Agriculture-related Climate Policies – Law and Governance Issues on the European and Global Level

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This paper analyses an area of climate governance which is currently undergoing fast developments on the EU and international level: land use and in particular, agricultural land use. Despite all recent developments, current climate policies in the EU as a whole, but particularly land use policies, prove to be of little use in achieving the ambitious temperature limit set out in Article 2 Paragraph 1 of the Paris Agreement. The Paris Agreement limits global warming to a maximum of 1.5 to 1.8 degrees Celsius. Climate protection law is the basis for the energy transition, which consists at the moment of transforming the electricity sector. Agriculture has not really been integrated yet. In addition, climate governance vastly ignores the fact that different environmental issues (like biodiversity loss, soil degradation and disrupted nitrogen and phosphorus cycles) are interlinked, and that rebound and shifting effects occur. This is despite existing alternative policy options.

I. The Problem

The Paris Agreement (PA), which entered into force in 2016, commits its Parties to limiting climate change to well below 2 degrees Celsius compared to pre-industrial levels, as well as to pursue efforts to stay within a 1.5-degree temperature limit. On both the European and national levels, most attention is paid to the electricity sector which accounts for a substantial part of emissions in industrialised countries, and for which several alternative climate-friendly technologies exist.[1] So far, not only are the heating and transportation sectors frequently left out, but also greenhouse gases (GHG) from land use, agriculture and forestry. An ambitious approach for a drastic reduction of GHG emissions from agriculture and the utilisation of the sequestration potential of the agricultural and land use sector is needed, especially with regard to livestock farming.[2] Furthermore, agriculture is crucial as it links climate issues with other similarly existential ecological challenges such as biodiversity, soils, water, nitrogen (N) and phosphorus (P) cycles.

The purpose of this paper is to analyse the current state of European climate change regulations of the agricultural sector (and its international background

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1 IPCC, 'Fifth Assessment Report, Summary for Policymakers' (2014) <https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf> accessed 17 November 2017: Carbon dioxide (CO_2) from fossil fuels and industrial processes accounted for 62% of global greenhouse gas emissions (GHG), further 11% accrue from land use, methane (CH_4) has a share of 16% and the remaining 8% of GHG consist of nitrogen (N) compounds (especially nitrous oxide, N_2O, and nitric oxides NO_x) as well as fluorinated (F) gases. Data in this varies according to which emissions are included in the agricultural sector.

2 Jonathan Verschuuren, 'Research handbook on climate change adaptation law' (2017), 51 ff (Climate Law); Christiane Bähr, 'Greenhouse Gas Taxes on Meat Products: A Legal Perspective, Transnational Environmental Law' (TEL 2015), 153 ff.

in continuance of prior research).[3] Supported by a brief analysis of the natural scientific data, this paper asks to what extent legislation has effectively addressed GHG emissions from agriculture. A legal analysis is methodologically based on legal interpretation methods as practiced worldwide (the focus here is on the literal sense and systematics of legal norms). If possible, ecological regulatory effects (and the effects of alternative regulatory options) are also considered. This extends the pure legal comparison in substance by aspects of legal effectiveness analysis, respectively governance research. An analysis of the relevant EU legal acts and the existing academic literature is intended to determine whether the existing governance approaches are suitable for complying with the target set out by the Paris Agreement. The paper will conclude that, on closer inspection, this target is more ambitious than is usually assumed. This could fundamentally shift the perspective on land-use governance – all the more so as an integrative perspective on the various land-use related environmental problems may prove necessary.

II. Climate Emissions from Land Use, Interlinked Environmental Issues, Frugality and the Paris Temperature Limit

Land use, land-use change and forestry (LULUCF) are some of the major areas in combating climate change. This sector includes storing and emitting carbon dioxide (CO_2) from forests, arable land, grassland and wetlands. The unique quality of the sector is that it does not only account for emitting GHG, but also serves as a sink. The storage capacities of soil, forests and wetlands are enormous – however, only if they remain intact or are used preserving their functions.[4] Traditionally, the term LULUCF was used in a narrow way. It did not cover agriculture as a whole; in particular, it did not cover emissions from livestock or fertiliser production. Since the Fifth Assessment Report of the IPCC, the term AFOLU (agriculture, forestry and other land use) was introduced alongside LULUCF, broadening the term to describe all climate aspects of land use as a whole. This extended definition includes also emissions from agricultural soils, enteric fermentation, manure management systems, and rice cultivation.[5] We will see, however, that under the current regulations, some emissions from land use are not covered by so-called LULUCF regulations, but rather by those aiming at the non-CO_2 sector in general (especially livestock farming – with the exception of grazing land). The focus of this paper is on agriculture, even if the term land use, as commonly used in international law, also includes forestry.

In the area of land use,[6] we are talking about the GHG carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and nitric oxides (NO_x), which are especially associated with livestock farming and animal feed production (starting with the fact that production of animal products including pastural agriculture makes up around three quarters of global agricultural use[7]). Generally speaking, we are dealing with digestion-related emissions (whereby the beef industry alone accounts for 72% of methane emis-

3 Felix Ekardt, 'Sustainability: Transformation, Governance, Ethics, Law' (2018 in press) (Sustainability); Felix Ekardt, Bettina Hennig and Anna Hyla, 'Landnutzung, Klimawandel, Emissionshandel und Bioenergie' (LIT 2010); Felix Ekardt et al, 'Legal Instruments for Phosphorus Supply Security' (JEEPL 2015) 343 ff; Felix Ekardt, Bettina Hennig and Valentin von Bredow, 'Land use, climate change and emissions trading. European and international legal aspects of the post-Kyoto process' (CCLR 2011) 371 ff; for current information on the vast contents see Charlotte Streck and Agustina Gay, 'The role of Soils in International Climate Change Policy' (International Yearbook for Soil Law and Policy 2016) 105 ff.

4 See for instance Climate Law (n 2), 51 ff. Verschuuren further points out that practices aimed at increased carbon sequestration of soils would have positive side effects like avoiding chemical fertiliser use and pesticides, see Jonathan Verschuuren, 'Towards an EU Regulatory Framework for Climate-Smart Agriculture: The Example of Soil Carbon Sequestration, Transnational Environmental Law' (TEL 2018) 304.

5 On the different definitions IPCC, '2006 IPCC Guidelines for National Greenhouse Gas Inventories' <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html> accessed 3 November 2017 (IPCC NGGIP); IPCC, 'Agriculture, Forestry and Other Land Use (AFOLU)' in IPCC, 'Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change' (2014) 816-822 (AR 5 AFOLU).

6 On this subject IPCC, 'Special Report on Land Use, Land-Use Change, and Forestry' (2000) (Special Report on Land Use); Camila Moreno, Daniel Speich Chassé and Lili Fuhr, 'Carbon Metrics. Global Abstractions and Ecological Epistemicide' (HBS 2015), 41 ff; Climate Law (n 2), 1 ff; Lasse Loft, 'Erhalt und Finanzierung biologischer Vielfalt, Synergien zwischen internationalem Biodiversitäts- und Klimaschutzrecht' (Springer 2009); Ulrich Hoffmann, 'Assuring Food Security in Developing Countries under the Challenges of Climate Change, Key Trade and Development Issues of a Fundamental Transformation of Agriculture' (UNCTAD Discussion Papers 2011); Harald Ginzky et al (eds), 'International Yearbook of Soil Law and Policy 2017' (Springer 2018).

7 Moreno et al (n 6) 41 ff; Almut Jering et al, 'Globale Landflächen und Biomasse nachhaltig und ressourcenschonend nutzen', UBA-Positionen, 2012.

sions from enteric fermentation[8]), fertiliser production, fertilisation and fertiliser storage, GHG-emitting land-use changes etc. (eg conversion of wetlands, grassland or forests into cultivated land).[9] In turn, land use is affected by climate change, which triggers feedback reactions with regard to the soil, even if land use does not ostensibly change, eg in permafrost soils and wetlands.[10] More specifically, considerable amounts of CH_4 are produced in digestive processes of ruminants. Likewise, N_2O and NO_x (as well as ammonium, NH_3) are a result of the application and storage of N-containing fertilisers. In addition, the production of nitrogen fertilisers is very energy intensive (which is frequently not counted as land-use related emissions), as will be elaborated later.

The quantity and quality of ecosystem-service potentials[11] depend on their state. Modern land-use practices can raise the supply of ecosystem services (eg climate regulation) in the short-term; however, due to different degradation processes, which, for example, are caused by intensive agricultural production, the medium and long-term quality of many ecosystem services might – considerably – deteriorate on a regional and global level and harm biodiversity. Soils, forests, plants or oceans can function as carbon reservoirs. The different kinds of sinks lead to calculation and balance problems, also because they have different quotas for the reflexion of solar radiation.[12] Therefore, deforestation with successive afforestation might not maintain the same effects on warming and cooling.[13] Also, besides sink and Albedo attributes, other climate-relevant ecosystem services must be considered.[14] Keeping this in mind, the idea of fighting climate change essentially through afforestation is doubtful: The effect is probably much lower than hoped for, as the sink capacity of trees and the available land is overestimated, while the land-use competition is underestimated.[15] Also, afforestation on land which was not managed before might lead to an increase in emissions. This happens, for example, when wetlands, unmanaged grasslands and forests are used to plant quickly growing, biomass-producing trees.

