C. Private law and climate litigation

Climate change and tort law[1]

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Abstract

Globally, carbon majors are increasingly brought to court to hold them accountable for their contribution to climate change. Plaintiffs rely on tort law to obtain compensation for climate change-related damages while at the same time raising public awareness for climate change. However, such lawsuits raise complex issues and call into question the suitability of conventional tort law for the compensation of climate damages: Plaintiffs must prove that they have suffered (concrete) damage, whereby the defendant's conduct (emission of greenhouse gases) was causal for the occurrence of the damage and the defendant has acted culpably. In light of the fact that many emitters made minimal contributions to climate change and that climate damage often occurs time-delayed and distant, it is hardly surprising that many climate lawsuits have failed to prove the above-mentioned criteria, with causality posing a particular hurdle. Based on a comparative law approach and including relevant case law, this article examines the challenges that arise in asserting climate damages against private actors based on tort law and highlights possible solutions.

1 Introduction

During the last three decades climate litigation has evolved into a new field of law. All over the world individuals and NGOs bring governments and big companies that are responsible for considerable amounts of greenhouse gas emissions (the 'carbon majors') to court in order to force them to take adequate measures to reduce greenhouse gas emissions.[2] So far only few of these claims focus on compensation on the

1 This contribution contains parts of the following publications: Monika Hinteregger, 'Environmental liability' in Emma Lees and Jorge Viñuales (eds), *The Oxford handbook of comparative environmental law* (OUP 2019); Monika Hinteregger, 'Civil liability and the challenges of climate change: A functional analysis' (2017) 8 Journal of European Tort Law 238 and Monika Hinteregger, 'The causal link in tort-based climate change litigation: A challenge for the courts' in Chantal Mak and Betül Kas (eds), *Civil courts and the European polity: The constitutional role of private law adjudication in Europe* (Hart Publishing in print).

2 See the case charts provided by the Sabin Center for Climate Change Law of the Columbia Law School <www.climatecasechart.com> accessed 24 August 2021, the Urgenda Foundation <www.urgenda.nl/en/themas/climate-case/global-climate-litigation> accessed 24 August 2021 and the Grantham Research Institute on Climate Change and the Environment <https://climate-laws.org> accessed 24 August 2021.

basis of tort law. In 2007 the State of California sued the six major American car manufacturers for damages caused by the emissions of greenhouse gases by their manufactured cars, but dropped the lawsuit after losing the suit at the court of first instance.[3] The claims in the cases *Comer v Murphy Oil,*[4] and *Kivalina v ExxonMobil,*[5] were dismissed by the courts holding *inter alia* that the claimants could not establish a sufficient causal link between their damage and the defendant's emissions.[6] The inability to show causation was also the reason the that the German Regional Court of Essen dismissed the damage claim of the Peruvian farmer and mountain guide *Saul Luciano Lliuya* against the German energy corporation *RWE*.[7] Lliuya was claiming a share of the costs which are necessary to protect his village in the Peruvian Andes from flooding by the Lake Palcacocha which is constantly rising due to glacial meltdown. Lliuya sued RWE for 0.5% of the costs of a protective dam (€ 17,000), because RWE is responsible for about 0.5% of the worldwide greenhouse gas emissions from human activity since the beginning of industrialisation. The court of second instance, the Higher Regional Court of Hamm, however, recognised the complaint and decided to start the evidentiary procedure.

The role of tort law for the compensation of climate change damage has already triggered a considerable amount of legal writing.[8] This high interest in tort law is

3 *California v General Motors Corp*, No C06-05755 MJJ, 2007 WL 2726871 (ND Cal 17 September 2007).

4 585 F.3d 855 (5th Cir 2009).

5 *Native Village of Kivalina v Exxon Mobil Corp*, 696 F.3d 849 (9th Cir 2012), cert denied, 133 Ct 2390 (20 May 2013). The Inuit village Kivalina in Alaska claimed monetary damages from the energy industry for the destruction of their village by flooding caused by climate change.

6 In the meantime, there are several further lawsuits against major oil companies pending in US courts, see <http://climatecasechart.com/case-category/common-law-claims/> accessed 24 August 2021.

