Biofuels:

An obstacle to real climate solutions

The EU wastes millions of hectares of land on biofuels, missing enormous opportunities to fight climate change, biodiversity loss and the global food crisis.

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A briefing by TRANSPORT & ENVIRONMENT OXFAM

Summary

A new study by the IFEU institute quantifies for the first time the enormous opportunity costs across Europe of dedicating millions of hectares of fertile cropland to the production of biofuels. The results are clear - this land could be used much better in the interest of mitigating climate change, stemming biodiversity loss or increasing global food security.

In 2009, the European Union (EU) introduced a biofuels mandate as part of its green fuels law, the 'Renewable Energy Directive' (RED). The proposition at the time was attractive: farmers would be supported to produce 'green fuels'. In reality, biofuels have harmed food security and obstructed climate change mitigation.

The study carried out by the Institut für Energie- und Umweltforschung (IFEU) on behalf of T&E shows that production of crops for biofuels consumed in Europe requires 9.6 Mha of land - **an area larger than the island of Ireland**. This is 5.3 Mha if the production of co-products, mainly feed for industrial livestock farming, is taken into account. The use of crops in biofuels is not distributed evenly across Europe. The largest consumers of such biofuels are Germany, France and Spain.

Using land for biofuel crops invariably means that it is largely lost as a natural carbon sink, habitat for endangered species or for the production of food.

Land as natural carbon sink

One option is to give the land back to nature, to restore natural ecosystems by relying mainly on natural processes, otherwise known as 'rewilding'. In this case, 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_2 from the atmosphere - **nearly twice the *officially* reported net CO_2 savings** from biofuels replacing fossil fuels (32.9 Mt of CO_2 eq). This would contribute to the EU's stated goals of increasing carbon sinks in the land sector and result in real climate benefits, contrary to the inflated emission savings from biofuels that rely on flawed carbon accounting.

Solar 40 times more efficient than crop biofuels

Using land for solar energy would also be far more efficient. You need 40 times less land to power an electric car with solar energy compared to a car using biofuels, the analysis shows. Therefore, if you converted just 2.5% of the land dedicated to biofuels to solar, you could produce the same amount of equivalent energy, with vast amounts of land left to rewild or for food production.

These results clearly show that crop-based biofuels make no meaningful contribution, but rather present an obstacle to mitigating climate change.

Land for biodiversity protection

In addition to the climate benefits, 'rewilding' millions of hectares of land would also be a key measure against the enormous loss of species we are currently witnessing. The EU has set itself targets to halt and reverse the loss of biodiversity in its proposal for a 'Nature Restoration Law',

adopted last year by the Commission. Ending the egregious waste of land for biofuels could contribute substantially to achieving these targets, with biofuel feedstocks requiring over 9% of Europe's croplands, including the share allocated to the production of feed for industrial livestock farming. The ecological impact of an area only the size of the 5.3 million hectares of cropland fully dedicated to the production of biofuels equals 2.1 million hectares of fully artificial, sealed landscapes. This amounts to 6% of the existing burden due to sealing in Europe.

Land for food production

Instead of producing biofuels, crops cultivated on these lands could alternatively be used for food production. As the IFEU study shows, this could cater for **the calorie needs of about a quarter of the people living in the EU and UK** (120-142 million people). It would also be more than sufficient to provide food for the 50 million people globally who are 'in emergency or worse levels of acute food insecurity', according to the United Nations.

There is an urgent need for policymakers to act. The EU institutions have recently decided against a phase out of crops in biofuels in their current revision of the Renewable Energy Directive. However, the rules laid out in this directive allow for each Member State to take such decisions unilaterally at national level. What to do with the land freed up from its current use for biofuels, whether allocating it to carbon sequestration, to food production, to halt biodiversity loss, or a mix of all three, will need inclusive debates on national and regional levels, involving all stakeholders concerned.

T&E and Oxfam urge policy makers across Europe to use their existing options under the RED and phase out all incentives for the use of crops in the production and consumption of biofuels.

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1. Introduction

So-called biofuels can be made from a wide range of materials sourced from plants, animals or even algae. However, in Europe, as well as globally, the most prevalent materials used are based on food and feed crops - cereals like maize and wheat or vegetable oils from the seeds of palm trees, soy, rapeseed and sunflower. Also sugar beet and sugar cane play a role. In 2009, the EU Renewable Energy Directive (RED) was created to promote the use of biofuels and other renewables, as a replacement for fossil fuels in the transport sector. However, in promoting biofuels, the EU did not account for the full climate impact of setting aside vast areas of land to grow crops for biofuels. This resulted in the consumption of a large amount of unsustainable biofuels with worse overall climate change impact than fossil fuels. In 2012 and 2016, the European Commission released two studies that modelled land use change related emissions of biofuels - mainly from deforestation and peatland conversion [1, 2]. They both showed that when projected indirect land use change (ILUC) emissions are taken into account, vegetable oil-based biodiesel leads to more emissions than fossil diesel.

In an attempt to address the loopholes in the RED, such as these unaccounted ILUC emissions, a first biofuels reform finalised in 2015 introduced a limit on food-based biofuels. The 2018 recast of the RED (known as RED II) helped limit the consumption of unsustainable biofuels further and promoted the use of advanced non-food feedstock. It introduced a limit on crop biofuels, based on their share in each Member State in 2020 (with 1 percentage point flexibility) and gave Member States the option to reduce the share of these biofuels to zero. However, no Member State has made use of this option so far and biofuels made from food and feed crops still account for the bulk of all feedstocks used for biofuels consumed in Europe. Advanced biofuels are still not contributing any significant volumes and the strong increase in waste-based biofuels led to a high reliance on imports for used cooking oil (UCO) [3] and strong competition with existing demand sectors such as the pet food industry for animal fat [4]. A further revision of RED II is currently in the making, with negotiations to be concluded in early 2023. The phase-out of all crops in biofuels is not on the table of these discussions, though.

While the European Commission at least commissioned research into land use change related emissions, it completely ignores the fact that also the production of biofuel feedstocks on existing crop lands comes with a significant cost. It blocks land from being used for other purposes - for natural carbon sequestration, for biodiversity and, last but not least, additional food production.

This leads to significant opportunity costs, as a new report from the IFEU institute, commissioned by Transport & Environment, shows. This briefing summarises its key findings.

