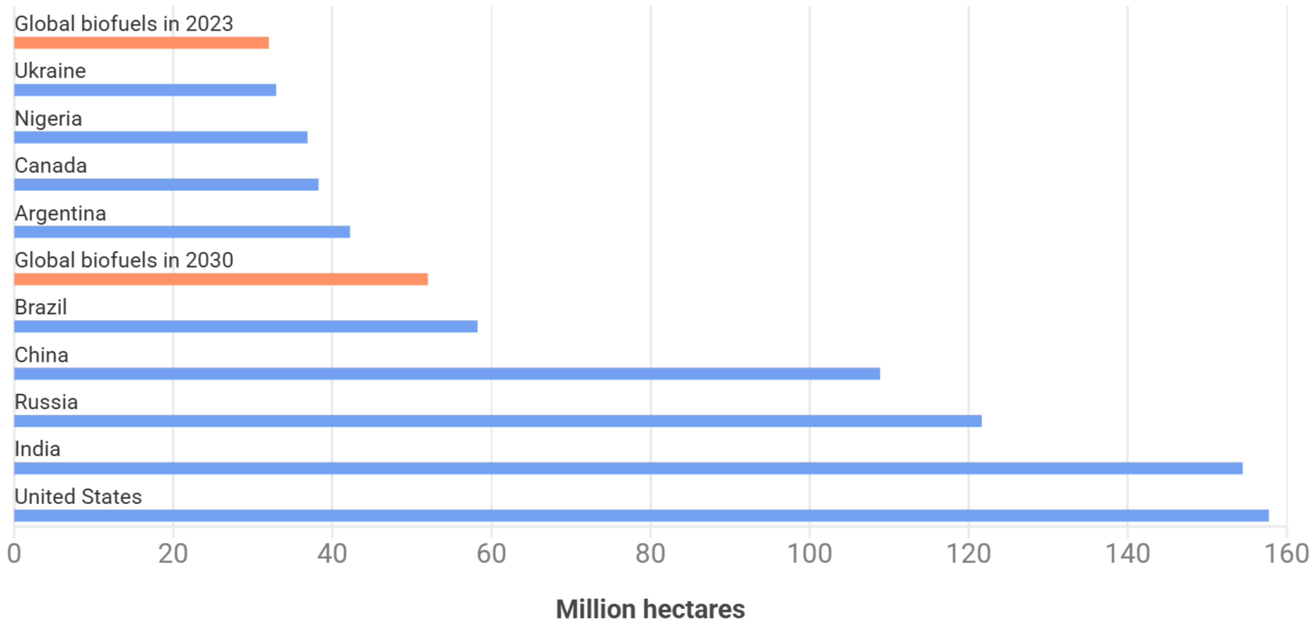


Source: T&E, based on Cerulogy (2024) and World Bank (2021) • Global biofuels demand based on adopted national policies, not accounting for potential additional shipping demand currently under discussion at the IMO. Land required for biofuels co-products is excluded.

