



Bioeconomy and Food Security

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Moral Conflicts Caused by Climate Change and Population Growth

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Abstract

To limit global warming to well below 2 °C, as agreed upon in the Paris Agreement, a fundamental transformation of all central areas of our societies is necessary. Such a transformation includes energy supply, industry, digital infrastructure, buildings, transport, land use and our general lifestyles. The most important part of such a transformation, however, is a near-term phase-out of fossil fuels. Bioeconomy—an economy based on renewable resources and circulation—suggests a possible solution to the question of how such a transformation can be realised. Using biofuels to produce energy is expected to become a key element of every bioeconomy. Yet, using (food) crops to produce biofuels might conflict with food security—particularly in regard of climate change and population growth. In this essay, I question whether the implementation of a bioeconomy will cause moral conflicts concerning food security in regards of climate change and population growth. Based on a literature review of recent articles, I argue that due to climate change and the anticipated population growth, moral conflicts will very likely arise regarding food security by implementing a bioeconomy based on biofuels. To succeed in transforming our societies and to limit global warming to well below 2 °C, the implementation of a bioeconomy is not enough—even though the idea behind is basically right. What it takes, however, is also a change in our personal behaviour. We need to live and consume in a far more sustainable manner since our consumption patterns are the key drivers of climate change.

Keywords

Bioeconomy · Food security · Climate change

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1 Introduction

A fundamental transformation of central areas of our societies, namely energy supply, industry, digital infrastructure, the building stock, transport, land use and our lifestyles—is inevitable in order to limit global warming to well below 2 °C.¹ This is particularly true of the massive consumption of fossil fuels.² For some years now, great hopes have been pinned on the so-called *bioeconomy* in order to successfully implement the necessary transformation within the coming decades.³ Basically, bioeconomy is concerned with the “Aufbau einer Kreislaufwirtschaft, die im Sinne von Ressourceneffizienz und Nachhaltigkeit eine bestmögliche Verwertung sowie Mehrfachnutzung von Rohstoffen und Stoffströmen [...] ermöglicht”.⁴ A key objective of bioeconomy is to reconcile food security with the sustainable use of renewable resources for industrial purposes, while at the same time ensuring environmental protection.⁵ According to a 2018 study, some 50 nations have defined bioeconomy as part of their policies.⁶ However, particularly with regard to the production of bioenergy and biofuels, the question arises as to what extent the agricultural production of food could be affected.⁷ Although it is stressed that the goal of food security is an essential component of the concept of bioeconomy, it is doubtful whether this goal can be achieved in the near future—especially considering the background of climate change⁸, the associated impacts on agriculture⁹, and a further increase in the world population, especially in sub-Saharan Africa.¹⁰

In this essay, I want to show that we as the present generation (a) have a moral obligation to ensure food security both *intra-* and *intergenerationally*, that we (b) have recognised and accepted this responsibility, but that we (c) do not currently fulfil this obligation, and that our current behaviour at the global level even leads us to (d) reduce, if not destroy, the conditions of possibility to achieve the goal of food security for future generations. Against this background, it is ultimately doubtful that bioeconomy, although basically pointing in the right direction, can achieve the goal of food security on a global level. In the following section, I will first explain where our moral obligation to ensure food security derives from. I will then show that we

¹Cf. Falk et al. (2019).

²Cf. Rogelj et al. (2015).

³Cf. Federal Ministry of Education and Research (2014).

⁴Ibid., 5, “establishment of a circular economy which, in terms of resource efficiency and sustainability, enables the best possible recycling and multiple use of raw materials and material flows [...]” (own translation).

⁵Cf. European Commission (2012).

⁶Cf. Von Braun (2018).

⁷Cf. Tilman et al. (2009), Sheppard et al. (2011) and Lewandowski (2015).

⁸Cf. Intergovernmental Panel on Climate Change (2018).

⁹Cf. Intergovernmental Panel on Climate Change (2019a).