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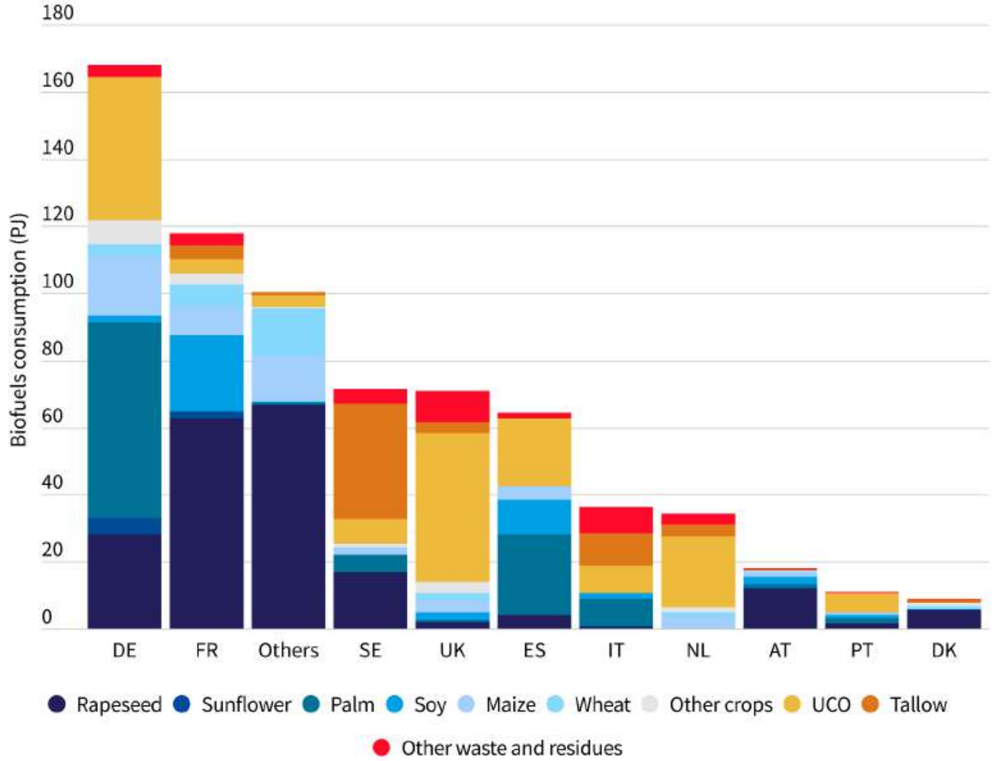
2. The land needs of Europe's biofuels consumption

Most of the biofuels used in Europe are based on food and feed crops grown on fertile agricultural lands - mainly rapeseed, palm oil, maize, soy oil, wheat and sugar beet. In 2020, food and feed crops accounted for 92% of bioethanol blended with gasoline, 55% of biodiesel and 7% of biomethane[1] [6]. Only just over half of the used feedstocks are grown domestically in Europe. Many of the feedstocks are almost entirely imported, such as soy from South America or palm oil from Indonesia and Malaysia. For others, like rapeseed, the import share has been steadily increasing since the introduction of the EU's Renewable Energy Directive [7].



Biofuels consumption (in PJ) refer to the volumes of biodiesel, bioethanol and biomethane consumed in the transport sector in 2020.

Source: IFEU (2023)

Figure 1: Biofuel volumes consumed in key European countries by feedstock

As can be seen in Figure 1, the consumption of biofuels in the transport sector is led by the largest economies, with Germany and France accounting for about half of the total volume. However, the types of feedstocks used differ largely from one country to another. For example, Germany's and France's biofuels consumption is mainly based on crops (72% and 90% respectively), while the United Kingdom and the Netherlands depend only little on these feedstocks (19% and 20% respectively) due to a higher reliance on used cooking oil and animal fats ('tallow'). All feedstock figures in this study refer to 2020 and do not

[1] Note: in this report, only biomethane consumed in the transport sector is considered. For all biomethane production, the share of crops amounts to 42% according to IFEU [5].

reflect national decisions on an earlier phase out of palm and/or soy oil from the respective countries' biofuels, that subsequently came or are about to come into force (see Section 3 from T&E's recent study on soy for an overview [8]). France, e.g., had fully eliminated the consumption of palm and soy oil based biofuels by 2022 [9].

Our (mis-)use of land

Land is one of the most precious and finite resources on our planet.
Most of humanity's essential needs are provided by the 29% of our planet's surface which is covered by land. Land to live on, to provide us with food, with clean air and water. This finite resource needs to sustain an ever-growing human population. Yet, nearly half of the land that is not covered by ice, rocks or sand, by now has been converted into agricultural lands (46%), mainly to feed livestock (77% of agricultural lands) [10]. In most regions, we are no good guardians of what has been given to us by nature. According to the United Nations, 20-40% of the world's land is degraded. This comes to over 50% for agricultural lands [11], where 24 billion tons of fertile soil is being lost each year, largely due to unsustainable agricultural practices [12].

In its Global Land Outlook report 2022, the United Nations concluded that '***Nature conservation is no longer enough – restoration is now an imperative since it is the abundance and complexity found in healthy ecosystems that have made complex human societies possible***'.

For the purpose of this study, the IFEU institute first calculated the total area of land currently cultivated with crops for the production of biofuels consumed in Europe. The calculation is based on yield factors derived from data compiled by the EU's Joint Research Centre [13].

According to this analysis, Europe's crop-based biofuel consumption requires a **total area (inside & outside of Europe) of 9.6 million hectares, equivalent to 9.2% of Europe's total croplands and larger than the island of Ireland.** This is 5.3 Mha (5.1%, larger than Denmark) if the production of co-products, mainly animal feed, on the same lands is taken into account.[2] Of these areas, more than two thirds are located within Europe (6.2 Mha, resp. 3.7 Mha taking co-products into account). The remaining area is located abroad, mainly in Asia, South America and non-EU countries in Europe.

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[2] Co-products from the production of biofuels are mainly used for animal feed: as protein rich meal from the processing of oil seeds, such as rapeseed or soy, or as so called 'distiller's dried grains with solubles' (DDGS) in the case of ethanol production from grains. The land used for the production of crops for biofuels and their co-products was allocated proportionally to each of the two segments, based on their respective energetic share. The methodology applied follows the rules laid out in the second iteration of the EU's Renewable Energy Directive (RED II). For more details see IFEU (2023) [6].

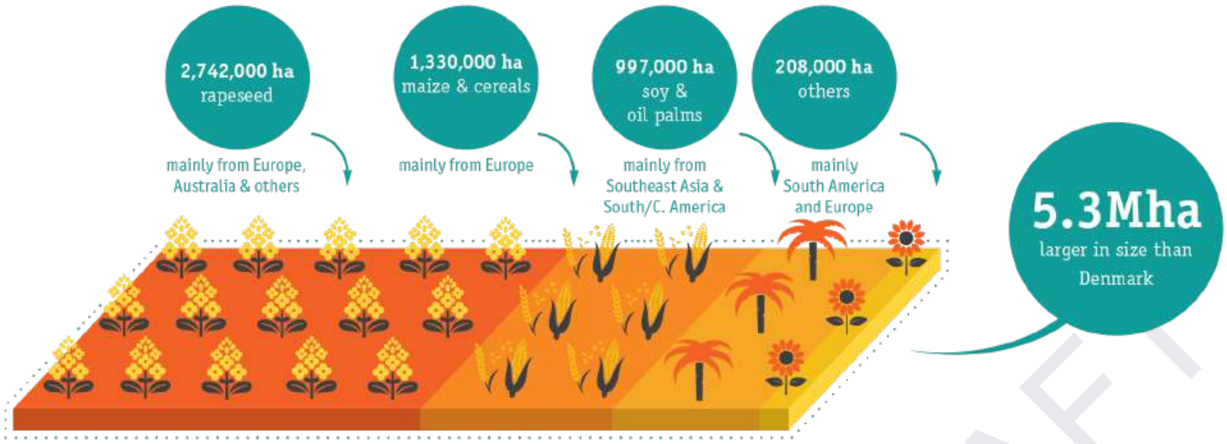

Figure 2: Global land use for biofuels consumed in Europe

The largest areas are covered by rapeseed (2.7 Mha), followed by maize (0.8 Mha), palm oil (0.6 Mha) soy (0.4 Mha) and wheat (0.4 Mha) (see Figure 2).