2.2 Fueling deforestation and emissions

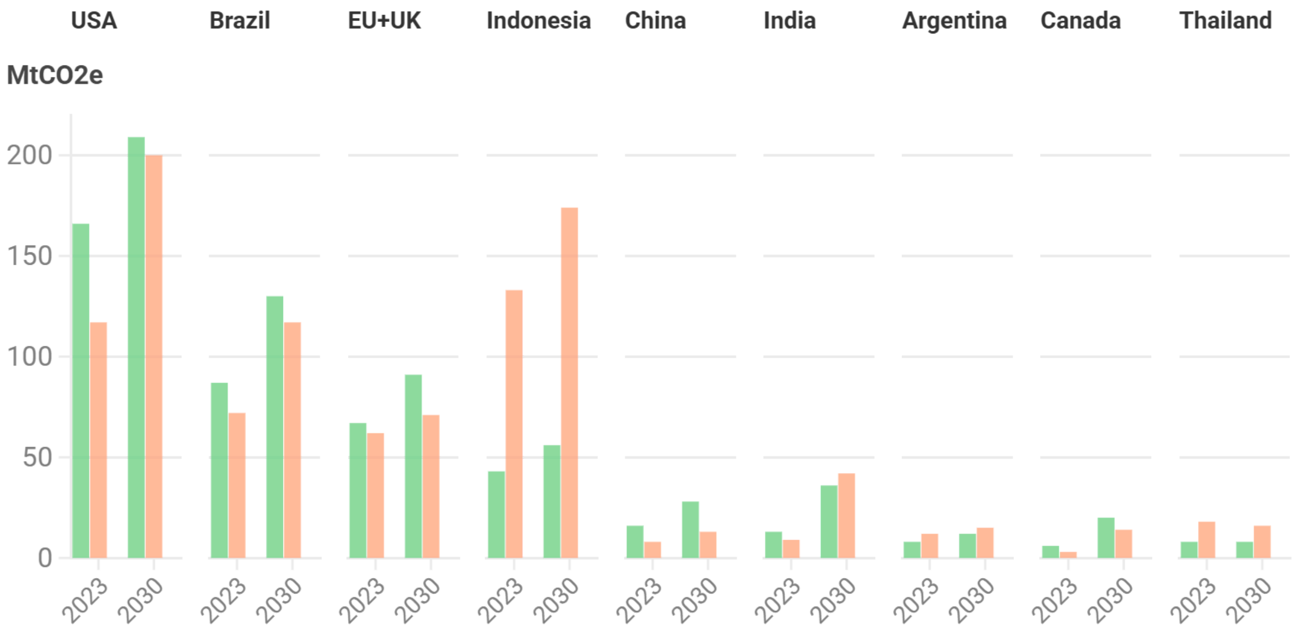
While biofuels replace polluting fossil fuels, they are also associated with significant greenhouse gas emissions, both from supply chains and from indirect land use changes (ILUC). In the most extreme cases, such as biofuels made from palm oil and soybean oil, emissions can be two to three times higher than those from fossil fuels, primarily due to their strong links to deforestation and peatland destruction.

When both direct and indirect emissions are included, Cerulogy's analysis found that biofuels emitted on average globally 16% more CO_2 than the fossil fuels they were supposed to replace in 2023. In most countries, biofuels deliver only limited emission savings, and in regions heavily dependent on palm and soybean oil, they actually cause significant emission increases.

As biofuel demand rises sharply and the growing dependence on crop-based feedstocks continues, total biofuel emissions are projected to exceed avoided fossil fuel emissions by around 70 $MtCO_2e$ in 2030, roughly equal to the emissions from almost 30 million mid-sized diesel cars.

Building on previous studies conducted at the European level, Cerulogy also alternatively assessed the carbon opportunity cost of land currently used for global biofuel production. It found that allowing this land to revert to natural vegetation could remove over 400 $MtCO_2e$ annually, nearly twice the direct emissions avoided from displacing fossil fuels with biofuels, and without even accounting for indirect land use changes in that case. Given the ongoing loss of natural carbon sinks, land-based biofuels thus do not stand up as a credible climate solution.

Biofuel policies will at best deliver limited emissions savings, when they don't do more harm than good



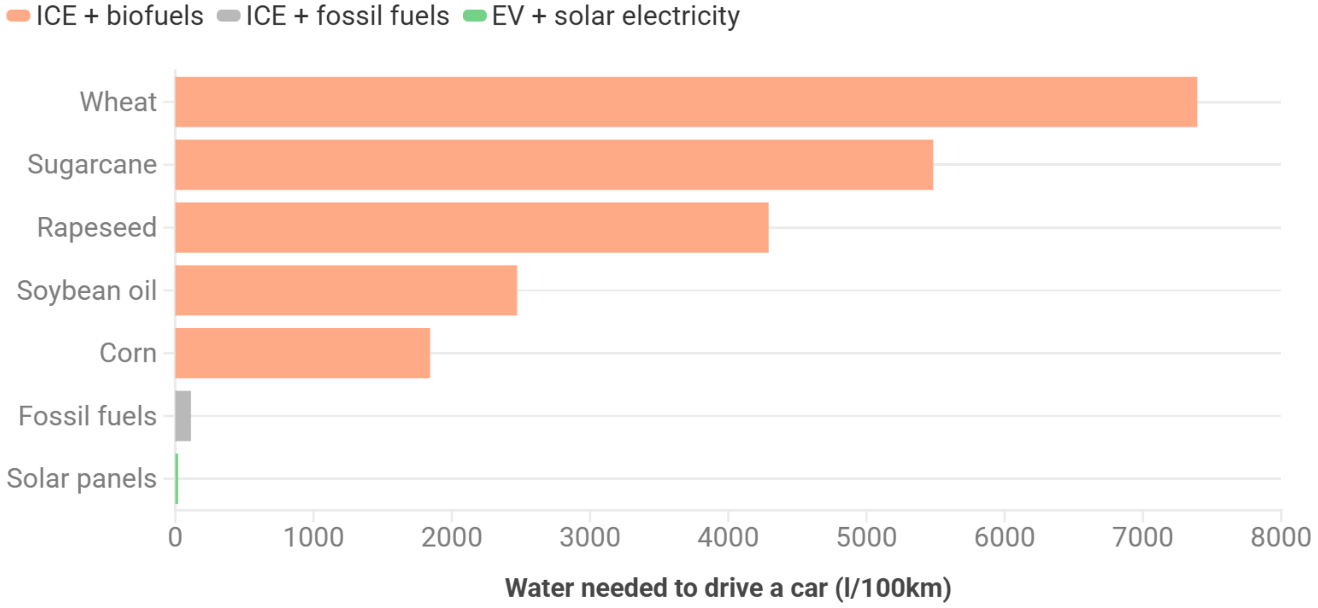
Source: T&E, based on Cerulogy (2024) • 2030 biofuels projections reflect the mix expected under existing regional policies. Indirect land use change emissions estimated using an adapted version of the EU GLOBIOM model.