¹⁰Cf. United Nations, Department of Economic and Social Affairs, Population Division (2019).

have accepted this moral obligation and are working to fulfil it, but that our efforts are not yet sufficient. After that I will explain and justify my doubts that bioeconomy can achieve the objective of food security. Lastly, I shall identify some of the measures that are needed to ensure that the objective of food security can be achieved in the near future.

2 The Human Right to Adequate Food

According to Article 11, paragraph 1 of the *International Covenant on Economic, Social and Cultural Rights* (ICESCR), everyone has the right “to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions”.¹¹ The ICESCR was adopted by the United Nations in 1966 and has been ratified by 170 states since its entry into force in 1976.¹² It can therefore be seen as a binding normative basis. The *Committee on Economic, Social and Cultural Rights* (CESCR) monitors and comments on the implementation of the rights established in the ICESCR. In 1999, the CESCR published a commentary on Article 11 of the ICESCR, further expounding the human right to an adequate standard of living. In this note, the CESCR stresses that

the right to adequate food is indivisibly linked to the inherent dignity of the human person and is indispensable for the fulfilment of other human rights enshrined in the International Bill of Human Rights. It is also inseparable from social justice [...].¹³

It also follows from Article 6 of the CESCR comment that

[t]he right to adequate food is realized when every man, woman and child, alone or in community with others, have physical and economic access at all times to adequate food or means for its procurement. The *right to adequate food* shall therefore not be interpreted in a narrow or restrictive sense which equates it with a minimum package of calories, proteins and other specific nutrients.¹⁴

The concept of adequacy is particularly emphasised by the CESCR and, remarkably, is linked to sustainable development in the field of food security, which should be guaranteed not only for present generations but also for future ones. Thus, Article 7 of the CESCR’s comment states that

[t]he concept of *adequacy* is particularly significant in relation to the right to food since it serves to underline a number of factors which must be taken into account in determining whether particular foods or diets that are accessible can be considered the most appropriate

¹¹United Nations (1967).

¹²Cf. United Nations Human Rights Office of the High Commissioner (2020).

¹³Committee on Economic, Social and Cultural Rights (1999), Art. 4.

¹⁴Ibid., Art. 6.

under given circumstances for the purposes of article 11 of the Covenant. The notion of *sustainability* is intrinsically linked to the notion of adequate food or food *security*, implying food being accessible for both present and future generations. The precise meaning of “adequacy” is to a large extent determined by prevailing social, economic, cultural, climatic, ecological and other conditions, while “sustainability” incorporates the notion of long-term availability and accessibility.¹⁵

The question of whether we as the present generation also have obligations to future generations is, however, a controversial ethical issue.¹⁶ Irrespective of the discussion on this question, it follows from the CESCR’s remark that such obligations exist insofar as human rights are used as an ethical basis. If we now take this as a moral yardstick and refer specifically to Article 11 of the ICESCR, this implies that we have a moral duty to end hunger in the world and to ensure that future generations have the possibility of sufficient and adequate food as well. Since human rights are egalitarian in nature and are to be applied equally to all people, the subject “we” in this essay refers to all people living at present. It remains to be noted, however, that societies of rich industrial nations should bear a special responsibility since they have the necessary (financial) resources and, furthermore, because of their economic power, are largely responsible for the current distribution of the world’s resources and thus of food.¹⁷ Nevertheless, the responsibility of rich industrial nations does not exempt other nations from their own responsibility. This is especially true with regard to the establishment of stable political conditions, which are a necessary, though not sufficient, prerequisite to the fulfilment of human rights.

However, if we look at the current situation in the world, it is clear that we are not fulfilling our moral obligation to provide adequate food for all people. According to the latest estimate of the *Food and Agriculture Organization of the United Nations* (FAO), between 720 and 811 million people were suffering from hunger in 2020, mainly in Asia and sub-Saharan Africa. In addition, more than 2.3 billion people did not have permanent access to safe and adequate food.¹⁸ In many cases, this situation constitutes a considerable injustice,¹⁹ which is morally reprehensible, in particular because there is de facto sufficient and adequate food for all currently living people.²⁰ This means that hunger in the world could be eliminated, at least at present, through a more just distribution. Adding to the moral guilt for this global injustice is the fact that our current behaviour is leading to a steady deterioration of the ecological state of the Earth, which could permanently change and even destroy the conditions for

¹⁵Committee on Economic, Social and Cultural Rights (1999), Art. 7.