These uncertainties also show that land-use questions as a whole are much more difficult to capture than fossil-fuel use alone. In this regard, the IPCC identifies the improvement of remote sensing technologies as most promising.[16] In addition however, there are factors like the high number of small emitters, difficulties in verifying single emission sources as well as problems with the monitoring methodology.[17] This is confirmed by the Australian Carbon Farming Initiative (CFI).[18] CFI is the world's first offset scheme, that allows the trading of carbon certificates derived by storing carbon or reducing GHG emissions within farming and forestry projects (next

8 Michelle Nowlin and Emily Spiegel, 'Much ado about methane: intensive animal agriculture and greenhouse gas emissions' in Mary Jane Angelo and Anél Du Plessis (eds), 'Research Handbook on Climate Change and Agricultural Law' (Elgar 2017) 239.

9 On emissions from agriculture see David Blandford and Katharina Hyssapoyannes, 'The Common Agricultural Policy in 2020: Responding to Climate Change' in Joseph A. McMahon and Michael N. Cardwell (eds), 'Research Handbook on EU Agricultural Law' (Elgar 2015) 175 ff; Stefan Frank et al, 'Reducing greenhouse gas emissions in agriculture without compromising food security?' (Environ Res Letters 2017) 5 ff; Bernhard Osterburg et al, 'Handlungsoptionen für den Klimaschutz in der deutschen Agrar- und Forstwirtschaft ' (2013) 4 ff.

10 On the issue of feedback effects in short Sustainability (n 3) Ch 4.4.

11 Ecosystem services include the supply of goods and services of nature which serve the functioning of the biosphere and which human kind can use for its purposes. On this Millennium Ecosystem Assessment in general: Millenium Ecosystem Assessment Board, 'Ecosystems and Human Well-Being: Synthesis' (2005) 9 ff.

12 See Adriana De Palma et al, 'Challenges With Inferring How Land-Use Affects Terrestrial Biodiversity: Study Design, Time, Space and Synthesis' (Next Generation Biomonitoring: Part 1 58 163-199 2018) 164 ff; with regard to the impact of intensive agriculture on soil biodiversity see M. J. Giller et al, 'Agricultural intensification, soil biodiversity and agroecosystem function' (Applied Soil Ecology 1997) 3 ff; with regard to water see David Dudgeon et al, 'Freshwater biodiversity: Importance, threats, status and conservation challenges' (Biol Rev 2006) 163 ff; Sustainability (n 3), Ch 4.9. Natural science findings show that global ecosystems have changed faster and more drastically in the past 50 years due to human impact than they have in any other comparable period in the history of humankind; see Secretariat of the Convention on Biological Diversity, 'Global Biodiversity Outlook 3' (2010).

13 See on this IPCC, 'Fifth Assessment Report 2013, Working Group I, Ch 7' <http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf> accessed 27 November 2017, 609.

14 Especially forests and other ecosystems like wetlands as humidifier are indispensable in the climate-relevant water cycle.

15 Celeste M Black, 'The use of market-based mechanisms to bolster forest carbon' in Larry Kreiser et al, 'Environmental Taxation and Climate Change' (Elgar 2011) 150 ff; Regarding consistency, efficiency and frugality: Sustainability (n 3) Ch 1.3.

16 See table in IPCC Summary (n 1) 50. Whether the statement in 2007 – as usually in the IPCC based on data from 2003 or 2004 – is still up to date that readiness for market of those technologies can be expected in about 20 years, is difficult to assess from a climate-sociological perspective.

17 See also European Commission, 'Commission Staff Working Document' (13 December 2013)SWD (2013) 531, 17.

18 Penny van Oosterzee, 'The integration of biodiversity and climate change: A contextual assessment of the carbon farming initiative' (Ecological Management & Restauration 2012) 238 ff; Phil Polglase et al, 'Opportunities for carbon forestry in Australia: Economic assessment and constraints to implementation' (CSIRO Sustainable Agriculture Flagship 2012) 1 ff.

to landfills), thus including the LULUCF sector in carbon pricing mechanisms to meet Australia's obligations under the Kyoto Protocol.[19] In addition to the difficult determination of the exact amount of carbon credits generated in each individual case[20] the CFI suffers particularly from low participation by farmers.[21] This is due to political and above all also carbon price uncertainties, which were partly very low due to the voluntary nature of the carbon market.[22] Therefore, there is also uncertainty regarding the number of available buyers.[23] Keeping those factors in mind is necessary when developing effective governance instruments.

Due to the global increase in consumption of animal products along with a growing population, longer transits, high food losses and more intensive soil usage, agriculture has become a major climate factor. The same factors are also responsible for other ecological issues like disrupted N cycles,[24] soil degradation, loss of biodiversity and considerable water pollution.[25] Climate change and biodiversity loss reinforce each other, and the storage capacity for GHG of vegetation has drastically declined over the past decades.[26] Considerable amounts of GHG are emitted in terms of global mineral fertiliser usage,[27] primarily for intensive agricultural production systems. In addition, heavy machinery uses an increasing amount of fossil fuels. Economic improvements, particularly in emerging countries, have led to a steadily growing demand for animal products.[28] This has made agriculture the main emitter of CH_4 and N_2O.[29] However, depending on the method of production, there is a substantial difference in the climate footprint of some agricultural products. Organic farming, for example, produces lower emissions per area, but looking at the emissions per product unit, they are on average higher than in conventional agriculture.[30] Combining organic farming, which uses less fossil fuels than conventional farming, with less animal food (instead of compensating for smaller yields by using more land), would improve the climate footprint of the food system immensely.[31] At

19 Oosterzee (n 18), 1.

20 With regard to the calculation of the reduction of GHG emissions of certain environmental plantings and the remaining uncertainties, see Polglase et al (n 18) 18 ff.

21 Marit E Kragt, Nikki P Dumbrell and Louise Blackmore, 'Motivations and barriers for Western Australian broad-acre farmers to adopt carbon farming' (Environmental Science and Policy 2017) 115 ff.

22 Oosterzee (n 18) 1; Kragt et al (n 21) 120.

23 Kragt et al (n 21) 120.

24 For all details on N-derived products like nitrate, nitric gases, ammonium and nitrous oxides see <https://www.oekom.de/fileadmin/zeitschriften/UB_Leseproben/UB_2016-09_Leseprobe.pdf> accessed 12 December 2017.

25 On different aspects Bettina Hennig, 'Nachhaltige Landnutzung und Bioenergie' (Metropolis 2017), Ch 2.1.2; Loft (n 6); Hoffmann (n 6) 5 ff; IPCC Special Report on Land Use (n 6); Moreno et al (n 6) 41 ff; Lieske Voget-Kleschin, 'Sustainable Food Consumption? Claims for Sustainable Lifestyles in Between Normative and Eudaimonistic Issues. The Example of Food Production and Consumption' (Thesis 2013) 163 ff and 215 ff; FCRN, 'What is efficiency? And is it sustainable? Animal production and consumption reconsidered' (2015) 2 ff; Susanne Stoll-Kleemann and Tim O'Riordan, 'The Sustainability Challenges' (Environment 3/2014) 34 ff; Mukund Govind Rajan, 'Global Environmental Politics. India and the North-South Politics of Global Environmental Issues' (Oxford University Press 1997), 159 ff; Sustainability (n 3) n Ch 4.9.

26 See Boris Sakschewski et al, 'Resilience of Amazon forests emerges from plant trait diversity' (Nature Climate Change 2016) 1032 ff.

27 See FAO, 'World fertilizer trends and outlook to 2020' (2017) 2.

28 With regard to the development of average meat consumption in developing countries and industrialised nations, see Nowlin and Spiegel (n 8) 235 ff.

29 See also Commission, 'The role of European agriculture in climate change mitigation' (Work Document) SEC (2009) 1093 final. Generally, agriculture accounts for about 20% of global GHG emissions. A definite estimation is not possible due to the difficulties in monitoring and the high global variability depending on food supply and different basic assumptions in each state; attempts are made in Julia Grünberg, Hiltrud Nieberg and Thomas G Schmidt, 'Treibhausgasbilanzierung von Lebensmitteln (Carbon Footprints): Überblick und kritische Reflektion' 2010, 55; IPCC AR 5 AFOLU (n 5) 822; Carbonbrief.org, 'Analysis: What does revised methane data mean for the Paris Agreement?' (29 September 2017) <https://www.carbonbrief.org/analysis-what-does-revised-methane-date-mean-for-paris-agreement> accessed 21 March 2018; Bähr (n 2) 153 ff.