2.3 Facing ecological risks

The environmental impacts of biofuels extend beyond greenhouse gas emissions, with significant consequences for biodiversity and ecosystems. For instance, water is a critical resource for growing crops used in biofuel production. As explained by Cerulogy, while the majority of water required by biofuel crops comes from natural rainfall, known as green water, many crops still rely on additional freshwater through irrigation, known as blue water. The demand for blue water irrigation depends on local environmental conditions, but some crops like wheat and sugarcane are especially water-intensive, resulting in a significant water footprint for biofuel production.

In comparison, the water used for fossil fuel production is generally several orders of magnitude lower. Our analysis shows that fueling a car with conventional biofuels requires close to 3,000 liters of freshwater on average to drive 100 kilometers. By contrast, powering an electric car with solar-generated electricity demands only about twenty liters of water. More information on our approach in the Methodology section.

High irrigation needs translate into a large water footprint per kilometer driven on first-generation biofuels



Source: T&E, own calculations based on Cerulogy (2024), Gerbens (2018), GREET (2024) and Yang et al (2022) • Only the blue water footprint of biofuels is considered here, thus only accounting for irrigation needs. Energy consumption assumed to be 7l/100km for a conventional car and 20 kWh/100km for an electric car, and the water footprint of solar electricity is conservatively assumed to be around 1 l/kWh.

T&E

Biofuels contribute to worsening water scarcity

While first-generation biofuels require more water than other energy carriers, many of the world's largest biofuel-producing countries are classified by the World Resources Institute as already experiencing high water stress. Climate change will, in many regions, increase pressure on water resources. India is notably categorized under extremely high water stress, while the country's biofuel production relies on some of the most water-intensive crop mixes globally. By 2030, we estimate that India's irrigation requirements for biofuel crop cultivation will double from 2023 levels, reaching approximately 4.7 billion cubic meters per year, nearly three times the current water demand of Mumbai's 13 million residents.

Similarly, studies indicate that Brazil's plan to expand sugarcane cultivation for ethanol production is likely to increase drought frequency in agricultural regions like the Cerrado and worsen water supply challenges for major cities. Our analysis shows that the country's biofuels irrigation needs might reach 25 billion cubic meters of water per year, resulting in the largest water biofuels footprint globally.

In addition, growing biofuel crops like corn, wheat, soy, and palm has been linked to up to a 50% decline in species richness and abundance compared to natural vegetation. These impacts are especially severe in tropical regions, where deforestation contributes to habitat loss, such as orangutans and tigers in

Southeast Asia, and jaguars and macaws in South America. Forest fragmentation further disrupts ecosystems, while ongoing deforestation in nature hotspots like Indonesia and Brazil continues to threaten biodiversity.