¹⁶Cf. for example Ott (2004), Meyer (2012) and Caney (2018).

¹⁷Cf. Pogge (2005).

¹⁸Cf. FAO, IFAD, UNICEF, WFP and WHO (2021).

¹⁹An injustice and thus a moral guilt of the present generation exists when those affected do not themselves bear responsibility for the lack of adequate food, but when this lack is caused by external circumstances, especially poverty. This means that the free choice of an unbalanced diet, which can also lead to malnutrition, is not understood as injustice.

²⁰Cf. Wood et al. (2018).

human life.²¹ This is mainly caused by climate change and its impacts,²² but also by the massive loss of biodiversity.²³ In this manner, our current behaviours lead to a reduction of opportunities for future generations to develop. This particularly affects the human right to adequate food since climate change will increase the intensity and frequency of extreme weather events—for example in the form of severe droughts or floods, especially in tropical regions such as sub-Saharan Africa—and thus severely impair agricultural food production. It follows, however, that not only are we failing to meet our moral obligation to our own generation, but we are also disregarding those we have to future generations.

The fact that we have recognised and accepted our moral obligation is demonstrated above all by the United Nations *Sustainable Development Goals* (SDGs).

3 The United Nations Sustainable Development Goals

In order to meet the diverse challenges facing humanity at the beginning of the twenty-first century, the United Nations has adopted the *Agenda 2030 for Sustainable Development* in 2015.²⁴ The overarching goal of this agenda is “to realize the human rights of all [...]”²⁵ Accordingly, among other goals, it seeks “to end poverty and hunger, in all their forms and dimensions”²⁶ and to take “urgent action on climate change”.²⁷ Central to the Agenda 2030 are 17 SDGs which comprise 169 targets. Although all SDGs are “integrated and indivisible”,²⁸ in this essay I will focus on only two SDGs that are particularly relevant for ensuring food security: SDG 2 *Zero Hunger* and SDG 13 *Climate Action*. The first and most important target of SDG 2 is to “end hunger and ensure access by all people, in particular the poor and people in vulnerable situations [...] to safe, nutritious and sufficient food all year round.”²⁹ Even though the term “adequacy” is not explicitly used, it can be concluded that if SDG 2 is successfully achieved by 2030, the human right to adequate food would be fulfilled for the 2030 present generation. Thus, the above-mentioned injustice concerning the *intragenerational* moral obligation would be solved as well.

²¹ Cf. Rockström et al. (2009), Steffen et al. (2015) and Steffen et al. (2018).

²² Cf. Intergovernmental Panel on Climate Change (2018, 2019a, 2019b).

²³ Cf. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019).

²⁴ Cf. United Nations (2015a).

²⁵ Ibid., 3.

²⁶ Ibid.

²⁷ Cf. ibid.

²⁸ Ibid.

²⁹ Ibid., 17.

Actions to achieve SDG 2 include doubling of agricultural productivity and facilitating access to various production factors, especially for disadvantaged groups such as women or indigenous people.³⁰ In addition, investments in various areas of agriculture, such as infrastructure and research, shall be increased and interventions in free trade, especially through agricultural subsidies, shall be ceased.