30 Eva-Marie Meemken and Matin Qaim, 'Organic Agriculture, Food Security, and the Environment' (Annu. Rev Resour Econ 2018) 4.10; Alfredo J Escribano and Petr Konvalina, 'Organic Livestock Farming – Challenges, Perspectives, and Strategies to Increase Its Contribution to the Agrifood System's Sustainability – A Review' in Petr Konvalina (ed), 'Organic Farming' (Ch 11, 2016) 3, 7-8; Abhishek Chaudhary, David Gustafson and Alexander Mathys, 'Multi-indicator sustainability assessment of global food systems' (Nature Communications 9 2018) Art 8, 1 ff; Peter Read, 'The role of carbon storage and climate change' in Francisco Rosillo-Calle et al (eds), 'The Biomass Assessment Handbook. Bioenergy for a Sustainable Environment' (Basingstoke 2007) 5, 225 ff.

31 See UNCTAD, 'Trade and Environment Review' (2013); Ann-Helen Meyer von Bremen and Gunnar Rundgren, 'Foodmonopoly. Das riskante Spiel mit billigem Essen' (2014) 97 ff; Jesco Hirschfeld, Julika Weiß und Thomas Korbun, 'Ansätze zur klimafreundlichen Agrarpolitik' (Ökologisches Wirtschaften 1/2009) 15-16; eg, organic farming can store for up to three times as much C as conventional agriculture, in addition to less climate relevant CO_2 and nitrogen emissions. See Read (n 30) 225 ff; Helmut Haberl and Karl-Heinz Erb, 'Assessment of Sustainable Land Use in Producing Biomass' in Jo Dewulf and Herman Van Langenhove, 'Renewables-Based Technology, Sustainability Assessment' (Wiley 2006) 183 ff; Michael Clark and David Tilman, 'Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice' (Environ. Res. Lett. 2017) 1 ff.

the moment, pressure on land use increases due to the trend of using (cultivated) biomass for energy and material use.[32] In view of its impact on climate, environment and food security, it should however only be used sparingly, despite the advantages its materiality might have for future energy supply.[33]

In agriculture, there are many technical approaches aimed at reducing emissions: precision farming and efficient fertilisation, rewetting of peatlands, vegetation decisions, animal feed composition etc.[34] But even though emissions intensity, meaning GHG per unit, has decreased since the 1960's because of increased efficiency in agriculture and forestry,[35] there has also been an increase in the intensity of land use with all its consequences. Therefore, agriculture is a sector which shows that besides technological solutions, frugality, meaning behavioural changes like clearly reduced consumption of animal products, is necessary.[36] In essence, this seems also necessary in order to meet the target of limiting global warming to 1.5 to 1.8 degrees compared to the pre-industrial level set in the Paris Agreement. This legally binding target requires zero emissions globally within the next one or two decades,[37] and even a technologically improved agriculture will still emit significant amounts of GHG. Thus, even if animal-based diets were to be reduced substantially, it will be necessary to absorb remaining emissions through technologies to create negative emissions.[38] With that in mind, rewetting peatlands, or (if land is available) afforestation, appear more reasonable than expensive and risky geo-engineering approaches.

As an agriculture sector which is compatible with the Paris Agreement, and also with other international binding agreements such as the Convention on Biological Diversity (CBD), will have to abandon fossil fuels, many issues still need to be addressed. As already mentioned, agricultural processes currently heavily rely on mineral fertilisers and the use of heavy machinery, that as of yet, cannot be operated by electricity alone. Furthermore, due to the highly globalised food market, a long processing chain for food production exists,[39] which requires the use of fossil fuels as well. With regard to the use of fertilisers, the orientation towards a circular economy[40] demands the use of recycled fertilisers such as recovered phosphorus from sewage sludge or organic fertilisers for food production, but they would need to be produced with renewable energies.[41] With regard to renewably-produced nitrogen in mineral fertilisers, there is the (so far little used) option to renewably generate hydrogen which is needed for the ammonium synthesis.[42] Traditionally, fossil gas is used for the energy-intensive Haber-Bosch process, it is

32 Reducing traditional use of biomass bears immense potential to reduce CO_2 emissions; see IPCC AR 5 AFOLU (n 5) 872. According to the IPCC, use of algae seems promising for further research for material and energetic use besides land-based biomass. So far however, there are no technologies available which are ready for implementation and economically sensible; see ibid 877.

33 In depth on this debate Hennig (n 25) Ch 2.2. Even if bioethanol is produced from waste from forests and agriculture only, there are trade-offs. In forests, the natural degradation process of eg deadwood releases C more slowly and more compliant with the natural C cycle of a forest than in energetic use. In agriculture, there might be side-effects, eg if waste which would usually remain on the field, is now used energetically and the C content of the soil decreases in the long-term. Direct competition of usage is an issue with agricultural waste, when they are traditionally used as livestock litter or as fertiliser. See IPCC AR 5 AFOLU (n 5) 871.

34 See on all this IPCC AR 5 AFOLU (n 5) 849, Figure 11.13; IPCC Summary (n 1) 55.

35 By 38% for milk, by 50% for rice, by 45% for pork, by 76% for chicken and by 57% for eggs. An exception are cereals, where emission intensity has increased by 45%; IPCC AR 5 AFOLU (n 5) 848 and 851 Figure 11.15. Other effects on the environment are disregarded.

36 On the (widely ignored) necessity of changing in animal product consumption see inter alia Bähr (n 2) 153 ff; Voget-Kleschin (n 25) 163 ff and 215 ff; FCRN (n 25) 2 ff; Stoll-Kleemann and O'Riordan (n 25) 34 ff.

37 More on different calculations (each based in IPCC data) with further references: Felix Ekardt, Jutta Wieding and Anika Zorn, 'Paris Agreement, Precautionary Principle and Human Rights: Zero Emissions in Two Decades?' (Sustainability 2018); On the PA in general see Felix Ekardt and Jutta Wieding, 'Rechtlicher Aussagegehalt des Paris-Abkommens: Eine Analyse der einzelnen Artikel' (ZfU special edition 2016) 36 ff.

38 See IPCC AR 5 AFOLU (n 5) 873-875. While the recent dietary changes worldwide develop in a contrary direction. Especially China and India show an increasing demand for animal products – with the respective rise of GHG emissions – while meat consumption in developed countries stagnates on a high level: Climate Law (n 2) 5; Bähr (n 2) 156.

39 Phillip Baker et al, 'Trade and investment liberalization, food systems change and highly processed food consumption: a natural experiment contrasting the soft-drink markets of Peru and Bolivia, Globalization and Health' (2016) 12 ff.

40 Commission, 'Proposal for a Regulation of the European Parliament and of the Council laying down rules on the making available on the market of CE marked fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 final' COM(2016) 157; with regard to P Thomas Nesme and Paul JA Withers, 'Sustainable strategies towards a phosphorus circular economy' (Nutr Cycl Agroecosyst 2016) 259 ff.

41 Johan Rockström et al, 'A roadmap for rapid decarbonization' (Science 2017) 1269 ff; Joeri Rogelj et al, 'Feasibility of limiting warming to 1.5 and 2°C' (Climate Analytics 2015).

42 In Norway this procedure is traditionally used; see Cédric Philibert, 'Producing industrial hydrogen from renewable energy' (Commentary 2017) <https://www.iea.org/newsroom/news/2017/april/producing-industrial-hydrogen-from-renewable-energy.html > accessed 23 July 2018.

however possible to generate hydrogen through water powered electrolysis with renewable energy – but at different economic costs for businesses.[43] In order to achieve regionally adapted fertilisation in agriculture, which is largely organic, it is necessary to establish livestock farming systems that are optimally adapted to the side-specific conditions. Integrated crop-livestock systems, that combine livestock farming and crop production and which are clearly geared to the locally available arable land in terms of the number of animals are therefore preferable.[44] Hence, this requires structural changes in the current farming systems, which have so far rather followed the ideal of specialisation and intensification and is inevitably associated with a significantly lower total production of animal foodstuff.[45] However, more research is needed to develop methods to close local fertilisation cycles and preserve climate and biodiversity at the same time according to the legally binding international agreements. In this context, a rough estimate would be helpful to determine how much organic fertiliser could be produced globally with varying amounts of livestock, and what levels of emissions would be produced (and how much carbon could be stored additionally in sinks due to changed land use and livestock). Not to forget that even with a much smaller quantity of animals, CH_4 and CO_2 emissions from the digestion of animals, considerable drivers of climate change, would remain. A further question is to what extent these emissions can be avoided, for example by improved feeding practises in cattle farming or methane capturing and conversion in piggeries. The remaining quantity of available fertiliser originates in farms and the additional sequestration potential of sinks due to changed land use practises (as result of a lower overall quantity of farm animals and less feed cultivation) determine the emission intensity of livestock farming decisively.[46]

III. State of Debate on LULUCF in International Law after the Paris Agreement

As shown, agriculture and especially livestock farming as well as the other land use activities are crucial for the achievement of the 1.5°C target of the PA, although the PA hardly mentions this.[47] The role of land-use related emissions and sinks[48] are covered in Article 5 Paragraph 1 of the Paris Agreement. This includes emissions from agriculture, other land use and deforestation. The PA adopts the list of sinks states in Article 4, Paragraph 1 of the UN Framework Convention on Climate Change (FCCC), which includes biomass, forests and oceans as well as other eco-systems on land, the coast and in the sea. The parties to the PA are required to take appropriate protection measures (while the PA leaves all activities at the discretion of states; except for the overarching objective which is very ambitious and legally binding). Whether this includes all emissions from agriculture as the IPCC suggests (also all livestock emissions; see above), or only covers land-based emissions remains unclear.