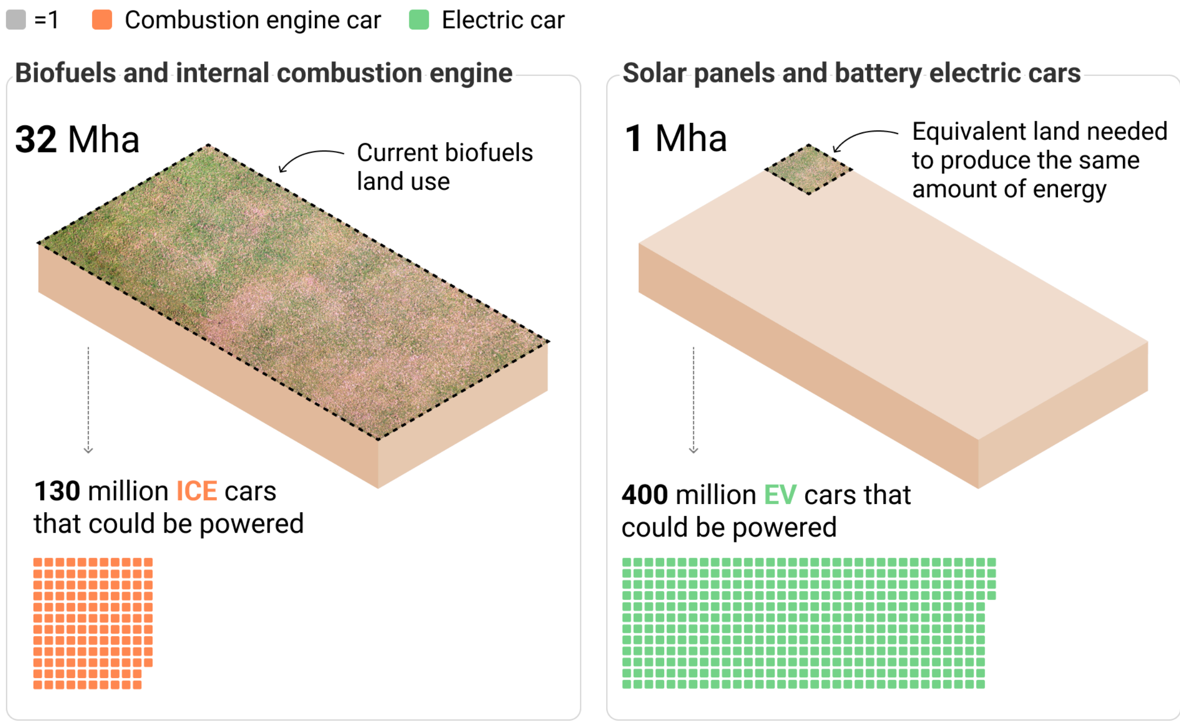
In temperate regions, where most land is already cleared, farming has intensified through large-scale monocultures, such as corn and soy in the US. These systems rely heavily on chemicals, which reduce soil organic matter and damage soil structure, harming long-term productivity. Since soils support about 25% of global biodiversity, this decline in soil health also threatens biodiversity and weakens resilience to climate extremes.

3. Land-based biofuels, an absurd climate solution

3.1 A fraction of biofuel land could power half the world's cars

As already shown in the European context, Cerulogy estimated that just 3% of the land currently used for global biofuels would be enough to generate the same amount of energy using solar panels. Since electric vehicles are far more efficient than internal combustion engines, the advantage becomes even greater. Our analysis finds that the same land area could power 90 times more electric cars with solar electricity than it could for diesel cars with biofuels. To put it in perspective, using solar panels on just 3% of current biofuel land could supply clean energy to a third of the global car fleet. More on our approach in the Methodology section.

Only 3% of the current land used for biofuels could power close to a third of the global car fleet with solar electricity



T&E, based on Cerulogy (2024) and own calculations. Assuming diesel cars running on 100% biofuels, while in practice biofuels are still mostly blended in small quantities with fossil diesel or petrol. More details in the Methodology section

Direct electrification of road transport thus appears as a more efficient use of land resources than first generation biofuels. Conventional cars are also still mostly using a blend of small biofuel shares mixed with fossil fuels. Finally, unlike biofuels, solar electricity can be produced without using arable land, which should be prioritised for growing food and natural restoration.

3.2 Aviation and shipping: the next biofuels scandal?

On top of already adopted biofuel mandates, international frameworks like ICAO's CORSIA for aviation and IMOs new Global Fuel Standard for shipping are adding pressure to the global biofuel demand.