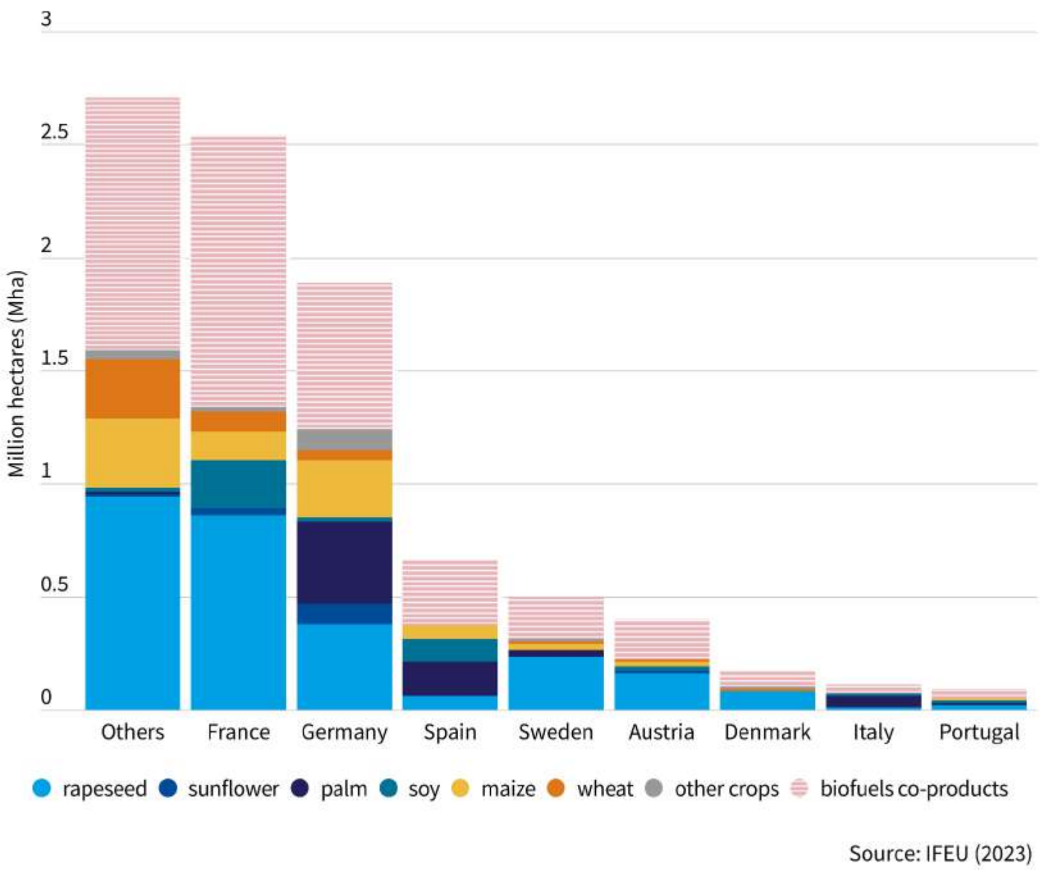

Figure 3: Land use related to key European countries' biofuel consumption

The land use related to biofuels consumption is not distributed equally across countries (see Figure 3). The total area depends to some extent on the economical power and hence overall fuel consumption of a given country. It depends even more so on the share of crop-based biofuels in their transport fuels, determining the total amount of such biofuels consumed. Also the type of feedstocks used plays a major role. France, for instance, uses less crop-based biofuels compared to Germany (see Figure 1), but has a larger 'land footprint' as its consumption relies mainly on rapeseed. This crop has a lower yield per hectare than palm oil - Germany's main crop for biofuels consumed. France's phase out of palm and now strong reliance on rapeseed has increased the area of land required for biofuels consumed in France. This also explains why e.g. Italy (relying on palm) has a lower land use footprint than Denmark (relying on rapeseed), despite consuming more crop-based biofuels overall.

The increase in land required to produce the same amount of biofuels, when switching from palm oil to e.g. rapeseed oil has been used by industry players as an argument in support of the continued use of palm oil. The expansion of palm oil, however, is linked to deforestation in Southeast Asia, resulting in immense emissions of greenhouse gases, pressure on biodiversity and also local communities, as T&E has shown repeatedly in the past. Rapeseed's higher land needs cannot be used to argue in favour of palm oil in biofuels. Both need to be phased out from this sector. Figure 3 also shows a large part of land used by unidentified countries ('others'). These are countries, for which detailed data on feedstocks are not available publicly. Data retrieved from the EU database SHARES shows that the main countries here are Poland and Belgium, with the former relying mainly on rapeseed [14], the latter on soy, palm and wheat [15]. Belgium has meanwhile decided to phase out palm and soy from biofuels consumed in the country and also considers a cut in the overall use of crop based biofuels [16].

The substantial land area dedicated to the production of crops for biofuels is lost to alternative uses, like the production of food or the regrowth of natural vegetation, which would help counteract biodiversity loss and mitigate climate change through carbon sequestration. The following chapter will detail the opportunities arising from such alternative use options.

3. Carbon Opportunity Costs

3.1. The need to get carbon out of the atmosphere

We have an excessive amount of carbon dioxide in the atmosphere already. Under any 1.5°C compatible scenario, we will need to reduce this level also by removing CO_2 from the atmosphere and storing the sequestered carbon elsewhere [17]. Known as Carbon Dioxide Removal (CDR), this can in principle rely on a variety of approaches, ranging from installing machinery at large scale for Carbon Capture and Storage (CCS) to allowing nature to restore itself, storing carbon in its biomass.

CCS as a technical fix has not been proven to work at a large scale, is extremely costly and its potential to deliver significant emission reductions by mid-century is currently limited. There are also concerns about ensuring the safe, permanent, and verifiable storage of CO_2 [18]. These problems are aggravated when using bioenergy with carbon capture and storage (BECCS). This either requires even more intense exploitation of forests, or intensified agricultural practices to provide the required biomass, resulting in unacceptable negative impacts on food security, land use rights, and biodiversity given its land use, water, and resource requirements. For example, it has been estimated that removing the amount of

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carbon equivalent to one-third of present-day annual emissions from fossil fuels and industry from the atmosphere by 2100 through BECCS relying on energy crops, would require up to 50% of today's croplands [19].