In climate negotiations, sinks were long left on the side-lines. Since 2011, however, the agriculture sector is covered through a general consultation process by the Subsidiary Body for Scientific and Technological Advice under the FCCC. Consequently, in November 2017, a three year working programme was formed especially to contribute adaptation solutions in the agriculture sector.[49] It follows that peasant farming receives more attention, which accounts significant-

43 ibid.

44 See Gilles Lemaire et al, 'Integrated crop–livestock systems: Strategies to achieve synergy between agricultural production and environmental quality' (Agriculture, Ecosystems & Environment 2014) 4 ff; eip-agri, 'Landwirtschaftliche Gemischtbetriebe: Tierhaltung und Marktfruchtbau' (2017) 1-2.

45 With regard to the positive effects of reduced livestock farming on biodiversity see Brian Machovina, Kenneth J Feeley and William J Ripple, 'Biodiversity conservation: the key is reducing meat consumption' (Sci Total Environ 2015) 419 ff; on the integrated land management FAO, 'Land resource planning for sustainable land management. Current and emerging needs in land resource planning for food security, sustainable livelihood, integrated landscape management and restoration' (2017) 9 ff; UNCCD, 'Global Land Outlook' (2017) 130 ff.

46 See Qian Yue et al, 'Mitigating greenhouse gas emissions in agriculture: From farm production to food consumption' (Journal of Cleaner Production 2017) 1011 ff; Climate Law (n 2) 1 ff; as well as on measures for mitigation GHG emissions Blandford and Hyssapoyannes (n 9) 181 ff.

47 Climate Law (n 2) 3; Sustainability (n 3) Ch 4.6 and 4.9.

48 Sinks in terms of Art 1 para 8 FCCC, include all processes, activities and mechanisms that absorb GHG from the atmosphere.

49 SBSTA, 'Issues relating to agriculture' (Draft conclusions proposed by the Chair) FCCC/SBSTA/2017/L.24/Add.1 based on the Decision 1/CP.17 'Establishment of an Ad Hoc Working Group on the Durban Platform for Enhanced Action' FCCC/CP/2011/9/Add.1. A summary of the results is found in SBSTA, 'Report of the Subsidiary Body for Scientific and Technological Advice on its forty-sixth session, held in Bonn from 8 to 18 May 2017' FCCC/SBSTA/2017/4 paras 37–40. A clear focus is on issues of adaptation and on increasing resilience in agriculture and connected socio-economic questions.

ly to feeding the global south and which is already heavily impacted by the consequences of climate change (see below regarding Article 7 PA). Yet, mitigation of emissions from agriculture is still only addressed infrequently.[50]

Article 3, Paragraph 3 of the Kyoto Protocol (KP) already regulated the crediting of sinks. Changes of carbon sinks since 1990 due to human-induced land-use change and forestry activities have been credited. However, permitted changes in land use are limited to afforestation, reforestation and deforestation.[51] Despite consistent forest stocks, countries with active forest management are able to receive net debits. To compensate for this loophole, it was agreed that those debits may not exceed the amount of allowances issued since 1990 during the first commitment period.[52] Article 3 Paragraph 4 KP regulates that any sink activities are creditable (in contrast to the confusing wording also within the first commitment period). According to the Accords of Marrakesh, forestry, farming on arable land and grassland as well as greening deserted land are recognised for crediting. However, there are quantity limits for the crediting of forestry activities: Firstly, C sinks from forestry may only be counted towards net losses of sinks according to Article 3 Paragraph 3 KP (deforestation) until the number of allowances compensated, but never higher than up to 9 Mt C/a at most. Secondly, the increase of carbon sinks through forestry according to Article 3 Paragraph 4 KP can only be credited up to the amount granted to states individually in the appendix for the first commitment period. For Germany, this amounts to 1.24 Mt C/a. A highly disputed question with regard to the recognition of land-use activities for climate protection was the regulation of sink projects within the flexible mechanisms of the KP. These are the Clean Development Mechanism (CDM), Joint Implementation (JI) and (international) emissions trading (ET).[53] The second commitment period of the KP from 2013 to 2020 contains the continuation of these provisions.[54] Until today, the amendment of the Kyoto Protocol, constituting the second commitment period, has not entered into force.[55]

Since the Bali conference in 2007, many political models to constitute and operationalise a global forest carbon market have been discussed under the label of REDD, respectively REDD+ (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries).[56] The idea is that by allocating monetary value to forests, they receive more attention in future policy decisions, thus increasing forest preservation in developing countries. In order to do so, emissions would first need to be monitored and evaluated with a specially designed methodology. The specific design of the REDD+ mechanism is still very controversial in its details: there are several types of operationalisation on the table (eg inclusion in the emissions trading, funds, development of an entirely new instrument), without any indication of finding a consensual solution. Despite a first REDD+ agreement at the Cancún conference in 2010 under the FCCC,[57] there is no perspective for the actual implementation of respective financing mechanisms or any concrete details.[58] Uncertainty remains also with regard to key issues such as financing and

50 Avoiding emissions which are produced in agriculture is at best a positive side-effect of this. When avoiding emissions is mentioned, main focus is on further research requirements. See eg SBSTA, 'Workshop on the identification and assessment of agricultural practices and technologies to enhance productivity in a sustainable manner, food security and resilience, considering the differences in agroecological zones and farming systems, such as different grassland and cropland practices and systems' FCCC/SBSTA/2016/INF.6, paras 20, 23, 27, 28, 38; on the PA, climate and agriculture also Streck and Gay (n 3) 129 ff.

51 See Decision 11/CP.7 'Land use, land-use change and forestry' FCCC/CP/2001/13/Add.1 58. Regulation linked to LULUCF activities were highly disputed in the negotiations of the Accords of Marrakesh. When the negotiations were about to fail, a compromise was found in favour of the position of Russia, Japan and Canada. It included that a wide range of sink activities are recognised as climate protection measures. This paved the way for the Kyoto Protocol entering into force after the withdrawal of the USA from negotiations.

52 On the following information of this paragraph FCCC/CP/2001/13/Add.1 (n 51) 59 ff.

53 FCCC/CP/2001/13/Add.1 (n 51) 60, 63. In depth on the CDM Anne Exner, 'Clean Development Mechanism' (2016); on JI Beatrice Garske, 'Joint Implementation' (2013); critically on both also Sustainability (n 3) Ch 4.6.

54 Doha Amendment to the Kyoto Protocol; Art 3 para 7 and Art 3 para 12.

55 UNFCCC, 'Status of the Doha Amendment' <http://unfccc.int/kyoto_protocol/doha_amendment/items/7362.php> accessed 30 November 2017.

56 REDD included originally merely emissions from deforestation and forest damage. Since 2007, it was broadened to REDD+, including now also forest protection in terms of management and reforestation. This provides the basis for mentioned efforts to monetarise the sector, because not only destruction can be punished, but also conservation rewarded.

57 See Decision 1.CP16 'Outcome Documents Ad Hoc Working Group on long-term Cooperative Action under the Convention' (in the following: COP-16/LCA) Ch C Arts. 68–79 .

58 See Art 77 COP-16/LCA, which defers the further debate on financing to COP-17.

the definition of key terms (eg 'sustainable forestry') and the decision to introduce market mechanisms into REDD+. A technical paper by the FCCC secretariat, published in 2008, giving an overview of the mitigation potentials and methods as well as its challenges[59] was largely inconsequential, except for the suggestion to include agriculture in the Nationally Appropriate Mitigation Action Plans of developing countries. Also, the need to attempt to provide finance was formulated.[60]

The negotiating drafts of the PA contained only reference to agriculture regarding climate-relevant policy areas which require additional finance.[61] In the final drafts, any mention of agriculture had disappeared altogether. Only the reference to food security was adopted into the agreement, however along the lines of recognising the need for adaptation in the preamble.[62] In terms of mitigating emissions from agriculture, the Paris Agreement does not provide clarity. Article 5 and 6 of the agreement contain vague statements on both land use and economic instruments (such as the JI or the CDM[63] under the Kyoto Protocol). Accordingly, their future is uncertain. In the negotiations to specify the agreement, Article 5 has, for the most part, been left aside. Decision 1/CP.21, which is the corollary decision to the PA, suggests in Article 54 that Article 5 Paris Agreement serves the implementation of REDD+. On the further configuration of instruments for inter-state cooperation according to Article 6, there are no indications of substantial decisions.