However, another, yet essential, condition to achieve SDG 2 and other SDGs is to stop climate change. This applies equally to the fulfilment of the human right to adequate food. Aware of the dangers of climate change, the United Nations has formulated SDG 13 as a further part of the Agenda 2030. According to this goal, “urgent action to combat climate change and its impacts”³¹ shall be taken. The key objective of SDG 13 is to limit climate change in accordance with the 1992 United Nations *Framework Convention on Climate Change* (UNFCCC).³² In this respect, SDG 13 is also in accordance with the 2015 Paris Agreement and its main objective of “[h]olding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.”³³

The SDGs demonstrate the insight and declared will of the community of states to initiate and implement the necessary changes. They demonstrate that we have recognised and accepted our moral responsibility towards the securement of well-being of our own generation and towards future generations. Against the background of climate change, which has been progressing largely unabated to date, and a further increase in the world population, the question arises as to whether the SDGs can be achieved by 2030 and beyond. These doubts become particularly clear in the light of two current United Nations reports, the so-called *Emissions Gap Report* and the *World Population Prospects*, both of which are briefly presented in the following section.

4 The United Nations Reports

4.1 The Emissions Gap Report

Every year, the *United Nations Environmental Programme* (UNEP) publishes the *Emissions Gap Report*. Based on the so-called *Nationally Determined Contributions* (NDCs)—current pledges by the member states of the Paris Agreement to reduce annual greenhouse gas emissions—the gap discussed in this report addresses the amount of greenhouse gas emissions that the global community is about to overshoot

³⁰Ibid.

³¹Ibid., 25.

³²Cf. United Nations (1992).

³³Cf. United Nations (2015b), Art. 2.

in 2030. UNEP finds that according to current NDCs there is a gap of 11 gigatons CO₂-equivalents³⁴ (Gt CO₂e) to the 2 °C target and a gap of 25 Gt CO₂e to the 1.5 °C target for 2030.³⁵ If, in addition, commitments linked to several conditions—mostly financial aid—are not met, the gap will increase by a further 2 Gt CO₂e for the 2 °C target and 3 Gt CO₂e for the 1.5 °C target. To compare: global greenhouse gas emissions in 2019 (the last available year) were 58,1 Gt CO₂e. If the 1.5 °C target of the Paris Agreement shall still be achieved, annual greenhouse gas emissions will have to be reduced by more than 50% until 2030. Such a significant decarbonisation is possible, but requires the fastest economic transformation in the history of mankind.³⁶ Even the 2 °C target is severely threatened in view of current efforts. Accordingly, there are considerable doubts as to whether SDG 13 and thus also other SDGs, such as SDG 2, can be met.

Based on current climate policies, global average temperature is likely to increase by 2.8 °C until 2100. Such a warming is highly likely to result in devastating consequences both for the environment and for mankind.³⁷

4.2 World Population Prospects

Another report related to the issue of food security is the biennial report on the expected world population growth by the United Nations *Department of Economic and Social Affairs* (UN DESA). The last edition of the *World Population Prospects* was published in 2019.³⁸ It has confirmed the findings and forecasts of previous reports³⁹ that the world population will continue to grow and will also become older on average. According to current estimates, the world population will grow by about 2 billion to 9.7 billion people by 2050. By 2100, it is estimated that another 1.2 billion people will be added. Much of the projected growth by 2050—more than 1 billion—will take place in sub-Saharan Africa. From 2050 onwards, further growth will be concentrated almost exclusively on this region, which is already affected by recurring hunger periods.⁴⁰ If the world population develops in line with the United Nations forecast, this will very likely increase the number of people suffering from hunger in sub-Saharan Africa, thereby fundamentally jeopardising the fulfilment of SDG 2 and other SDGs.

³⁴One gigatonne equals 10⁹ tonnes. CO₂ equivalents are an artificial unit that also takes into account the effect of other greenhouse gases, such as methane (CH₄) or nitrogen oxide (NO₂), on the basis of CO₂'s harmfulness to the climate.

³⁵Cf. United Nations Environment Programme (2021).

³⁶Cf. Falk et al. (2019).

³⁷Cf. Steffen et al. (2018) and Lenton et al. (2019).

³⁸Cf. United Nations, Department of Economic and Social Affairs, Population Division (2019).

³⁹Cf. United Nations, Department of Economic and Social Affairs, Population Division (2015, 2017).