The IMO's new climate rules, adopted in April 2025, introduce emissions intensity targets and a carbon pricing mechanism set to take effect in 2028. According to T&E's report, these measures could see biofuels supplying up to one-third of global shipping fuel demand by the mid-2030s, driven largely by cheap and high-emitting feedstocks like palm and soy oil. Meeting this demand would nearly double current global biofuel use and require up to 35 million hectares of cropland, the equivalent of Germany's entire land area, for shipping alone, raising serious concerns about deforestation and food security.

Combined with national SAF mandates, CORSIA is expected to further increase biofuels demand by allowing their use as a key compliance option for decarbonising international aviation. While the IMO is still debating whether to account for indirect land-use change (ILUC) in its fuel eligibility criteria, CORSIA does include ILUC factors in its emissions accounting, effectively limiting, though not entirely excluding, the use of the most carbon-intensive biofuels.

4. World leaders should not fall into the biofuels trap

As governments around the world seek to decarbonise their transport sectors, policymakers must understand the environmental risks and limited climate benefits of biofuels. International framework negotiations, global summits and climate financing mechanisms must consider the direct and indirect climate and wider environmental impacts of biofuels and not promote them as a quick-fix solution to the transport energy transition.

4.1. COP30: Pro-biofuels government on home soil

Bioenergy will feature at this year's UNFCCC Conference of the Parties (COP30) in Belem, Brazil. The host country, which considers its bioeconomy strategy as a national priority for increasing productivity and competitiveness, has already highlighted biofuels as "a competitive differential with the potential to reposition the country in the global energy transition". Brazil has announced that the COP30's Action Agenda will support the full implementation of the UNFCCC Global Stocktake. It is crucial for conference attendees and relevant decision makers to be fully aware of the serious environmental and climate risks attached to a significant uptake in biofuels production, particularly in the context of the Global Stocktake.

Brazil's biofuels policy ambitions are at odds with those in Europe, which include safeguards against the worst carbon-emitting feedstocks, such as palm oil (and potentially soybean oil). This was evident during the 2024-2025 IMO negotiations on sustainable fuel criteria, where there was significant pushback from the Brazilian delegation[2], along with other countries, against the ILUC approaches

[2] See submission ISWG-GHG 16/3/6: FURTHER DEVELOPMENT OF THE LIFE CYCLE GHG ASSESSMENT (LCA) FRAMEWORK, submitted by Brazil together with Angola, Argentina , China, Ecuador, UAE and Uruguay.

implemented in the EU's Renewable Energy Directive. Brazil's suggestions to move away from a quantitative approach of measuring ILUC indicators towards a qualitative approach are highly problematic, as this could see the worst carbon-emitting feedstocks, palm and soy oil, considered as sustainable.

Furthermore, the Brazilian bioeconomy strategy's reference to "non-tariff barriers related to land use and emissions" (p.17-18) as a key inhibitor of biofuel expansion also raises concerns over the country's priorities when it comes to the climate impacts of biofuels and economic competitiveness and productivity of its bioeconomy.

4.2. Funders beware

Despite international financing mechanisms' ambitions to support projects addressing climate change, funding pathways can end up financing biofuels projects more likely to worsen the crisis than improve it. For example, recent analysis by T&E showed that between 2021-2025, the European Investment Bank invested over €7 billion to dirty transport projects in the name of climate action, including granting €500 million and €120 million financing agreements to oil majors Eni and Repsol, respectively, to fund questionable biofuels facilities.

This year's COP30 will see the launch of the Tropical Forest Forever Facility (TFFF), a new initiative from the Brazilian government designed to provide payments to countries with tropical forests. The TFFF has been flagged as being a potential breakthrough on forest protection, as long as strict criteria are adhered to, while another analysis has been more scathing of the TFFF. With more and more countries looking to ramp up so-called bioeconomies in order to address climate change, it is hugely important for global decision makers to be properly informed about the environmental risks and limited benefits of bioenergy and biofuels, and not to rely on unbalanced narratives and false promises that attach monetary value to deforestation and biodiversity destruction.