This, however, does not cover the whole debate on land use, because Article 4 of the Paris Agreement remains applicable. Measures to reduce emissions in the LULUCF sector occur in almost all climate-policy programmes of developing countries at a prominent position.[64] Some industrialised countries also take climate measures in forestry and even at times in the agricultural sector.[65] Besides, there are voluntary carbon markets with quality standards (Gold Standard, Community & Biodiversity Standards, Plan Vivo).

In the negotiation process of the PA, the EU suggested that all agricultural emissions including enteric fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savannas, field burning of agricultural residues, liming, urea application and other carbon-containing fertilisers should be included.[66] Even though not included in the PA, some of this is reflected in the EU climate legislation beyond 2020.

IV. State of EU Regulation on Climate-Related Land-Use Emissions

1. EU Emissions Trading Scheme, Effort Sharing Regulation and Regulation of Land-Based Emissions

The current EU climate targets until 2020 do not include emissions directly from land use beyond factors such as mineral fertiliser, transportation etc. Not included are both sink effects of soil and biomass as well as emissions which result from agriculture and forestry, but also from land use changes.[67] However, CO_2 emissions which result from the LULUCF sector, like from fossil fuels for processing activities (eg fertiliser production and processing of agricultural products in industry), have always been covered by

59 UNFCCC, 'Challenges and opportunities for mitigation in the agricultural sector' (Technical Paper of 21 November 2008) FCCC/TP/2008/8.

60 UNFCCC, 'Report on the workshop on opportunities and challenges for mitigation in the agricultural sector' (7 April 2009) FCCC/AWGLCA/2009/CRP.2 No. 9, 18-19.

61 UNFCCC, 'Ad Hoc Working Group on the Durban Platform for Enhanced Action' (Negotiating text version of 25 February 2015) FCCC/ADP/2015/1 35. Jonathan Verschuuren, 'The Paris Agreement on Climate Change: Agriculture and Food Security' (EJRR, 7 1 2016) 57.

62 Jonathan Verschuuren, 'Climate change and agriculture under the United Nations Framework Convention on Climate Change and related documents' in Mary Jane Angelo and Anél Du Plessis (eds), 'Research Handbook on Climate Change and Agricultural Law' (Elgar 2017) 43-44.

63 However, only projects in the LULUCF sector aiming at reducing methane or dealing with bioenergy can be included in the CDM. For more on the conditions and limits see Donald F Larson, Ariel Dinar and J Aapris Frisbie, 'Agriculture and the clean development mechanism' (World Bank 2011) 9.

64 See IPCC AR 5 AFOLU (n 5) 863.

65 Forestry is therefore since 2008 part of the New Zealand emissions trading under the Kyoto Protocol; since 2012, there are reporting requirements for certain branches of agriculture, especially on livestock farming. In California, emission certificates from LULUCF are tradable from reduction of methane emissions, from biogas plants and from livestock farming, carbon sequestration of urban and rural forestry and elimination of ozone-damaging substances; see IPCC AR 5 AFOLU (n 5) 865.

66 Commission, 'Energy Union Package Communication From The Commission To The European Parliament And The Council, The Paris Protocol – A blueprint for tackling global climate change beyond 2020' (25 February 2015) SWD(2015) 17 final 7, 16.

67 Commission, 'A new EU Forest Strategy: for forests and the forest-based sector' COM(2013) 659 final, 9-10.

the EU Emissions Trading Scheme (EU ETS).[68] Apart from that, agriculture is a non-ETS sector in the EU. To date, this also includes emissions from the use of heavy machinery (and from the transport sector in general) occurring in the context of agriculture.[69]

Emission trading systems are a major policy instrument to reduce GHG not only in the EU but also in a large number of countries worldwide.[70] ETS could serve as an instrument for a phase-out of (especially climate-relevant) fossil fuels and – with regard to agriculture – fossil-based mineral nitrogen fertilisers. The current ETS Directive (Article 5) covers only mineral fertilisers without storage and application on the land (just like it does not cover most of the heating and transportation sector). Furthermore, even the complete inclusion of fertiliser would be largely without substance, as long as a cap, in accordance with Article 2 Paragraph 1 Paris Agreement, is missing and there are huge amounts of old certificates on the market. Also, the reduction of surplus certificates, as decided in 2017, has had little impact.[71]

Similar to the implementation of the Kyoto Protocol as part of international climate law, the EU works on its own distribution of the intended climate targets within the PA with respective implementation on EU level.[72] The EU implementation acts are additional to the national climate agendas of its Member States. One example is the 2030 climate and energy framework (succeeding the Climate and Energy Package) passed in 2014.[73] Key targets are 40% GHG reductions compared to 1990, 27% electricity generation from renewable energies, 27% energy saving (through energy increased efficiency) compared to a business-as-usual scenario. To achieve this, 43% of GHG included in the EU ETS are to be reduced and 30% (compared to 2005) in the non-ETS sectors buildings, transportation, agriculture and waste. Effort Sharing, consisting of the Effort Sharing Decision (ESD) with targets until 2020 and the Effort Sharing Regulation (ESR) for the period from 2021 to 2030, is the main instrument of the EU's energy and climate strategy. It divides the EU targets among its Member States according to their Gross Domestic Product[74] and contains reduction targets for GHG emissions, including non-CO_2 emissions.[75] Yet, they are treated separately from other GHG sources, because at the time the targets were passed, they seemed too diffuse, even though they are part of the reduction commitments of the KP.[76] The LULUCF sector is only required to occur in the national inventories.[77]

After the EU Member States had ratified the PA, a proposal for a new ESR was introduced in July 2016 and passed in May 2018, containing revised targets within the so-called EU energy and climate package of reducing GHG emission by 30% by 2030 compared to 2005 levels.[78] Through Article 7 (Effort Sharing

68 Directive 2003/87/EC of the European Parliament and the Council 13-10-2003 on a system for trading emission certificates in the community and amending Directive 96/61/EG of the Council [25 October 2013] L 275/32 Art 5. This is not affected by Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 [19 March 2018] L 76/3.

69 TEL 2018 (n 4) 307.

70 Climate Law (n 2) 6.

71 Michiel Stork and Charles Bourgault, 'Fertilizers and Climate Change – Looking to 2050' (Fertilizer Europe/Ecofys 2015) <https://issuu.com/efma2/docs/ecofys_fertilizers_and_climate_chan> accessed 23 July 2018; Helge Sigurd et al, 'Carbon leakage in the nitrogen fertilizer industry' (Copenhagen Economics 2015) 5-10; on the overall shortcomings of the EU ETS Wolfgang Eichhammer et al, 'Impacts of the Allocation Mechanism Under the Third Phase of the European Emission Trading Scheme' (Energies 11 2018); Sustainability (n 3) Ch 4.5.

72 Submission by Latvia and the European Commission on behalf of the European Union and its Member States, Intended Nationally Determined Contribution of the EU and its Member States, 6 March 2015, <https://www4.unfccc.int/sites/submissions/indc/Submission%20Pages/submissions.aspx> accessed 19 July 2018.

73 Commission Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A policy framework for climate and energy in the period from 2020 to 2030 [2014] COM/2014/015 final framework for climate and energy.

74 Decision 406/2009/EC on the Effort of Member States to Reduce Their GHG Emissions to Meet the Community's GHG Emission Reduction Commitments up to 2020 [2009] L 140/136.

75 According to Annex A Kyoto Protocol Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6) and since 2013 also nitrogen trifluoride (NF_3).

76 See Commission, 'A Roadmap for moving to a competitive low carbon economy in 2050' COM(2011) 112 5, 9.

77 Decision No 529/2013/EU of the European Parliament and of the Council of 21-05-2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities [18 June 2018] L 1656/80.