3.2. Nature as our best ally

We urgently need to reduce greenhouse gas levels in our atmosphere with measures that come with co-benefits, not massive collateral damages. First, by ending the burning of fossil fuels and by reducing emissions from agriculture and forestry. We need to protect existing carbon sinks on land and in the oceans. We need to stop destroying forests, mangroves, seagrass meadows and the conversion of natural habitats into crop lands or for infrastructure purposes. The stronger our efforts in these sectors, the less carbon we will need to remove from the atmosphere. For the remaining removal needs, nature is our best partner, we only need to provide it with space.

There is much potential in allowing nature to restore itself in places where current land use is producing marginal yields, wasteful or even damaging. This applies to degraded land, but also to much of the land dedicated to the production of animal feed or feedstocks for biofuels and biogas - accounting for the vast majority of agricultural lands globally [8].

The estimates for the potential of CDR through nature restoration vary widely and care should be taken to not rely too much on this measure. Realising any nature based CDR potential will also not be a quick fix to our climate crisis, but a key long term element in our mitigation efforts and needs to be embedded in holistic solutions, creating benefits for biodiversity and global food security.

Carbon removal through ecosystem restoration can never be used to offset ongoing fossil fuel emissions. It needs to be seen as an essential, but additional tool to fight climate change, that must not be in conflict with global food security, stemming species loss or social justice.

3.3. The opportunities missed

One option for using land currently occupied by the cultivation of crops for biofuels production is to maximise its use for carbon storage in natural vegetation. In many cases this can be accomplished by trusting nature to do it right, leaving areas 'fallow', so that nature can restore itself. In some areas, it may be necessary to initially assist nature, e.g. by stopping drainage or making seeds available. Such 'rewilding' would not necessarily start on the most fertile croplands currently used for biofuels production, but rather on marginal lands or lands with a high carbon or biodiversity value, like wetlands. The current use of those lands would shift to those croplands used for biofuels before.

To calculate the carbon opportunity costs[3] of crop-based biofuels, the IFEU institute started from the calculated land area occupied (see Section 2), the carbon stock of the current cropland vegetation and the official values for average carbon stocks of natural vegetation on these lands [20], in most cases forests. It assumed a 30 year period for natural regrowth achieving these values, for breaking down

[3] Opportunity costs are the forgone benefits that would have been derived from an option not chosen.

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carbon accumulation to an annual level. This allows full comparison with official figures on emission reductions from replacing fossil fuels in transport with biofuels.

This analysis shows that the natural vegetation developing on the size of land currently occupied for crop biofuel production for Europe, even when excluding areas allocated to co-products and solar energy, could **remove 64.7 million tonnes of CO_2 per year from the atmosphere - nearly twice the officially reported net CO_2 savings from biofuels replacing fossil fuels** (32.9 $MtCO_2eq/a$). It is important to note here, that these officially reported net CO_2 savings are a very optimistic assumption and need to be questioned, as they do not include emissions from indirect land-use change - mainly deforestation and peatland development - which more than outweigh savings from replacing fossil fuels with vegetable oil based biodiesel, in particular. The emission saving factors used in this study also rely on data provided by the German federal agency for agriculture, which assume emission reduction factors far above the default factors laid out in the RED and also above most if not all such factors used by other Member States

Ending the use of crop-based biofuels in Europe should of course not lead to an increase in the consumption of fossil fuels. The IFEU has therefore taken into account that a part of the area currently allocated to the production of biofuel crops, would be allocated to the production of solar electricity for powering cars instead - resulting in the same total mileage as provided by crop-based biofuels. The land required for this purpose is minimal as the combination of electrification in transport and electricity production from **solar panels is 40 times more efficient** according to calculations by the IFEU institute. Other studies report efficiencies to be even 100 times higher [21].

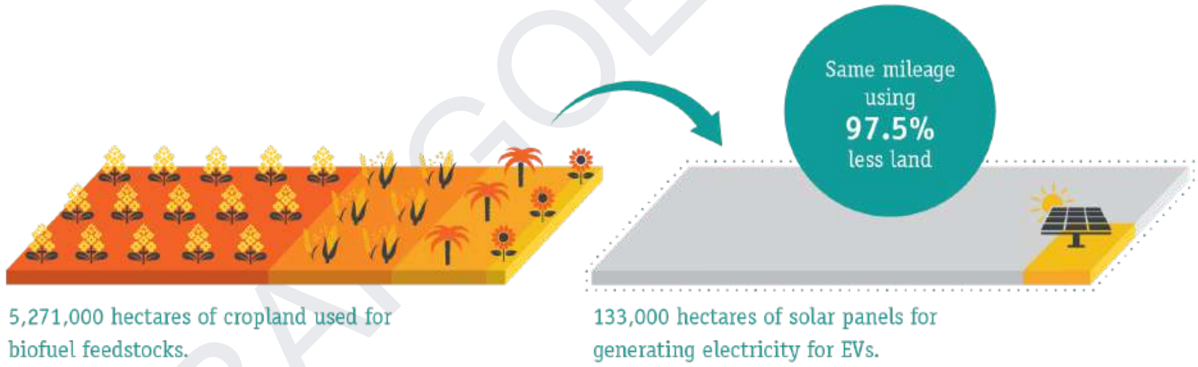

Figure 4: Land used for biofuels vs land used for solar power to deliver the same car mileage

Only 0.133 Mha, or 2.5% of the area freed up from biofuel crops (see Figure 4), would be needed for solar panels to produce the same amount of energy currently provided through biofuels in cars. 97.5% of the land would remain available for rewilding or additional direct food production[4].

[4] In a previous report following the same methodology for Germany only [22], the IFEU institute concluded that 3% of the area related to Germany's crop-based biofuel consumption would be needed for solar panels to produce the same amount of energy in cars. The slight difference with the 2.5% described here comes from the differences between the German feedstock mix and the European feedstock mix and thus from the difference in the biofuel energy produced per hectare.

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Using this amount of solar energy in cars instead of fossil fuels would increase the overall emission savings to 107.2 $MtCO_2$/a - **more than three times the officially reported net CO_2 savings from biofuels replacing fossil fuels** (see Figure 5).