⁴⁰Cf. Food and Agriculture Organization of the United Nations et al. (2021).

5 Possible Solutions

5.1 Climate Engineering

One possibility of counteracting climate change and its impacts that has been widely discussed for some years is the so-called *climate engineering* (sometimes also called *geoengineering*).⁴¹ It is commonly defined as “the deliberate large-scale manipulation of the planetary environment [...]”.⁴² Due to the insufficient efforts to date to limit climate change, the use of climate engineering methods appears to be very likely, if not necessary, in the near future in order to achieve the 2 °C/the 1.5 °C target agreed upon in the Paris Agreement.⁴³

Climate engineering can basically be divided into two categories: *Solar Radiation Management* (SRM) and *Carbon Dioxide Removal* (CDR).⁴⁴ SRM methods aim to manipulate the Earth’s radiation budget by either reducing the proportion of sunlight incident or increasing the proportion of sunlight reflected by the Earth. This will counteract global warming, but not the actual cause of anthropogenic climate change, i.e. the sharp increase of atmospheric CO₂-concentration compared to the pre-industrial period. In contrast to that, CDR methods aim to reduce the CO₂-concentration in the atmosphere. In this way not only global warming would be counteracted, but also some of its impacts, e.g. ocean acidification.

SRM methods are evaluated very critically, especially from an ethical point of view, as they are associated with high environmental risks.⁴⁵ In contrast, CDR methods tend to be assessed more positively because they are (a) mostly based on natural processes, such as photosynthesis or the natural weathering of rocks, and because (b) they fight the root cause of climate change. Nevertheless, there are also various ethical reservations against CDR.⁴⁶ In principle, the best solution to climate change is a significant and immediate reduction in anthropogenic greenhouse gas emissions.⁴⁷

Currently, the most frequently discussed CDR method is *Bioenergy with Carbon Capture and Storage* (BECCS).⁴⁸ This method combines the use of biomass to produce bioenergy (BE) with the use of Carbon Capture and Storage (CCS) technology to subsequently store the emissions generated during the production of bioenergy.⁴⁹ In addition to afforestation, the use of BECCS is assumed in most scenarios assessed by the *Intergovernmental Panel on Climate Change* (IPCC) in its

⁴¹ Cf. The Royal Society (2009), Rickels et al. (2011) and Caldeira et al. (2013).

⁴² Cf. The Royal Society (2009, p. 1).

⁴³ Cf. Mace et al. (2018).

⁴⁴ Cf. Rickels et al. (2011).

⁴⁵ Cf. Preston (2013).

⁴⁶ Cf. *ibid.*

⁴⁷ Cf. Intergovernmental Panel on Climate Change (2018).

⁴⁸ Cf. Fuss et al. (2018).

⁴⁹ Cf. Canadell and Schulze (2014).

last Assessment Report of 2013, in which global warming could be limited to below 2 °C by 2100 with a probability of more than 66%.⁵⁰ However, the area used for BECCS in these scenarios is so vast that conflicts in land use, especially in tropical regions, would be virtually unavoidable. The same applies to those scenarios in which large-scale afforestation was assumed.⁵¹

5.2 Sustainable Intensification of Agriculture

In view of a growing world population and a growing demand, especially for animal food, an expansion and intensification of agriculture seems almost inevitable.⁵² However, an expansion of conventional agriculture, for example through extensive deforestation or the drainage of peatlands, would further intensify climate change, as additional CO₂ would be released into the atmosphere.⁵³ This in turn would have negative impacts on agriculture, as extreme weather events would increase. Against the background of this dilemma, the concept of sustainable intensification of agriculture has been discussed for several years now.⁵⁴ The idea behind it is to increase crop yields without increasing the ecological footprint of agricultural production and, if possible, even reducing it.⁵⁵ Essential for a sustainably intensified agriculture is that the concept of sustainability is at its core and is not just understood as an attribute to an otherwise conventional production method.⁵⁶ Accordingly, a sustainably intensified agriculture also encompasses several aspects, such as reducing food waste, adjusting subsidies for agricultural products in industrialised countries, ending the agricultural use of individual areas, using fertilisers more efficiently, using new technologies, better education, especially for women in rural regions of sub-Saharan Africa, and a strategy adapted to local conditions.⁵⁷ The use of genetically modified seeds is also not excluded in principle in the context of sustainably intensified agriculture.⁵⁸

⁵⁰Cf. Intergovernmental Panel on Climate Change (2014).