78 See Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 [19 June 2018] L 156/26].

Regulation), a newly established LULUCF Regulation, passed in May 2018 is integrated into the climate package.[79] So, starting in 2021 for the first time, LULUCF emissions will be regulated and not only monitored. Article 2 of LULUCF Regulation defines managed wetlands, grasslands, croplands and forests as well as changes in land use as subjects to the target of no net loss in Article 4 of the LULUCF Regulation. Therefore, land-based emissions from agriculture are covered.[80] The question, however, where emissions from fertiliser application are accounted for is not easily answered. The ESR covers emissions from agriculture as a whole, including fertiliser application.[81] On the other hand, the definition of cropland management in the LULUCF Decision 529/2013/EU includes all activities on land which are used for growing agricultural crops. Therefore, it can be argued that N_2O and CH_4 emissions which occur in the application process fall under the ESR, whereas N_2O emissions on cropland are accounted for in the LULUCF Decision as they are part of growing agricultural crops. In addition, the newly established LULUCF Regulation (which is an amendment of the initial LULUCF Decision) does not include emissions from enteric fermentation which might occur from livestock on grassland – they are also covered by the ESR. The Regulation introduces improved methods for monitoring and reporting of LULUCF-emission levels. Emissions from livestock farming (except from grazing land) and fertiliser application in the agricultural sector are therefore part of the targets within the Effort Sharing Regulation.[82] The goal of the LULUCF Regulation is to achieve a balance between biomass losses and gains in the intermediate term: According to the *no-debit rule*, a negative balance must be compensated within ten years. Limited exceptions are allowed in case of *force majeure*. The reference period for emissions is set between 2000 and 2009. Additional emission reductions can be counted towards the reduction target under the Effort Sharing Regulation up to 280 Mio. t CO_2 equivalents. This might give an incentive to increase carbon sequestration in agricultural practices,[83] or it might create a loophole to compensate inadequate measures, for example regarding livestock farming through afforestation (eg at the expense of biodiversity).[84]

In addition to the possibility of counting net emission reductions from the LULUCF sector towards the overall target, the Effort Sharing Regulation contains flexibility clauses to further facilitate reaching reduction targets in the non-ETS sectors. Also, Member States with especially high emissions or without zero-priced allocations of EU-ETS certificates are given the option to erase certificates instead of reducing emissions in the non-ETS sector. Particularly because emissions from land use are hard to monitor and flexibility clauses might have problematic impacts (problems of traceability).[85] Thus, even though this does not affect the no-debit rule of the LULUCF regulation, it creates a loophole to achieving the targets set in the Effort Sharing Regulation. As emission reductions in agriculture (especially livestock farming) are hard to achieve due to a lack of effective technical measures, compensation in this sector is likely.

79 Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU [19 June 2018] L 156/1.

80 Commission, 'Impact assessment accompanying the document proposal for a regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change' (20 July 2016) SWD(2016) 249 final 3 LULUCF Regulation.

81 ibid 30.

82 Framework for climate and energy (n 73) para 2; TEL 2018 (n 4).

83 See eg TEL 2018 (n 4) 308.

84 See eg Hanna Aho, 'The EU's new LULUCF Regulation: is it fit for (climate) purpose? (FERN 17 April 2018) <https://fern.org/LULUCFRegulationResult> (19 July 2018). A discussion about different possible approaches and their limitations and opportunities can be found in Hans Joosten et al, 'Peatlands, Forests and the Climate Architecture: Setting Incentives through Markets and Enhanced Accounting' (UBA 2016). Furthermore on possible negative side-effects of the flexibility clauses: Commission, 'Impact assessment accompanying the document proposal for a Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change' (of 20 July 2016) SWD(2016) 249 final 29.

85 See Ekardt, Hennig and Hyla (n 3), 11 ff; Sustainability (n 3), Ch 4.9; Felix Ekardt and Bettina Hennig, 'Ökonomische Instrumente und Bewertungen der Biodiversität' (2015).

The issue of bioenergy must also be taken into account. The package on the energy union contains a reference that in transitioning towards renewable energy, the impacts of energetic biomass use on land use and food production have to be considered.[86] According to the IPCC guidelines, energetically-used biomass is counted as emissions-neutral in order to avoid double-counting (as long as it occurs in the national biomass inventories)[87] – even if this is (obviously) technically incorrect. The revision of the Renewable Energies Directive proposes to limit the amount of biomass used by 2030 and options to minimise emissions and environmental impact.[88] However, this does not change the fact that bioenergy does not represent the net-zero emission balances sought in the LULUCF context.

There is another factor that is relevant in terms of loopholes. Even though LULUCF is not part of the EU ETS, LULUCF activities have so far been introduced through the Linking Directive. It integrates the flexible mechanisms of the Kyoto Protocol (state ET, CDM and JI) into the EU ETS, creating a link between international mechanisms and the current EU ETS.[89] Allowances generated from sinks may not be used to meet reduction requirements within the industrial plant-based EU ETS, but only within the state emissions trading: Assigned Amount Units (AAU) of a hosting state generated Emission Reduction Units (ERU, credits for JI projects) can on the other hand be traded for plant and individual accounts. A limited sectoral consideration of LULUCF activities was allowed under Article 23 and 24 of the ETS Directive. Plant owners, participating in the plant-based EU ETS are allowed to partially cover their reduction requirements through participation in CDM and JI projects (see above). This enables them to introduce LULUCF activities (those outside of the EU) via CDM and JI. The legal status has been analysed elsewhere in detail.[90] Due to the vague statements of Article 6 of PA, the future legal status remains uncertain. With the LULUCF Regulation and the Effort Sharing Regulation, the EU meets its commitment to include all sectors, thus also LULUCF and agriculture, with targets reflected in EU legislation.[91]

However, looking at the overall target in Article 2 Paragraph 1 of PA, it must be noted that the emissions reductions called for, including those in the area of land use, are very ambitious. The no-debit rule sought in the LULUCF context is heading in the right direction; but both the ESR and the LULUCF regulation still suffer from serious flaws. To sum them up: (1) Neither the target of a 43% reduction in GHG emissions by 2030 under the EU ETS (including eg fertiliser production), nor the 30% target by 2030 compared to 2005 levels of the ESR will be sufficient. (2) Despite the improvements in monitoring methodology, LULUCF emissions remain relatively difficult to capture. This may turn into a loophole in the future. (3) The inclusion of non-EU certificates, the creation of which is even more uncertain, exacerbates the problem. (4) Actions in the agricultural sector under the Effort Sharing Directive might be further delayed, since states with especially high emissions are given the option to erase certificates instead of reducing emissions in the non-ETS sector – due to the extreme quantities of unneeded old allowances in the EU ETS. (5) The previous regulation of bioenergy is also only allegedly net-zero. (6) The comprehensive addressing of LULUCF emissions creates an incentive for measures such as monocultural afforestation, which bind emissions in the short term but point in the wrong direction for biodiversity and in the long term also for the climate. (7) In light of all these problematic elements, it is unfavourable that any LULUCF measures can (supposedly) compensate tangible emissions from fossil fuels or animal husbandry.

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86 See Commission Energy Union Package – 'A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy' (25 February 2015) COM(2015) 80 final, 15. An elaborate analysis of the effects on the LULUCF sector is found in Hannes Böttcher and Jakob Graichen, 'Impacts on the EU 2030 climate target of including LULUCF in the climate and energy policy framework' (Öko-Institut 2015) <https://www.oeko.de/oekodoc/2320/2015-491-en.pdf>.

87 IPCC NGGIP (n 5) Ch 1, 1.18; Regulation (EU) 2018/841 (n 79) 3 No. 15.

88 Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources COM/2016/0767 final/2 Arts 7, 26.

89 Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (5 June 2009) L 140; see especially Art 30 para 3.

90 See Exner (n 53); Garske (n 53).

91 See Commission, 'Proposal for a Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation (EU) No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change' COM (2016) 479 final Art 12; see also the remarks in Section II.

2. EU NE(R)C Directive and the Clean Air Policy Package

Since ESR only serves as a framework for the Member States, the EU has further regulations addressing individual areas of land-use emissions. First, there is another indirect framework regulation with partial relevance to land-use emissions. The 7th Environmental Action Programme (EAP) which runs until 2020 plays a key role in structuring EU energy policies.[92] One of six working programmes is the Clean Air Policy Package. It provides the framework to amend the National Emission Ceilings Directive (NEC Directive 2001/81/EC) on national emissions ceilings for certain air pollutants.[93] Along with it, the requirements of the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone are implemented in the EU. In addition to the Directive 2008/50/EC on ambient air quality and cleaner air for Europe,[94] the NEC Directive is the main instrument of European clean air policy. It is also connected to the agricultural sector, which will be analysed in the following.

Essentially, the NEC Directive does not regulate GHG emissions directly, but defines maximum values for sulphur dioxide, nitric oxides, ammonium as well as volatile organic compounds, the reduction of which at the same time contributes to the reduction of GHG emissions. The binding targets of the NEC Directive from 2010 were not kept by ten Member States of the EU, especially for ammonium. In Germany,[95] the maximum values were exceeded for three of four air pollutants, partially dramatically – including ammonium. At this point, the connection with the agricultural sector becomes obvious: In Germany, 95% of ammonium emissions can be traced back to agriculture.[96] Ammonium emissions[97] are on the one hand crucial for nitrogen depositions which lead to rising emissions of the GHG N_2O;[98] on the other hand, the forerunner product of climate-relevant nitrous oxide and ammonium leaves fine particles as secondary product. Fine particles – however often only associated with emissions from transportation – thus also occur in connection with agriculture.[99] Therefore, the amended NERC Directive (Directive on the Reduction of National Emissions of Certain Atmospheric Pollutants),[100] which entered into force on 31 December 2016, as one of the working programmes within the Clean Air Package, picks up were the NEC left off by introducing more ambitious maximum values until 2030. It also contains the suggestion to include measures to limit atmospheric ammonium and fine-particle emissions in the agricultural sector within national clean air action programmes.[101] However, climate-harmful methane is not included in the amended NERC Directive, due to possible conflicts with direct GHG emission reductions.[102]

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92 Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet' L 354/171.