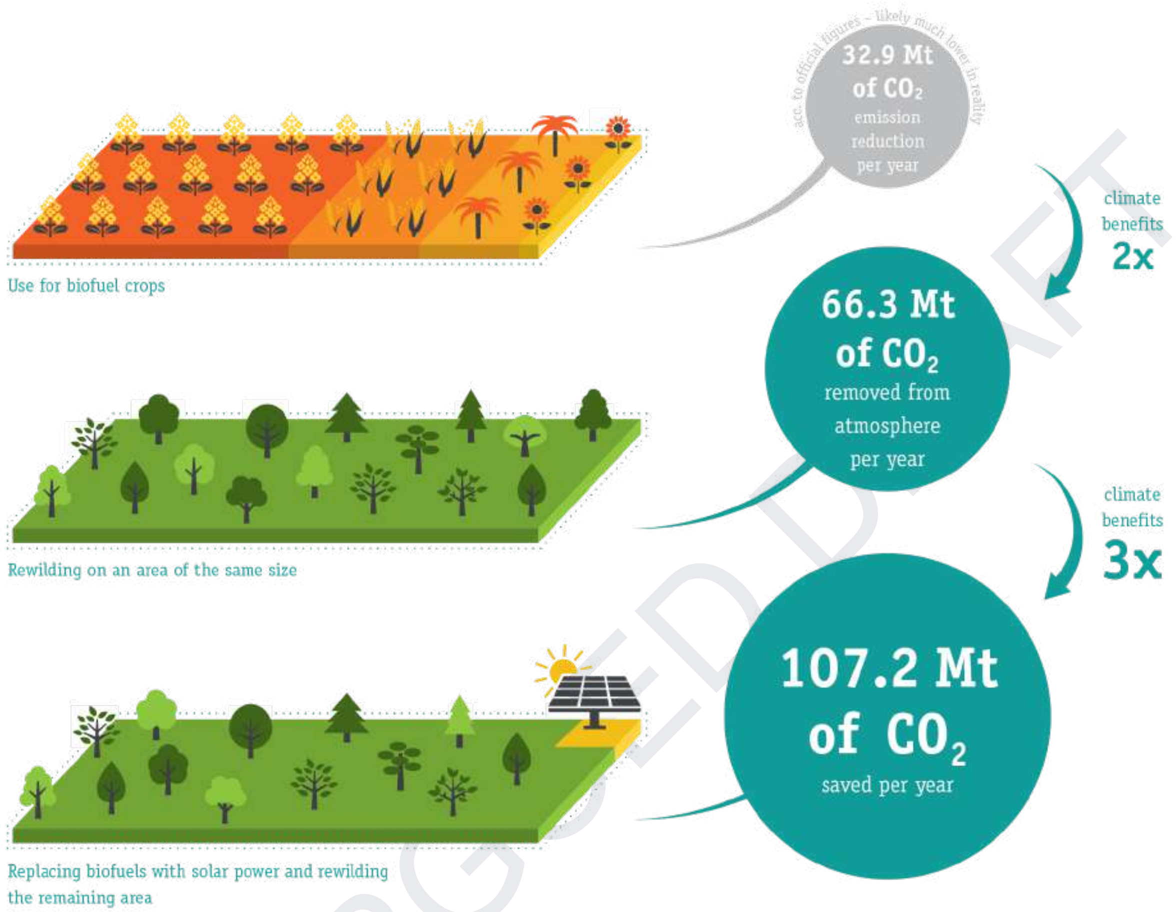

Figure 5: Rewilding and solar power combined, instead of biofuels - up to 3 times more climate benefit from the same area

In principle, the area required for solar energy generation could easily be set aside within Europe from areas currently used for biofuels crops. In practice, areas other than fertile crop land should be prioritised for solar panels [23].

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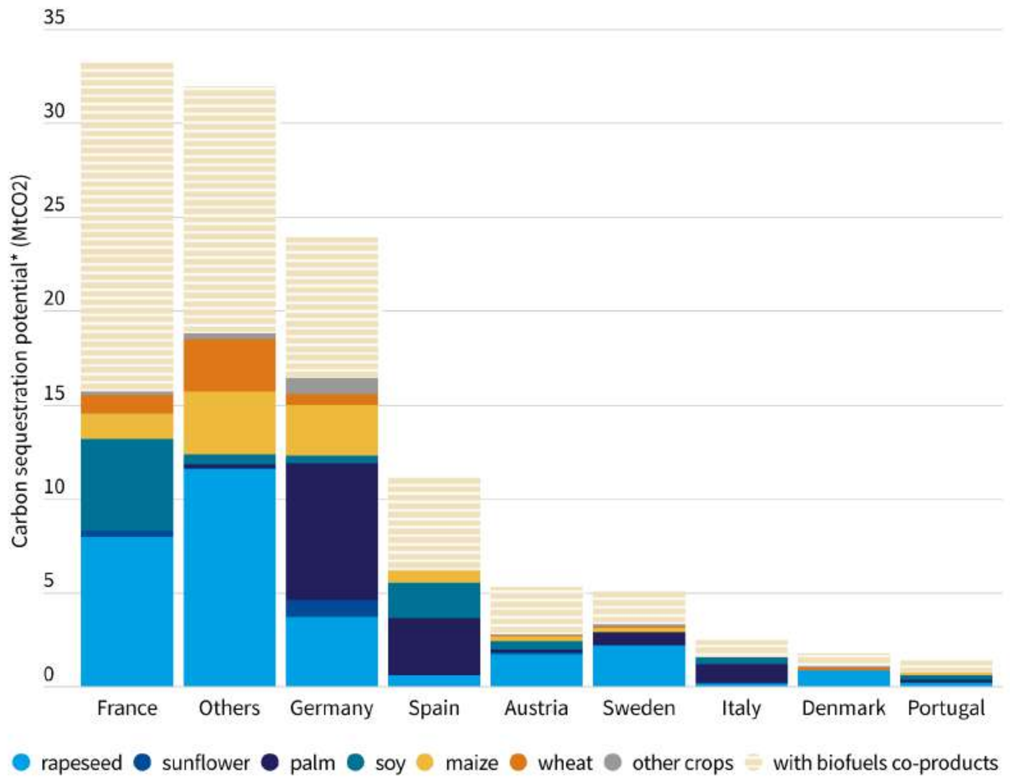

*The carbon sequestration potential refers to the carbon that could be taken out from the atmosphere if the area currently dedicated to crop-based biofuels were rewilded.

Source: IFEU (2023)

Figure 6: Carbon opportunity cost for selected countries

The distribution of identified carbon opportunity costs across countries is shown in Figure 6. Germany and France are clearly leading in this comparison, changing position here compared to their ranking in overall land use (see Figure 3), when areas allocated to co-products are not considered. The lower land use of Germany, due to its heavy reliance on palm oil, is here compensated for by the higher carbon costs linked to occupying land in the tropics. The annual rate of potential carbon storage by forests regrowing in the tropics across insular Asia amounts to 5.67 t/ha according to the Commission guidelines used for the IFEU study [20], whereas it rates at 'only' 2.9 t/ha for forests growing in temperate continental areas of Europe - the main source area for the rapeseed used in France. This changes dramatically again, when the areas allocated to co-products are taken into consideration again. The allocation to co-products is relatively small for palm oil, where the oil is by far the dominant product (91%; see Table 7 in the IFEU report). For rapeseed, however, the co-production of animal feed is a major factor, with the oil accounting for only 59%. Taking co-products into account the total land area needed for rapeseed increases strongly, leading to much higher carbon opportunity costs, despite the lower carbon sequestration potential in Europe, the main region of origin of rapeseed used for biofuels.