⁵¹Other CDR methods, such as *Enhanced Weathering* or *Direct Air Capture*, were not considered in the last IPCC Assessment Report and are also not discussed any further in this essay.

⁵²Cf. Food and Agriculture Organization of the United Nations (2018).

⁵³Cf. Ramankutty et al. (2018).

⁵⁴Cf. Pretty and Bharucha (2014), Godfray and Garnett (2014) and Rockström et al. (2017).

⁵⁵Cf. Sonnino et al. (2014).

⁵⁶Cf. Rockström et al. (2017).

⁵⁷Cf. *ibid.*

⁵⁸Cf. *ibid.*

6 Bioeconomy

The sustainable intensification of agriculture is one way of meeting the growing demand for food in the future and at the same time counteracting the problem of hunger, especially in sub-Saharan Africa. However, this only marginally addresses the fundamental problem of climate change, as the majority of anthropogenic greenhouse gas emissions are caused by the burning of fossil fuels.⁵⁹ In order to fulfil the objectives of the Paris Agreement and to limit global warming to well below 2 °C above pre-industrial levels, a comprehensive and far-reaching transformation of all areas of life is required, especially in industrialised societies.

The concept of bioeconomy is an important part of this transformation as it aims to achieve sustainable economic growth in harmony with nature.⁶⁰ Essential for this is the renunciation of fossil fuels in favour of renewable resources. However, using plants to produce bioenergy or biofuels is controversial from an ethical point of view in regard to the human right to adequate food, as edible plant varieties such as sugar cane, corn or soya are used, too.⁶¹ And the more these plants are used for the production of bioenergy, the smaller the proportion of agricultural land used for the production of food, which was recently only about 18%,⁶² compared to 71% for the production of animal feed for livestock.⁶³ A further reduction of agricultural land used to produce food would very likely contribute to increasing hunger in the world—what, in turn, would be in clear contradiction to the United Nations SDGs and to our moral obligation to realise food security. Although non-edible plants, such as miscanthus or switchgrass, have been discussed as potential energy sources, too, this does not significantly change the conflict over arable land, as non-edible plants also need land to grow.⁶⁴

Nevertheless, the topic of food security is defined as a key objective of bioeconomy.⁶⁵ In order to guarantee this, the cultivation of food should be given priority on the one hand, and food waste should be reduced on the other.⁶⁶ In principle, existing resources should be used more efficiently. However, the answer to the question of how comprehensively a changeover to renewable resources can actually be achieved by using bioeconomic methods and whether food security will in fact always be a priority remains uncertain, at least for the time being.

⁵⁹Cf. Le Quéré et al. (2018).

⁶⁰Cf. Federal Ministry of Education and Research (2014).

⁶¹Cf. Thompson (2012) and Gamborg et al. (2012).

⁶²Cf. German Environment Agency (2013).

⁶³Cf. *ibid.*

⁶⁴Cf. Murphy et al. (2011).

⁶⁵Cf. Federal Ministry of Education and Research (2014).

⁶⁶Cf. *ibid.*

7 Discussion

Both climate change and projected population growth will have a major impact on agricultural food production in the near future. Both factors will make SDG 2 and other SDGs more difficult to achieve. Furthermore, the use of climate engineering will become almost unavoidable in the near future. According to current models, this will also have a strong impact on agricultural food production, especially in tropical regions. This will make it even more difficult to meet our moral obligation to provide adequate food for all people.