93 See Press Release European Commission, 'Environment: New policy package to clean up Europe's air' (2013) IP/13/1274.

94 On this issue, there are connections to air-quality related directives, like Commission Directive (EU) 2015/1480 of 28 August 2015 amending several annexes to Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council laying down the rules concerning reference methods, data validation and location of sampling points for the assessment of ambient air quality [29 August 2015] L 226/4.

95 See European Environment Agency, 'NEC Directive reporting status 2015' (2016) <https://www.eea.europa.eu/themes/air/national-emission-ceilings/nec-directive-reporting-status-2015> accessed 23 July 2018).

96 See Wissenschaftliche Beiräte für Agrarpolitik und für Düngungsfragen/SRU, 'Novellierung der Düngeverordnung. Nährstoffüberschüsse wirksam begrenzen' (2013) 8; Hans-Dieter Haenel, Claus Rösemann and Ulrich Dämmgen, 'Calculations of gaseous and particulate emissions from German agriculture 1990-2015: Report on methods and data (RMD) submission 2017' (Thünen Report 46 2017).

97 This shows particularly well the interdependency of different emissions. Another current example is the so-called Kigali amendment to the Protocol of Montreal of 2016. It intends the reduction of GHG emissions by setting timelines for a phase-out of HFC gases in developing and industrialised countries. These GHG are used to substitute CFC gases, which were avoided due to their ozone-altering effect.

98 See Haenel, Rösemann and Dämmgen (n 96); Susanne Wagner et al, 'Costs and benefits of ammonia and particulate matter abatement in German agriculture including interactions with greenhouse gas emissions' (Agricultural Systems 2015) 58 ff; Friedheim Taube, 'Umwelt- und Klimawirkungen der Landwirtschaft' (2016) 28.

99 See Patrick Brassard et al, 'Comparison of the gaseous and particulate matter emissions from the combustion of agricultural and forest biomasses' (Bioresource Technology 2014) 300 ff; Fabien Paulot and Daniel J Jacob, 'Hidden Cost of U.S. Agricultural Exports: Particulate Matter from Ammonia Emissions' (Environ. Sci. Technol. 2014) 903 ff; SRU, 'Stickstoff, Lösungsstrategien für ein drängendes Umweltproblem' (2015) 105.

100 Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC [17 December 2016] L 344/1.

101 See L 344/1 of 17-12-2016 (n 100) 3.

102 See L 344/1 of 17-12-2016 (n 100) Annex II, Tab A, 19 ff.

Until 2025, Member States are supposed to define which emission reduction commitments are suitable to meet the 2030 targets. Calculations are to be based on a linear curve of emissions targets for sulphur oxides, nitric oxides and volatile organic compounds except for methane, ammonium and particulate matter.[103] It was not possible for the Council and the EU Parliament to agree on a binding mid-term target, as had been originally proposed by the EU Commission for 2025. In this process, clear problems of implementation in the past were observed.[104] Regardless of whether climate issues can be sensibly addressed at all in these regulations, the analyses of this chapter change little of the impression that EU decision-makers do not live up to the requirements of Article 2 of the PA. This is also true with regard to EU fertiliser law, organic farming law, and Common Agricultural Policy as we have shown elsewhere.[105]

V. Governance Issues relating to Sustainability and Land-Use Emissions

This dissatisfactory legal consideration of climate impacts of land use and agriculture leads to the questions why this is the case – and even more which promising governance options there could be. Due to the limited space in this paper, this will only be regarded briefly. Too high GHG emissions of land use despite a declared intention of more sustainability can only surprise at first glance. For instance, farmers are subject to a trade-off between economic and ecologic interests. This is more severe than in other areas of economic activity because of the income situation in the agricultural sector. Although farmers have a certain motivation to keep their soils intact, because long-term quality of soils is a necessary basis for securing permanent harvests, short-term economic interests will often have the potential to determine their actions. These economic expectations are fuelled by distributive enterprises. Additionally, the EU subsidy system, complemented by national programmes, continually supports the short-sightedness, which is primarily focused on mass production of agricultural products. It therefore sets incentives for ecologically and resource-politically problematic intensive livestock farming. Citizens in turn often respond to the (short-term) low food prices. All this could be elaborated further and be condensed to a theory of causes for non-sustainability and requirements of transformation. This would also bring values, emotions, path dependencies, problems of collective goods, concepts of normality, and the interaction among stakeholders into play, in addition to the mentioned self-interest.[106]

The final assessment of mentioned approaches in command-and-control law and subsidy regulation as well as the development of effective governance instruments requires knowledge of those motivational issues and an analysis of typical problems of sustainability governance. It is tempting to further strengthen existing rudimentary instruments for land-use regulation – as has been indicated at different points in this paper. However[107], (1) there is the issue of effective enforcement of any created regulation especially in agriculture. Within command-and-control law and subsidies law (eg CAP), which is currently dominant in this sector, it is not possible to fully resolve this problem, because an infinite number of small individual actions would need to be monitored by administration. (2) Furthermore, command-and-control and subsidies approaches with their focus on a special place, action or product have the disadvantage that they tend to trigger unwanted shifting effects of environmental problems to other countries and where possible to other sectors. Reducing fertilisation for example in Germany could lead

103 See L 344/1 of 17-12-2016 (n 100) Art 4 para 2, 7.

104 European Environment Agency, ‘NEC Directive reporting status 2017 – The need to reduce air pollution in Europe’ (2017) <https://www.eea.europa.eu/themes/air/national-emission-ceilings/nec-directive-reporting-status> accessed 3 November 2017.

105 See Felix Ekardt et al, ‘Land-Use Governance, Livestock Farming, and Economic Policy Instruments’ (Sustainability 2019, in press).

106 Covered in detail in Sustainability (n 3) Ch 2; Felix Ekardt, 'Wir können uns ändern: Gesellschaftlicher Wandel jenseits von Kapitalismuskritik und Revolution‘ (2017).

107 On governance problems and the following debate on instruments see Sustainability (n 3), Ch 4; Hennig (n 25) Ch 3.4 and 4; Christoph Demmke, ‘Towards Effective Environmental Regulation: Innovative Approaches in Implementing and Enforcing European Environmental Law and Policy’ (2001); also Valentin von Bredow, ‘Energieeffizienz als Rechts- und Steuerungsproblem’ (2013); Niko Bosnjak, ‘Ein Emissionshandelssystem der ersten Handelsstufe’ (2015) <https://enviroliteracy.org/environment-society/economics/regulatory-policy-vs-economic-incentives/> accessed 23 May 2018; emphasizing a sound inspection and enforcement of market-based policies Marjan Peeters, ‘Utrecht Law Review 2006’ 177 ff.

to an intensified farming elsewhere. This makes it also hard to primarily focus on new approaches that are just established on a domestic level (eg meat tax). (3) As shown in chapter II, emissions from land use are oftentimes hard to exactly quantify. In particular, the many different land-use processes that cause emissions and whose exact emissions are highly depended on their individual circumstances make precise monitoring difficult.[108] (4) Also, there are potentially rebound effects if in a specific area, eg, fertiliser use is improved while the overall global trend of increasing land use continues. (5) Even if an approach addresses all these problems, it needs to contain an ambitious target in line with Article 2 PA; this can be said neither for existing detailed regulations nor for the existing EU ETS as (despite its cap) an economic instrument that legally encloses the use of fossil fuels.

Nevertheless, the issue is put on the agenda by the imminent review of the CAP – and by obligations under international law like the limit of global warming to well below 2 degrees, even better 1.5 degrees according to Article 2 Paragraph 1 PA, which point towards a fossil-fuel-free (eg without any mineral nitrogen fertiliser based on fossil fuels and maybe without heavy machinery, see chapter II) and low-emission agriculture (and the compensation of remaining emissions). This calls for completely new concepts, given that the timeline is only one or two decades (see chapter II). Therefore, a completely different perspective is needed.

VI. Enhanced Governance Options

Central starting point[109] for land-use governance in terms of climate protection are livestock emissions and fossil fuels, due to their key role for the climate and further ecological problems. Eliminating fossil fuels from the market and drastically reducing livestock, globally or at least in the EU, within one or two decades is the overall strategy for climate protection. Eliminating fossil fuels could be done by means of an extended and drastically reformed EU ETS covering all fossil fuel uses with an ambitious cap (oriented on Article 2 Paragraph 1 of the Paris Agreement). This would mean thinking materially and geographically broad and working with an instrument with an absolute quantity limit (cap), which is the condition to eliminate rebound and shifting effects (it would however, probably require a complementary border adjustment for imports and exports in order to account for eg animal feed and to avoid shifting effects). The gradual phase-out of fossil fuels in electricity, heating, transportation and agriculture would have incisive effects on the agricultural sector, because of the impact on mineral fertilisers, mobility, machinery etc. Also, efficiency measures and less consumption of animal products – which would be particularly hit due to their currently high feed intensity – as well as less food waste were triggered.[110] At the same time, animal products from pasture farming would be thrived (while having a better climate footprint due to no animal feed from arable land and no additional acquisition and as a result to an intact C cycle).