4.3. Biofuel superpowers unite

Striking a balance between economic growth and climate change mitigation is a constant challenge for governments and decision makers. To garner influence within this global political and scientific debate, biofuels superpowers have formed broad international membership initiatives, such the Global Biofuels Alliance (GBA) and the Biofuture Platform, which aim to expedite the global uptake of biofuels. In 2023, GBA members comprised about two thirds of global biofuel production, amounting to over 74 Mtoe, including the two largest biofuel producers, Brazil and USA. The Biofuture Platform is also a member of the alliance.

The vested interests in the biofuels industry of these membership organisations are a cause for concern, especially considering the direct access they have to the flagship OECD organisation, the International Energy Agency. Acknowledgements to GBA and Biofuture Platform members in the IEA's recent report on Carbon Accounting for Sustainable Biofuels include several fossil fuel industry representatives who are investing heavily into biofuels, such as Eni, Shell and Fuels Europe. Recommendations within this report align with Brazil's recent calls to move towards qualitative risk-based, which IEA asserts is a good alternative option to modelling approaches implemented in Europe, which currently delegitimise some of the worst deforestation-causing feedstocks, such as palm oil and potentially soy oil.

T&E Recommendations:

1. **Safeguard climate policy from first-generation food and feed crop biofuels:** World leaders and relevant decision makers must ensure that climate and energy transition plans uphold robust safeguards against the most destructive biofuel feedstocks, namely first generation food and feed crops. Weakening land use change accounting mechanisms, such as quantitative, evidence-based ILUC modelling, in favour of weaker qualitative approaches that allow food and feed crop feedstocks count as renewable risks legitimising biofuels that cause deforestation, biodiversity loss and higher lifecycle emissions than fossil fuels. T&E strongly recommends phasing out first generation food and feed crop biofuels from renewable energy targets, as well as greater transparency and monitoring of advanced and waste feedstock supply chains to combat fraud concerns.

2. **Direct climate finance to genuine decarbonisation projects:** Financing mechanisms must adopt stricter sustainability criteria that exclude investments in biofuel expansion and ensure projects deliver verifiable emissions reductions. Finance mechanisms should prioritise accelerating the deployment of electric vehicles powered by renewable energy, improving energy efficiency and genuinely sustainable alternatives. Financing mechanisms must have stricter environmental criteria in order to avoid subsidising false solutions.

3. **Shield climate governance from vested industry stakeholders:** Policymakers should limit the influence of vested biofuel industry alliances, such as the Global Biofuels Alliance and Biofuture Platform, within international energy and climate decision-making bodies. While these groups frame biofuels as essential to the energy transition, their members include major fossil fuel companies with a financial stake in maintaining deforestation-linked fuel supply chains. Decision-making processes at the IEA, UNFCCC and other institutions must be transparent, free from conflicts of interest, and guided by independent science, not corporate agendas.

Further information

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Methodology

Analysis of water impacts from fuel production

As discussed in Section 2.3, most crops used for biofuel production require additional freshwater, known as blue water, depending on local conditions. A peer-reviewed study from 2018 provides estimates of these water impacts across different biofuel crops. Furthermore, Cerulogy reports that fossil diesel production generally consumes less than 10 tonnes of water per tonne of oil equivalent (t/toe), depending on oil extraction and refining conditions. At the same time, several studies, including analyses from the EU Joint Research Centre (JRC) or academic papers, indicate that the average water footprint of solar panel production is typically below 6 t/toe.

Using these sources, we calculated the average water impact associated with driving a vehicle 100 km, considering key biofuel crops, fossil diesel, and solar electricity. For this analysis, we assumed an average fuel consumption of 7 l/100km for new diesel cars, knowing that the world fleet average is likely higher, and a conservative 20 kWh/100km for a typical battery-electric vehicle.

Analysis of land requirements for biofuels and electric cars

Cerulogy's study estimated that producing 4.6 EJ of electricity, the same amount of energy as current global biofuel consumption, would require only around 1 Mha of photovoltaic panels. This represents just 3.4% of the land currently used for crop-based biofuel production, excluding co-products such as animal feed.

Assuming an average electricity consumption of 20 kWh per 100 km for electric vehicles and a global average annual mileage of 15,000 km, based on global car emissions and number of vehicles in the fleet, we estimate that approximately 400 million electric cars could be powered by solar electricity generated on only 3% of the land currently dedicated to biofuels. This figure corresponds to nearly a third of the current global car fleet.