7 For information on the case see <https://germanwatch.org/en/huaraz> accessed 24 August 2021; Anne Kling, 'Die Klimaklage gegen RWE – Die Geltendmachung von Klimafolgeschäden auf dem Privatrechtsweg' (2018) 51 Kritische Justiz 213; Hans-Jürgen Ahrens, 'Außervertragliche Haftung wegen der Emission genehmigter Treibhausgase?' (2019) 70 Versicherungsrecht 645; Gerhard Wagner, *Klimahaftung vor Gericht* (C.H. BECK 2020).

8 For the discussion in legal literature see, for instance, Jaap Spier, 'Legal aspects of global climate change and sustainable development' (2006) 7 InDret: Revista para el Análisis del Derecho 1; Randall Abate, 'Automobile emissions and climate change impacts: Employing public nuisance doctrine as part of a "global warming solution" in California' (2008) 40 Connecticut Law Review 591; David Grossman, 'Warming up to a not-so-radical idea: Tort-based climate change litigation' (2003) 28 Columbia Journal of Environmental Law 1; James Salzman and David Hunter, 'Negligence in the Air: The Duty of Care in Climate Change Litigation' (2007) 155 University of Pennsylvania Law Review 1741; Michael Duffy, 'Climate change causation: Harmonizing tort law and scientific probability' (2009) 28 Temple Journal of Science, Technology and Environmental Law 185; Michael Faure and Marjan Peeters (eds), *Climate change liability* (Edward Elgar 2011); Richard Lord et al. (eds), *Climate change liability: Transnational law and practice* (CUP 2011); Douglas Kysar, 'What Climate Change Can Do About Tort Law' (2011) 41 Environmental Law 1; Gregory Munro, 'The public trust doctrine and the Montana constitution as legal bases for climate change litigation in Montana'

often driven by the expectation that spectacular tort law cases usually gain a lot of publicity. They will therefore raise public awareness of the risks posed by climate change and then induce governments and industry to intensify their efforts to reduce their greenhouse gas emissions. Since companies tend to avoid negative publicity, this may even be the case when the individual claim is not successful. A further advantage of tort law, compared to instruments of administrative law or tax law, is that it covers cross-border damage and that it relies less on the initiative of public authorities, who often fail to address environmental problems adequately. Accordingly, there is no doubt that the enforcement of liability claims against emitters of greenhouse gases could have its merits. It must be stressed, however, that plaintiffs will have to deal with high cost of litigation and that serious factual and legal uncertainties will make such trials to an arduous task for plaintiffs and defendants alike.

From the perspective of tort law theory, the application of tort law to climate change damage has several beneficial effects. First of all, it ensures that the committed wrong is redressed and that victims get compensated for their losses (the compensatory function of tort law).[9] Tort law has also significant preventive effects. The threat of liability makes potential polluters aware of the risks of their actions and gives them a strong incentive to minimise the expected damage costs in their own future economic interest. According to the economic theory of tort law,[10] the goal of tort law is the minimisation of the total costs of accidents comprising both the cost of prevention and remediation. An effective system of tort liability must therefore avoid the externalisation of costs. It must ensure that each economic actor takes all the potential costs of his activity into account when performing the activity. Only then will the actor be induced to conduct a correct cost-benefit analysis and avoid an ac-

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(2012) 73 Montana Law Review 123; Michael Gerrard and Joseph MacDougald, 'An introduction to climate change liability litigation and a view to the future' (2013) 20 Connecticut Insurance Law Journal 153; Jordan Ellis, 'The sky's the limit: Applying the public trust doctrine to the atmosphere' (2014) 86 Temple Law Review 807; Erik Pöttker, *Klimahaftungsrecht* (Mohr Siebeck 2014); Maria Lee, 'Climate change tort' (August 28, 2015) <https://ssrn.com/abstract=2695107> accessed 24 August 2021; Jacqueline Peel and Hari Osofsky, *Climate change litigation* (CUP 2015); Wolfgang Kahl and Marc-Philippe Weller (eds), *Climate change litigation: A handbook* (C.H. Beck, Nomos, Hart Publishing 2021); Marc-Philippe Weller and Mai-Lan Tran, 'Klimawandelklagen im Rechtsvergleich – private enforcement als weltweiter Trend?' (2021) 29 Zeitschrift für Europäisches Privatrecht 573.