Furthermore, livestock as such needs a cap as well. Again, Article 2 Paragraph 1 PA is the yardstick next to the avoidance of the governance problems already described (such as shifting effects). Both factors show that it makes little sense to apply national measures such as meat taxes, which also only address a part of the animal food and aim to reduce consumption by a only a few percent.[111] In addition, in contrast to taxes, the EU has the legislative competence for controlling quantities by qualified majority in

108 Still a little more optimistic Ekardt, Hennig and von Bredow (n 3) 371 ff; Ekardt, Hennig and Hyla (n 3) 11 ff.

109 Concepts on this in Sustainability (n 3) Ch 4; Hennig (n 25) ; Bosnjak (n 107); von Bredow (n 107).

110 Especially on food waste IAASTD, 'Global Summary for Decision Makers' (2008); Dana Cordell et al, 'Preferred future phosphorus scenarios: A framework for meeting long-term phosphorus needs for global food demand' (2009) ; Dana Cordell, Jan-Olof Drangert and Stuart White, 'The story of phosphorus: Global food security and food for thought' (2009) 19 Global Env Change 2; Stefan Henningsson et al, 'The value of resource efficiency in the food industry: a waste minimisation project in East Anglia, UK' (2004) Journal of Cleaner Production, 505-512; see also FAO, 'Food Losses and Food Waste' (2011) <http://www.fao.org/docrep/014/mb060e/mb060e00.pdf> accessed 6 December 2017.

111 Other authors also point out the necessity of reducing livestock to reduce greenhouse gas emissions and trigger a number of other environmental benefits, in which the focus is on introducing (greenhouse gas) taxes on meat consumption, see inter alia Bähr (n 2) 154; Andrew N Sharpley et al, 'Future agriculture with minimized phosphorus losses to waters: Research needs and direction' (AMBIO 2015) 167; Sarah Säll and Ing-Marie Gren, 'Food Policy' (2015) 1 ff; critical Céline Bonnet, Zohra Bouamra-Mechemache and Tifenn Corre, 'An Environmental Tax Towards More Sustainable Food: Empirical Evidence of the Consumption of Animal Products in France' (Ecological Economics 2018). Our paper instead proposes a wider approach to tackle several environmental problems by starting at the beginning of the value chain with fossil fuels – and a clear orientation to Art 2 para 1 PA.

the Council of Ministers (Article 192 TFEU). There are two different ways of controlling quantities in this case: Livestock could be additionally included in an amended EU ETS or could be subject to its own ETS (probably the latter since the cap for animals could not be zero). Alternatively, an area-bound livestock farming (Flächenbindung) could be introduced by means of command-and-control law, ie a regulatory limitation of the number of livestock per area (the aim here would not merely be to close local nutrient cycles, but to achieve drastic emission reductions, so that in the end, together with – limited – possible compensation measures, for example in wetlands, zero emissions result). To implement an area-bound livestock farming or an ETS cap for animals is therefore possibly very similar – in each case it concerns a cap, which must be monitored and which therefore generates a certain expenditure for authorities and norm addressees (although large stables already have a monitoring system in place for emission control legislation). It could also be conceivable to integrate only large livestock farming facilities into an ETS (or to create a separate ETS) and to regulate grazing animals and small farmers without a trade component with a strictly area-bound livestock farming.

The difference would essentially lie in the trade component that an ETS would have. And since the cap would have to be drastically oriented to the Paris Agreement, it would possibly give greater resistance without the trade component, which enables the compensation between norm addressees in different situations and thus reduces costs – and increases flexibility. In order to avoid hot spot problems (the classic argument for regulatory law) while at the same time being cost efficient and flexible, a cap-and-trade could also be combined with external regulatory limits (floor and ceiling). Regardless of the quantity limitation approach chosen for animals, import-export regulation, such as border adjustments, would be necessary, as with fossil fuels. In addition, the abovementioned question must be decided whether animals and fossil fuels themselves or rather their emissions are subject to a cap. The latter is theoretically more flexible. However, it requires the exact depiction of the different emissions that currently pose challenges (whereas animals – possibly differentiated by species – and fuels as such would be easy to grasp).

These governance options would not endanger global food security but rather set incentives for a different lifestyle in industrialised countries and upper classes of developing countries. By the same token, other consequences of conventional agriculture like biodiversity loss, soil degradation, water pollution and disrupted nutrient cycles etc. are also addressed. Mineral nitrogen fertiliser, as far as it is based on fossil fuels, will be taken off the market inherently, thus supporting organic farming. Furthermore, the push-back of energy-intensive machinery sets incentives for small-scale farming (as well as potentially lower use of pesticides). Transportation and industrial processing will become more expensive. Pricing of fossil fuels also in the agricultural sector would also relieve other problems and reduce illnesses[112] (at the same time health expenses), because fossil-fuel caused air pollution would be eliminated.

However, it would be suboptimal to regulate fossil fuels and livestock only, because this could support the run on bioenergy, which is also relevant to climate and biodiversity, or compensate smaller crop yields through higher land use.[113] Pricing fossil fuels and livestock farming also does not address land-use emissions which occur otherwise, eg through organic nitrogen fertiliser, humus degradation and land-use change through grassland ploughing or deforestation. Including the just named other land-use emissions into the EU ETS proves more difficult than is the case with fossil fuels and livestock farming, and it leads to the dangers described above in the analysis of the LULUCF regulation. Also beyond agriculture, the many different land-use processes that cause emissions and whose exact emissions highly depend on their individual circumstances cannot be monitored as precisely as required for a quantity control mechanism like the EU ETS, not even with satellite-based remote monitoring.[114] Therefore, alternative approaches have to be developed, like a general

112 With regard to the health effects of globally aligned eating habits and high meat consumption, see Sonia S Anand et al, 'Food Consumption and its Impact on Cardiovascular Disease: Importance of Solutions Focused on the Globalized Food System. A Report from the Workshop Convened by the World Heart Federation' (Journal of the American College of Cardiology 2015) 1590 ff.

113 See also CBD, 'Global Biodiversity Outlook 3' (n 12) 75 ff; Hennig (n 25).

114 Still a little more optimistic Ekardt, Hennig and von Bredow (n 3) 371 ff; Ekardt, Hennig and Hyla (n 3) 11 ff.

price on land – or addressing other (besides livestock quantities) particularly emission-intensive factors such as land-use changes or wetland cultivation. Whether this is an economic or – now only complementary to the described big economic approach – a command-and-control approach, eg through binding rewetting targets for peatland, requires further debate.[115] It would be in favour of the latter, if emissions eg of wetlands cannot be measured with enough precision to be included in economic approaches, and given that there are only small enforcement problems with a command-and-control approach. With regard to the treatment of organic and renewable-based fertilisers, it is also questionable whether the explained economic approach on fossil fuels and livestock emissions is sufficient and whether complementary (!) command-and-control regulations are viable if strengthened in their ambition and enforcement. Discussions to date on land-use governance, for example on national meat taxes, ignore the drastic objective of the Paris Agreement – they address too little the weaknesses of national and sectoral regulations (in particular shifting effects). It should be noted that an agriculture oriented to Article 2 Paragraph 1 PA is not about individual agricultural offsets (even if baselines were more precise and ambitious as it was shown in chapter VI 1). It is about changing the agricultural sector as a whole.[116]

This shows that there are clear governance options which are adequate to meet the overarching targets under international law (especially Article 2 Paragraph 1 PA). It has been shown that phasing-out fossil fuels and drastically reducing livestock are key pathway settings for sustainable agriculture. Equally, insufficient effectiveness of past approaches is essentially due to typical governance problems and aspects of motivational problems with regard to different stakeholders. However, since the latter also applies to politicians, rapid change of the current status is not very likely.

115 The literature focusses on approaches which set a price for single emission intensive actions or products, in which consumption-oriented taxes play a major role (eg Bähr (n 2) 153 ff. and Stefan Wirsenius, Fredrik Hedenus and Kristina Mohlin, 'Greenhouse Gas Taxes on Animal Food Products: Rationale, Tax Scheme and Climate Mitigation Effects' (Climatic Change 2011)159 ff. for meat taxes or Cesar Revoredo-Giha, Neil Chalmers and Faical Akaichi, 'Simulating the Impact of Carbon Taxes on Greenhouse Gas Emission and Nutrition in the UK' (Sustainability 2018) 134 ff for carbon consumption taxes). Other approaches aim more at including agricultural emissions respectively agricultural offsets (voluntarily) in existing regulations such as emission trading schemes (eg TEL 2018 (n 4) 301 ff). Further studies focus on peatlands and forests and policy options like including them in domestic emission trading systems or establishing market mechanisms for peats: Joosten et al (n 84).

116 As mentioned before some emission trading schemes allow agricultural offset projects to generate credits, eg nitrous-oxide reductions, animal feeding improvements or waste biomass usage: Climate Law (n 2) 8 ff as well as TEL 2018 (n 4) 301 ff – once again without clear orientation to Art 2 para 1 PA.