Setting aside vast areas of land for crop biofuels is a fundamental miscalculation: the climate damage from giving up so much land that could otherwise help draw down carbon from the atmosphere by far exceeds the small benefit from replacing fossil fuels. If one wants to use millions of hectares for the

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benefit of the climate, growing crops for biofuels, or any bioenergy, is the wrong choice. The right choice would be to boost natural carbon storage on this land. Incidentally, that's also the choice that benefits biodiversity and ecosystem health. The EU has acknowledged this principle in the deal reached in November 2022 on Land Use, Land Use Change and Forestry (LULUCF), committing to increase the EU's target for net carbon removals by natural sinks to 310 million tonnes of CO_{2eq} by 2030. Now it is time for the EU to take the right measures to achieve this goal [24].

To mitigate climate change, land should be allocated to nature restoration, with climate benefits 2 to 3 times higher compared to the official savings from replacing fossil fuels with crop-based biofuels.

4. Food Opportunity Costs

4.1. The global food crisis

The global production in agriculture is sufficient to provide enough food for all people. It is not the lack of production, but the lack of access to food, that causes malnutrition and famine. The prices for food commodities and transport fuels are decisive factors determining whether people have access to sufficient and healthy food. The prices for both had already been rising during the COVID pandemic in 2020 and 2021. The war against Ukraine has sent the prices soaring even higher - for all key food commodities even to new record highs [25]. As a result, the number of people who are exposed to acute food insecurity or are at high risk, has been pushed to an all time high of 345 million people in 2022, according to the World Food Programme (WFP) of the United Nations. That's an increase of almost 200 million people compared to pre-pandemic levels [26]. **Globally, 50 million people are 'in emergency or worse levels of acute food insecurity'** [26]**.** In June 2022, the WFP had to announce the suspension of food assistance in South Sudan, due to lack of funding, exposing up to 1.7 million people to the risk of starvation [27].

Direct food aid is no long term solution to eradicating hunger. But life saving where people are starving right now. Instead of taking immediate action, EU Member States kept burning the equivalent of some 15 million loaves of bread and 19 million bottles of sunflower and rapeseed oil in cars and trucks - every single day [28, 29]. Most of the oils and grains used for EU biofuels are perfectly fit for human consumption. It is a myth that only grain is used that cannot be used for bakery products [30].

As ever increasing volumes of grains and vegetable oils are used in biofuels, driven not by market forces, but policy mandates, prices for these commodities lose elasticity and would be lower in the absence of such mandates [31]. The FAO Food Price Indices for all but one[5] of the covered commodities have recently declined to pre-war levels, but are still hovering near or above the levels that have given rise to the global food crisis in 2011 [25]. Ending policy mandates for crop-based biofuels would immediately ease pressure on the prices for these commodities. In the long term, the world will need to provide substantially more calories to feed a growing global population. The World Resources Institute projects the additional needs

[5] Sugar.

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to be over half of what has been produced in total in 2010 [32]. This clearly emphasises the need to reconsider any non essential use of available crop land, in particular in a world increasingly faced with extreme weather events causing havoc on harvests across entire regions.

Allocating the land now used for crop-based biofuels to food production would provide significant additional harvests, making food more affordable and accessible again.

4.2. Food vs fuel

To calculate the additional amount of food that could be produced by ending mandates for crop biofuels, the IFEU study used two approaches:

1. What amount of food could be produced on the land now dedicated to produce crops for biofuels consumed in Europe?
2. What would be the equivalent calorific value of the crops, if they would be used for human nutrition and not for biofuel consumed in Europe?

Following the first approach, the IFEU study shows **that the calorie needs of 120 million people, nearly a quarter of the people living in Europe, could be met if the land now fully dedicated to biofuels for consumption in Europe (5.3 Mha) would be used for growing wheat**[6]. This amount of calories would also be more than sufficient to provide for the needs of the 50 million people globally that are ‘in emergency or worse levels of acute food insecurity’, according to the United Nations [26].

In the second approach, starting from the calorific value for human nutrition of the crop-based biofuel consumed, and again taking co-products allocated to the production of animal feed out of the equation, the needs of 142 million people could be catered for (28% of Europe’s population).

If livestock farming was reduced in parallel, to balance reduced production of feed when phasing out crop-based biofuels[7], the number of people whose calorie needs could be met rises significantly - to 220 million people, or 43% of Europe’s population[8]. A significant reduction of the consumption of meat and dairy products in the Global North is absolutely essential to effectively address both the climate (livestock farming contributes an estimated 14% of global GHG emissions [33]) and biodiversity crises and would come with major benefits for our health [34–36].

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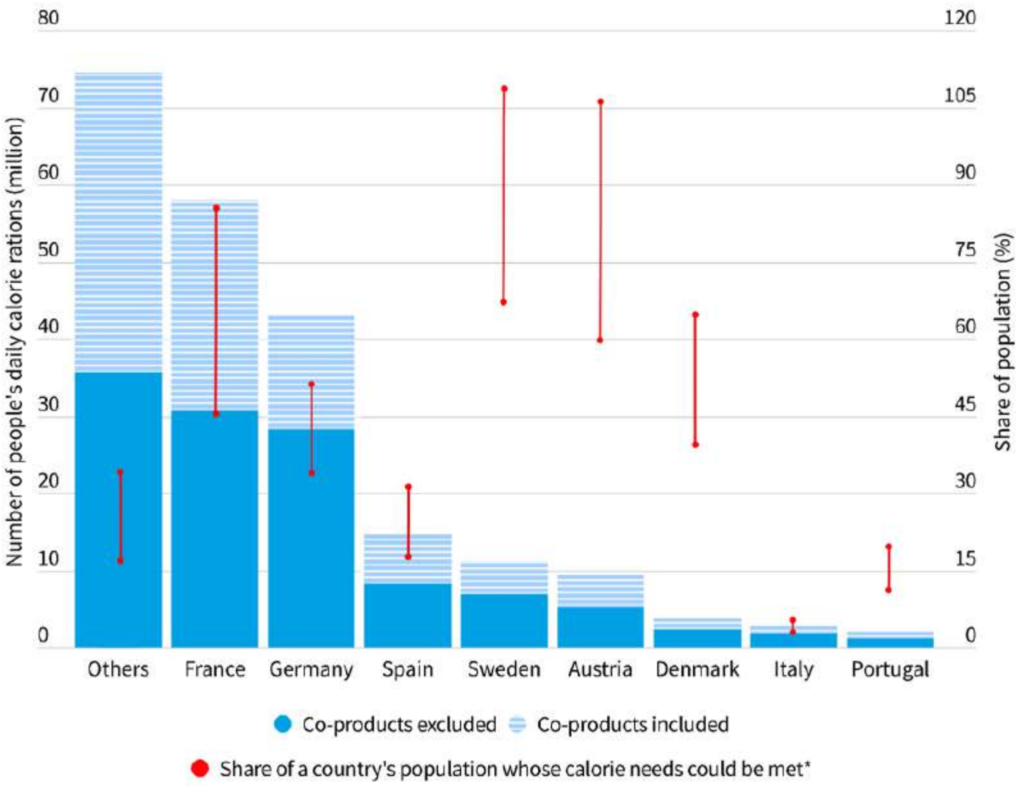
[6] Not all of the areas currently producing biofuel feedstocks for Europe are suitable for growing wheat. However, this is a conservative assumption as growing e.g. rice or corn in major supply countries such as Brazil or Indonesia would result in higher calorie yields.
[7] That is, co-product allocation is not taken into account.
[8] In both IFEU’s first (220 million) and second approach (221 million).