9 This function of tort law is stressed by traditional tort law theory, see Helmut Koziol, *Basic questions of tort law from a Germanic perspective* (Jan Sramek Verlag 2012) 75ff; André Tunc, 'Introduction', *International encyclopedia of comparative law*, vol 11 Torts (1983) I-164ff.

10 Ronald Coase, 'The problem of social cost' (1960) 3 The Journal of Law and Economics 1; Guido Calabresi, *The costs of accidents: A legal and economic analysis* (Yale UP 1970); Steven Shavell, *Economic analysis of accident law* (Harvard UP 1987); Michael Faure (ed), *Tort law and economics* (2nd edn, Edward Elgar 2009); Richard Posner, *Economic analysis of law* (9th edn, Wolters Kluwer Law & Business 2014); Hans-Bernd Schäfer and Claus Ott, *Lehrbuch der ökonomischen Analyse des Zivilrechts* (6th edn, Springer Gabler 2020).

tivity that is not worth its costs. It is assumed that emitters of greenhouse gases who are liable for all the harm they cause will adapt their behaviour and reduce their future emissions in their own interest. Making enterprises liable for the harm they cause, therefore, would lead to a reduction of greenhouse gas emissions by way of the market mechanism because enterprises with lower greenhouse gas emissions will have lower damage costs. This would improve their position on the market and will give other enterprises with higher liability costs an incentive to lower their own greenhouse gas emissions in order to reduce these costs.

It is apparent that tort can only achieve these effects if each emitter of greenhouse gases is prepared to take full responsibility for the harm caused. In the following I will show that this is not yet the case and that the application of tort law to climate change damage encounters several fundamental difficulties. I will discuss two of them in more detail: the availability of effective causes of action and the problem of causation.

2 Causes of action for climate change damage

2.1 Applicable causes of action

2.1.1 International law

Tort law is mostly national law. Until now there are no international liability regimes for the compensation of climate change damage, neither under the UN Framework Convention on Climate Change (UNFCCC)[11] or the Paris Agreement.[12] Article 8 of the Paris Agreement explicitly addresses the problem of loss and damages but according to Deliberation 51 this does not include a basis for any liability or compensation.

2.1.2 Fault based liability

All national tort laws provide for fault-based liability.[13] In the civil law countries fault-based liability is regulated in the civil codes and requires the proof of actionable

11 United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107 (UNFCCC).

12 Paris Agreement (adopted 12 December 2015, entered into force 4 November 2016) UNTS 52.

13 See the comprehensive comparative law analyses by Helmut Koziol (ed), *Unification of tort law: Wrongfulness* (Kluwer Law International 1998); Bernhard Koch and Helmut Koziol

damage, fault and causation. In common law jurisdictions the tort which comes closest to the concept of fault liability is the tort of negligence. The tort of negligence is comprised of four elements: actionable damage, duty of care, breach of duty and causation. The plaintiff must show that the defendant owed him a duty of care, that the defendant breached this duty, and that the occurrence and type of damage was foreseeable.

The burden for the proof of fault and causation usually lies with the claimant. Under certain conditions, however, jurisdictions provide that the burden of proof concerning the proof of fault can be lightened or even shifted to the defendant.[14] In this context it is important to note that there is a fundamental difference with respect to the required standard of proof in the national jurisdictions. Most civil law countries require that facts are established with high probability, but in the common law countries the relevant standard of proof is the balance of probabilities.

2.1.3 No-fault liability

No-fault liability comes in different gradations from absolute liability for ultra-hazardous activities that does not allow for any or only a few defences (e.g., for nuclear power plants or airplanes),[15] to rules of strict liability for dangerous activities (e.g., cars) with some defences (such as act of war, hostilities, armed conflict, civil war, insurrection and natural disaster of an unforeseeable character), to types of aggravated fault liability for specific objects, such as animals,[16] buildings[17] or defective

(eds), *Unification of tort law: Strict liability* (Kluwer Law International 2002); Pierre Widmer (ed), *Unification of tort law: Fault* (Kluwer Law International 2005).