Bioeconomic processes aim at a sustainable production, in which fossil fuels are to be dispensed with. In view of climate change and its associated impacts, this is also urgently required, since a large proportion of anthropogenic greenhouse gas emissions are caused by the use of fossil fuels. To this extent, bioeconomy represents a plausible approach to limit climate change. However, there are justified doubts as to whether bioeconomy can also guarantee the goal of food security. Although currently there would be enough food available to feed all people adequately, it is realistically unlikely that there will be a change in global food distribution in the near future. For this reason, and in view of the expected population growth, an intensification and expansion of (conventional) agriculture, especially in sub-Saharan Africa, will hardly be avoidable in order to stop hunger in the world in the sense of SDG 2.

Even though there are various ways of counteracting hunger without expanding and intensifying conventional agriculture—including new technologies for managing agricultural land, more efficient use of fertilisers and more education, a reduction in food waste and an adjustment of agricultural subsidies in developed countries—it remains doubtful whether the goal of food security can actually be achieved through bioeconomy. The abandonment of fossil fuels will increase the demand for biomass. Although biomass can be obtained in part from organic waste and agricultural residues, these sources alone will hardly be able to meet the entire demand. To this extent, bioeconomy will lead to increased competition for arable land, which will result in an expansion and more intensive use of such land. This in turn will intensify climate change, which will have a negative impact on agriculture as extreme weather events will increase. However, the use of climate engineering is also likely to lead to competition for agricultural land, as very large areas of land are required both for the use of BECCS and afforestation. A portfolio solution that includes various CDR methods would also increase the competition for agricultural land, as both, BECCS and afforestation, would very likely be part of such a solution. In this respect, moral conflicts in land use as a result of climate change and population growth will hardly be avoidable in the near future.

Since we have a moral obligation to fight hunger, we will have to increase the amount of agricultural land available for food production. However, this will exacerbate climate change. In order to limit global warming it will very likely require the use of climate engineering in the near future, given our current efforts. Now, if the two methods mentioned above are used, this will limit the amount of land available to agriculture. The conflict of goals between food production and climate protection will also give rise to various moral conflicts. People in tropical regions of

the world will have to decide whether they want to continue to grow food on their land or whether they want to grow special plants or trees for climate protection. They will have to decide whether they want to sell and migrate their land in the face of climate change or continue to live in their familiar surroundings under much worse conditions.

But inhabitants of industrial nations will have to ask themselves, too, whether they are willing to pay more for sustainably produced food. Whether they are willing to use their wealth and technical capabilities to combat the impacts of climate change particularly in tropical regions, which have been caused by burning large amounts of fossil fuels. If we do not fundamentally change our way of life until 2030 and fulfil our moral obligations, we will neither achieve the United Nations SDGs nor continue to live in a world as we know it today.

Even if the approach of bioeconomy is basically convincing: In order to actually be able to achieve the goal of food security and also to limit climate change, more than just a change in the economy is needed. It requires a fundamental change in our way of life. Our enormous appetite for consumption is a driving force behind climate change and global injustice, and thus also for the unfair distribution of food in the world. If industrialised societies manage to make their consumption more sustainable and conscious, there is hope that the SDGs can actually be achieved by 2030. Sustainable and conscious consumption means, for example, that a new T-shirt cannot be bought for €3.00 if it is supposed to have been produced under fair and climate-neutral conditions. Sustainable consumption also implies higher prices for animal food, especially meat, as such food is very emission-intensive to produce and thus have a negative impact on the climate. Another important aspect of sustainable and conscious consumption concerns the way we travel. Instead of travelling by plane, in many cases we could use a train. Instead of owning and using a private car, we could use a bicycle, car-sharing or even public transport. These are just a few aspects of a whole range of possibilities for tackling climate change and hunger on a small scale. Sustainable and conscious consumption does not necessarily mean renunciation. But it does mean that we are prepared to recognise the true value of things and are accordingly willing to pay for them. In the rich societies of the West, sustainable and conscious consumption would not mean existential cuts, but it would do much more justice to our moral obligation to global food security, which has already been accepted in principle.

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