*The range of population needs covered refers to the food opportunity costs without (min) and with (max) biofuels co-products included

Source: IFEU (2023), share of population based on Eurostat (2019)

Figure 7: Croplands used for biofuels could provide calorie needs of millions of people

Figure 7 shows the potential for food production by European countries. As it is based on the first approach taken by IFEU, it is directly related to the amount of land used by each country for its biofuels consumption. The share of a country's population for which the area could provide sufficient calories, however, varies widely. While it is close to half the population for France and Germany, even taking the conservative approach with areas allocated to co-products excluded, it can reach even more than 100% for countries with a rather small population and a high level of crop-based biofuels consumption, like Sweden and Austria, if co-product areas are included. With the global food crisis worsening, the moral justification of dedicating such large areas of crop land to the production of biofuels and co-products used as animal feed, needs to be questioned. Only the area dedicated to such use for France would be sufficient to grow food for that 50 million people globally that are at imminent risk of starvation.

Amounting to over 5% of Europe's arable land (over 9% when including share used for feed), fields no longer allocated to biofuels production could also be used to facilitate a transition from industrial to organic agriculture across larger regions, compensating for potential yield decreases. It is also almost equal to the areas of farmland set aside in the EU for biodiversity purposes, and which the Commission opened up again last year for farming, in response to the Ukraine war and expected shortages in food and feed supplies [37].

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Phasing out crop-based biofuels could make a significant contribution to mitigate inflation in food prices, enhance global food security and support more sustainability in agriculture and healthier diets.

Farmers do not need to depend on crops in biofuels

Today, Europe's food production is an integral part of the global food system. This system is highly complex and there are no simple fixes, nor simple answers to dealing with change. Some elements are rather clear though - farmers need to get decent prices for their products to be able to survive economically, people need to have access to affordable food to be able to survive physically. Policies are critical in defining the right balance between these two fully legitimate interests.

The EU's Renewable Energy Directive, however, distorts this balance by forcing fuel suppliers to pay nearly any price for the feedstocks they use for the production of biofuels [31]. In times of scarcity, this contributes to prices spiralling out of control, leaving low-income families and even entire countries scrambling for securing access to sufficient food. It also puts industries at disadvantage against the biofuels sector, as they can't access their traditional raw materials anymore, like in the case of animal fat used in the pet food industry [38].

Policies that create a level playing field for all these sectors, carefully tuned to avoid crop prices reaching levels that increase global hunger, would help mitigate this current distortion. It would provide farmers beyond the biofuels sector with customers that also need to get out of fossil fuels, e.g. in the oleochemical sector. Policies strictly enforcing the waste hierarchy principle - material use first, energetic use last - would be a key addition to ensure the best, long lived use of available resources.

In the case of rapeseed, which serves as a good example here with the oil and protein it yields, these changes would still support production on current levels, and hence avoid any negative impact on protein supplies to the animal feed industry from domestic sources. The current level of rapeseed consumption for biofuels needs to be questioned though. For more than 10 years, the EU's rapeseed production does not show any increase anymore [39]. The increasing consumption in Europe is more and more based on imports, from Canada, Australia and until recently the Ukraine. This simply adds to the import dependency for protein sources.

Finally, our current food system and the highly industrialised agricultural management system it is based on is not sustainable, it needs fundamental change. We will need to use less land and use it better. This can mainly be achieved by reducing meat and dairy consumption, which most farmland is dedicated to. A debate needs to take place to decide on the best pathway for land use in the EU. Dedicated tools need to be developed to support farmers managing less livestock and farmland to feed them, and engaging in more sustainable food production and ecosystem restoration for carbon sequestration and biodiversity benefits. This change would prioritise marginal lands, to reduce the impact on harvest volumes. Those lands are often also the ones most interesting from a carbon or biodiversity perspective, like wetlands.

In a nutshell, policy makers need to remove market distorting policies, such as biofuel mandates, so that the market can solve a part of the challenges we face. And they need to create policies that ensure farmers are supported for management practices that are in the interest of the commons, but do not create sufficient profits.

5. Biodiversity Opportunity Costs

5.1. The global biodiversity crisis

Throughout history, humans have profoundly transformed the environment, putting enormous pressure on other forms of life. Wild mammals, e.g., are now making up for only 4% of global mammal biomass. Humans on the other hand for 34%, livestock & pets for a staggering 62% [40]. This explains why around one quarter of wild species in assessed animal and plant groups are now threatened with extinction, many likely to disappear within decades, if no action is taken [41]. The current rate of species extinction is estimated to be 10 to a 100 times higher than the average over the past 10 million years [41] and scientists warn that we are in the midst of the 'sixth mass extinction' [42], with rates accelerating.

The main cause of species extinction is habitat loss driven by our relentless degradation of forests and other natural ecosystems and conversion into areas for agriculture, mining and infrastructure [41]. The UN estimates 20-40% of the world's land to be degraded [11], while more than 80% of Europe's natural habitats are estimated to be in poor condition, according to the European Commission [43]. A report by the German Ministry of Environment explicitly pointed out the increased cultivation of rapeseed and maize for energy use as one of the reasons for this worrying trend [44].

To halt and reverse this trend many initiatives have been started, including the United Nations strategic plan for forests 2017–2030, setting a goal of increasing the global forest area by 3% by 2030 [45]. More recently, the UN also launched the 'Decade on Ecosystem Restoration' [46] and facilitated the Montreal agreement on a Global Biodiversity Framework including a target for restoring '*30 percent of terrestrial and marine ecosystems*' [47] by 2030, amongst several other important targets. The European Commission responded to these UN initiatives by adopting a proposal for a new regulation on nature restoration in 2022 ('Nature Restoration Law') [43].

5.2. Reallocating land to 'rewilding'

To protect biodiversity and strengthen ecosystems, we need to stop ongoing destruction and change management practices in degraded areas. Industrial farming, including the cultivation of crops for biofuels, is a key driver of biodiversity loss globally [48]. Occupying vast areas with crop monocultures for biofuels invariably means less space for natural ecosystems and fewer habitats for wild plants and animals. These ecological opportunity costs can be assessed, based on a methodology developed by the

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IFEU Institute[9] [49] through a comparison with fully sealed landscapes, i.e. areas under infrastructure such as houses, industrial plants, roads, etc., largely void of any biodiversity.