14 Examples: § 831 German Civil Code (BGB) (*Bürgerliches Gesetzbuch*) (for product liability); Article 150 Dutch Code of Civil Procedure (*Wetboek van Burgerlijke Rechtsvordering*) allows the court to reverse the burden of proof if this is stipulated by a special statute or if it is seen to be reasonable and fair; Article 492 § 2 Portuguese Civil Code (*Código Civil*) explicitly provides for a reversal of proof for dangerous activities establishing a rebuttable presumption that the operator was at fault; Spain: 'theory of risk' according to which the burden of proof lies with the person who profited from the introduction of a risk. In common law the rule of *res ipsa loquitur*, according to which the court may infer negligence from the fact that the accident causing the plaintiff's harm is a type of accident that ordinarily happens as a result of the negligence of a class of actors of which the defendant is the relevant member, may lighten the plaintiff's burden of proof. See Monika Hinteregger, 'Liability for Terrorism-Related Risk Under Member State Law' in Lucas Bergkamp et al. (eds), *Civil liability in Europe for terrorism-related risk* (CUP 2015) 91.

15 E.g., c IX of the Chinese Tort law which provides for strict liability for ultra-hazardous activities comprising nuclear facilities, civil aircrafts, the possession or use of dangerous materials and excavation activities.

16 E.g., Article 1905 Spanish *Código Civil*; § 833 German BGB; § 1320 S 2 Austrian ABGB.

17 E.g., Article 1907 Spanish *Código Civil*; Article 2053 Italian Civil Code (*Codice Civile*); § 1319 Austrian ABGB.

products.[18] A very peculiar no-fault liability concept is provided by Article 1242 of the French and Article 1384 of the Belgian Civil Code which provide that the custodian of a thing is responsible for the harm caused by the thing (*responsabilité du fait des choses*). In the common law the rule in *Rylands v Fletcher*,[19] a specific cause of action for the recovery of damage caused by the escape of a dangerous thing because of unnatural use of land, may be applied. This rule, however, has undergone quite a different development in various common law jurisdictions. While in the US,[20] and India,[21] it has become a comprehensive rule of strict liability for abnormally dangerous activities, it was narrowed down in England and Wales by subsequent court rulings and has now become a sub-category of private nuisance which, contrary to private nuisance which requires continuous interference with the land, also extends to sudden incidents.[22] The rule in *Rylands v Fletcher* can only be invoked by persons with a proprietary interest in the land affected and does not provide recovery for personal injuries.[23] Scotland,[24] never applied the rule in *Rylands v Fletcher* at all, and the Australian High Court rejected the rule in *Burnie Port v General Jones Pty Ltd,*[25] holding the opinion that the rule in *Rylands v Fletcher* is absorbed by the principles of ordinary negligence.

Many civil law countries provide for specific strict liability rules governing environmental damage.[26] A recent example is the comprehensive rule on compensation

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18 For Europe see Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (1985) OJ L210/29, as amended by Directive 1999/34/EC of the European Parliament and of the Council of 10 May 1999 amending Council Directive 85/374/EEC on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (1999) OJ L141/20.

19 (1866) LR 1 Ex 265; affirmed (1868) LR 3 HL 330: '[a] person who, for his own purposes, brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril; and, if he does not do so, is *prima facie* answerable for all the damage which is the natural consequence of its escape.'

20 See § 20 Restatement (Third) of Torts (American Law Institute 2010): '1 – An actor who carries on an abnormally dangerous activity is subject to strict liability for physical harm resulting from the activity. 2 – An activity is abnormally dangerous if: a) the activity creates a foreseeable and highly significant risk of physical harm even when reasonable care is exercised by all actors; and b) the activity is not one of common usage.'

21 *M.C. Mehta v Union of India* (UOI) and Ors. AIR (1987) SC 1086.

22 *Cambridge Water v Eastern Counties Leather plc* (1994) 2 AC 264 (HL and CA): single escape of dangerous substances because of the unnatural use of the land; requirement of foreseeability (no liability for harm which the defendant could not reasonably foresee).

23 *Hunter v Canary Wharf Lt*d (1997) AC 655 (HL).

24 *RHM Bakeries (Scotland) Ltd v Strathclyde Regional Council* 1985 SC (HL) 17.

25 (1994) HCA 13.

26 For instance Argentina: General Environmental Act, No 25.675, Article 27 (*Ley General del Ambiente*); Brazil: Article 14 § 1 of the National Environmental Policy Act, Law No 6938 from 31 August 1981 (*Ley sobre la Política Nacional de Medio Ambiente*); Germany: Law on Environmental Liability of 10 December 1990, BGBl 1990 I, 2634 (*Umwelthaftungsgesetz*); Finland: Environmental Damages Act of 1994 (*Laki ympäristövahinkojen korvaamisesta*); In-

for ecological damage in French law (Articles 1246-1252 Code Civil). The new Chinese Tort Law also contains in Chapter VIII comprehensive strict liability rules regarding environmental pollution. The polluter is liable for any harm caused by environmental pollution (Article 65 Tort Law), and the burden of proof for causation is shifted to the defendant (Article 66 Tort Law).

No-fault liability has important advantages for the plaintiff because there is no need to show that the defendant or one of his agents was at fault. Liability only requires the proof of actionable damage, the establishment of causation and that the damage is covered by the specific liability rule. Whether this is the case is a matter of construction of the specific rule. None of the existing strict liability rules explicitly address the emission of greenhouse gases and climate change damage. The applicability of such a rule to climate change damage is therefore uncertain and a matter of construction.

2.1.4 Neighbourhood liability and nuisance

Many countries provide for specific rules concerning compensation for polluting interference between neighbouring lands. They usually require a continuous, unlawful and indirect interference (smoke, wastewater, noise etc) with the use or enjoyment of land. The right to claim damages entails that the interference exceeds a certain tolerance threshold. In the civil law countries these rules, often originally inspired by German law, are provided in the civil codes (i.e., laws of the neighbourhood).[27] In France a similar result is reached through case law ('*troubles de voisinage*')[28] and in the common law countries the corresponding remedy is the action of private nuisance.[29]

Both the laws of the neighbourhood and nuisance have a somewhat restricted scope of application. A damage claim arising out of the laws of the neighbourhood or nuisance is only available to persons who have a close relationship to the affected land, such as the owner or otherwise authorised occupant (e.g., tenant). The action

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donesia: Article 88, 2009 Law No 32/2009 on Environmental Management (*Undang-Undang No 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup*); Sweden: c 32 Environmental Code (*Miljöbalken*). For the European countries see Monika Hinteregger (ed), *Environmental Liability and Ecological Damage in European Law* (CUP 2008); Monika Hinteregger, 'Liability for Terrorism-Related Risk Under Member State Law' in Lucas Bergkamp et al. (eds), *Civil Liability in Europe for Terrorism-Related Risk* (CUP 2015) 103f.

27 E.g., § 364a Austrian ABGB; § 906 (2) German BGB and § 14 German Federal Emission Control Act (*Bundes-Immissionsschutzgesetz*); Article 1003 and Article 1108 Greek Civil Code (*Astikos Kodikas*); Article 844 Italian Civil Code etc.

28 Nadège Reboul-Maupin, *Droit des biens* (8th edn, Dalloz 2020) 356ff; Philippe Malaurie and Laurent Aynès, *Les Biens* (8th edn, LGDJ 2019) 344ff.

29 Charles Wild and Stuart Weinstein, *Smith and Keenan's English law* (17th edn, Pearson 2013).

covers primarily real property damage, such as costs of repairs or diminution of the value of the property, but some countries also allow recovery for personal injury and death (e.g., Austria, Belgium, France, Greece, Italy, and Sweden), at least when consequential to property damage (e.g., England and Wales).

The common law provides for another tort of nuisance, not known in the civil law countries: the tort of public nuisance. This tort covers interference with a public interest and can be claimed by the state against a person who unreasonably interferes with a right common to the public (public waters, air).[30] Private parties can bring an action for public nuisance only if they have suffered particular injury different from those suffered by the public at large. An action in public nuisance allows recovery for personal injuries and property damage as well as pure economic loss.

2.1.5 EU-Environmental Liability Directive

Another possible instrument for climate change litigation is liability according to the EU Environmental Liability Directive,[31] which has, during the last decade, evolved to a comprehensive instrument for the prevention and remediation of loss of biodiversity including the maritime environment.[32] It gives public authorities the right to claim for prevention or restoration of certain types of environmental harm, namely damage to protected species and natural habitats that fall under the Birds and Habitat Directives,[33] water damage which is defined according to the Water Framework Directive[34] and damage to land that creates a significant risk to human health. The Directive thus certainly constitutes an important tool to fight the negative impacts of climate change on natural resources. It is, however, not a basis for civil law litigation, because: (i) the Directive resorts to public law; (ii) the right to take action is awarded to state agencies ('competent authority') and; (iii) it does not cover harm sustained by private persons (personal injury, property damage, economic loss).