Applying this methodology, the IFEU study shows, that the ecological damage arising from 5.3 million hectares of cropland fully dedicated to the production of biofuels **amount to 2.1 million hectares of fully sealed landscapes, equivalent to 6% of the total area sealed for housing and infrastructure across Europe**

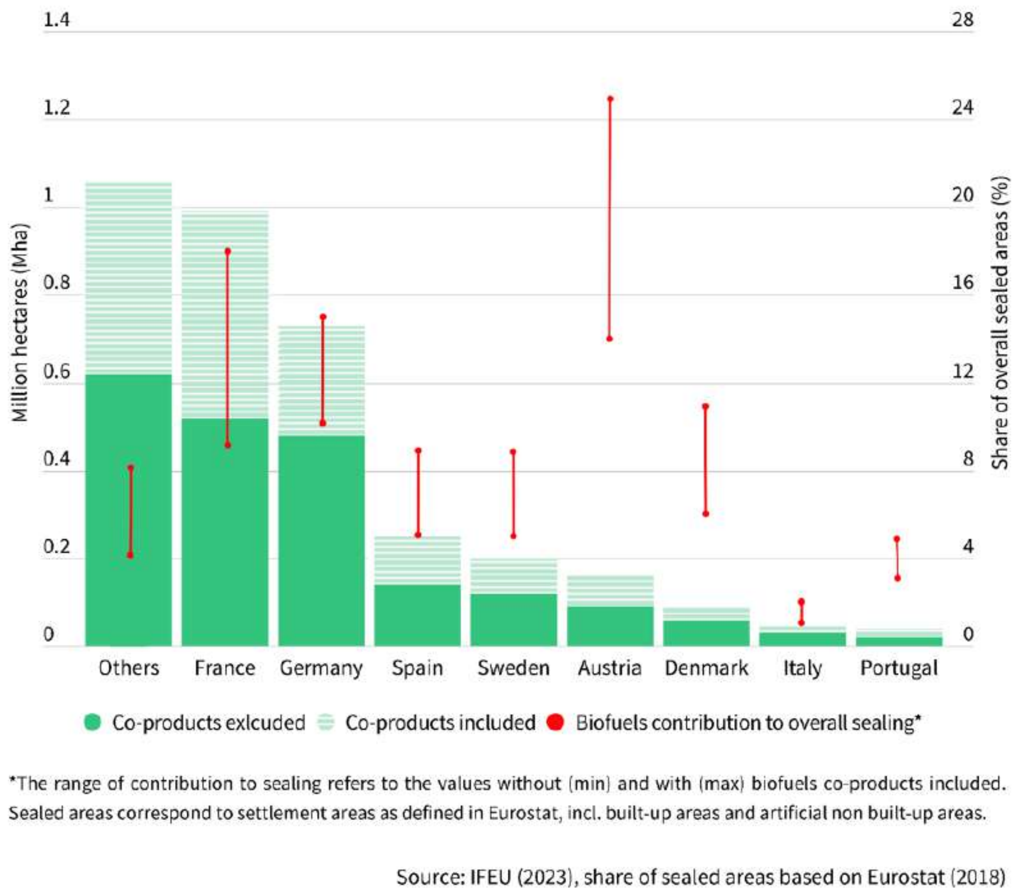

Figure 8: Biodiversity opportunity cost if biofuel crop land were rewilded

Figure 8 indicates the biodiversity opportunity cost by country. Also here, the costs are directly related to the area of land dedicated to the consumption of biofuels by any given country. The chart also shows the comparison of areas 'sealed' for the production of crops for biofuels with the overall area estimated to be sealed in each country. This more granular analysis reveals the real impact of crop-based biofuels on biodiversity, which is not easy to observe when looking at the European average only. In particular countries with a very high consumption of crop-based biofuels, even though also being large in land size,

[9] The methodology is based on the concept of 'hemeroby' which describes the degree of human intervention in any given area as distance from nature. Expressed as 'degree of remoteness' on a scale of 0 (natural) to 1 (artificial), croplands are given a factor of 0.39.

show a significant 'sealing share', above this European average of 6%. Therefore, France's 'sealing' linked to growing crops for biofuels exceeded 8% of its total sealed area and Germany 10%.
For smaller countries with high levels of consumption of such biofuels, the share can even reach values more than twice the European average, e.g. 14% in the case of Austria. Focusing on rewilding on land the size used today for biofuels crops, could make a significant contribution to those countries efforts to halt the loss of biodiversity, as well as to achieving the EU's targets under its proposed 'Nature Restoration Law' [43], in particular on '*improving and re-establishing biodiverse habitats on a large scale*' and improving '*forest connectivity*'.

Ending the use of land for biofuels allows strengthening Europe's natural habitats and the web of life those support, increasing their resilience to future challenges, in particular from climate change.

6. Conclusions

As the IFEU study has demonstrated, dedicating land to the production of crops for biofuels is no meaningful contribution, but rather an obstacle to fighting climate change. Assuming real climate benefits from replacing fossil fuels with crop-based biofuels is based on flawed carbon accounting and fundamentally wrong. Rewilding in combination with solar energy production as laid out above could provide three times higher climate benefits than those assumed in official accounting. This has also been shown to come with co-benefits for Europe's biodiversity, making its ecosystems more resilient to climate change and other challenges. This land could also be allocated to food production, easing pressure on global commodity markets, strengthening regional food supplies and hence help reduce global food insecurity.

A holistic approach will be needed to identify the best use of land in a more sustainable future. As a first step, we will need to end any destructive or wasteful use of land. We will then need to find the right balance between the needs arising from all the crises of our times, be it climate change, species loss, pollution and last but not least, social injustice. Whether this balance will prioritise the sequestration of carbon, food security or biodiversity will need inclusive debates on global, national and regional levels. These debates will certainly also need to take economic factors into consideration, especially the needs of farmers, but must centre around the needs of people and future generations, not around the interests of corporations and shareholders.

Where providing nature with more space again to grow is identified as the best use of land, this must fully respect and integrate the needs of local communities. Indigenous peoples around the globe, in particular, have proven to be the best guardians of healthy and stable ecosystems. We can all learn from them.

To open the door towards a better use of land, **T&E and Oxfam urge policy makers across Europe to use their options under the RED and end all incentives for the use of crops in the production and consumption of biofuels.**

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The resulting reduction in land demand for crop cultivation should be used for increasing ecosystem restoration efforts, contributing to the objectives laid out in the 'EU's Nature Restoration Law' and for supporting a transition towards a more sustainable agriculture.

As the EU's revision of the RED still hasn't been finalised, **we also urge the Commission, Council and Parliament to adopt the good elements tabled with regards to crop-based biofuels, in particular the proposed earlier phase out of palm and soy oil from the EU's biofuels.**

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Further information

Maik Marahrens
Senior Campaign Manager Biofuels & Energy
Transport & Environment
maik.marahrens@transportenvironment.org
+49-(0)151-62816697

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