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30 Restatement (Second) of Torts § 821B (1) (American Law Institute 1979) defines public nuisance as 'unreasonable interference with a right common to the general public.'

31 Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage (2004) OJ L143/56.

32 Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (2008) OJ L164/19. For the status quo of the ELD see <http://ec.europa.eu/environment/legal/liability/index.htm> accessed 24 August 2021.

33 Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (2010) OJ L20/7; Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (1992) OJ L206/7.

34 Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (2000) OJ L327/1.

2.2 Conclusions for climate change damage

Today the most realistic cause of action for climate change damage under civil liability is fault-based liability. There is no specific no-fault liability regime for climate damage and the rules on neighbourhood liability and nuisance require a continuous, unlawful and polluting interference (like smoke, wastewater, noise etc) with the use or enjoyment of land from one neighbouring land to the other. Although greenhouse gases undoubtedly constitute pollutants in the sense of neighbourhood law, they cannot be readily subsumed under this requirement because greenhouse gases do not interfere with the neighbouring land. They are released from the emitter into the atmosphere, accumulate there over a long period of time and cause the temperatures on earth to rise. This leads to a change in climate patterns which triggers certain natural events (storms, rise of the sea level) that cause damage. It is very questionable if such an indirect causal relationship can be regarded as interference according to neighbourhood law.

The civil law jurisdictions have a common and rather consistent concept of fault-based liability. It requires actionable damage, the establishment of causation and fault. Those jurisdictions which follow the Germanic civil law tradition (Austria, Germany, Switzerland, Netherlands) split the notion of fault into two parts: (i) unlawfulness, which relates to the assessment of the act of the damaging party and; (ii) fault, which deals with the blameworthiness of the concrete actor. In the Roman countries, like France, Italy and Spain, unlawfulness is not regarded as a separate requirement but is absorbed by the criterion of fault. For the assessment of the liability of enterprises for climate change damage this dogmatic difference is, however, not really important because in all jurisdictions the assessment of fault for specialists and professionals follows an objective standard. In addition, it is a common rule that specialists and professionals must meet a higher diligence standard than the average person according to their special knowledge and abilities.

The criterion of fault (in the wider sense) is the result of a comprehensive assessment comprising several factors, such as the magnitude of the risk, the gravity of the harm, the cost of precautions and the social utility of the defendant's conduct.[35] For the assessment whether an emitter of greenhouse gases failed in the past to exercise due and reasonable care, it is helpful to relate to the findings of the economic theory

35 Helmut Koziol, *Österreichisches Haftpflichtrecht* (Vol 1, 4th edn, Jan Sramek 2020) C/2/6ff. For an overview of the different concepts in the European countries see Helmut Koziol (ed), *Unification of tort law: Wrongfulness* (Kluwer Law International 1998) and for a discussion of the different theories on unlawfulness in the Germanic countries (conduct theory and result theory) see also Helmut Koziol, *Österreichisches Haftpflichtrecht* (Vol 1, 4th edn, Jan Sramek 2020) C/1/3ff.

of law. According to the so-called 'Learned Hand' formula,[36] a damaging party fails to exercise due care and, therefore is at fault, when the costs of precaution are less than the costs of the expected damage, which consist of the amount of the expected loss multiplied by the probability that the loss will occur. In order to define the optimal level of care this cost-benefit analysis must relate to marginal costs, as the injurer is only obliged to take care up to the point where the costs of care become equal to or greater than the expected costs of the injury. According to this assessment, not all greenhouse gas emissions can be judged as being unlawful but only those which cannot be prevented at reasonable cost.

The assessment of unlawfulness (or fault in the broad sense) must always be performed *ex ante*. It must relate to the time of the emission and not to the time when the harm occurred. The notion of unlawfulness thus requires foreseeability of the harm at the time of emission. With respect to climate change damage, this point of time can lie considerably in the past. For the evaluation of unlawfulness, it is thus important to determine when industrial emitters of greenhouse gases must have become aware of the negative impacts of greenhouse gases on the global climate. This was surprisingly early. Climate science shows that the risk of climate change was already known at the end of the 19th century. The first scientific analyses of the warming effects of greenhouse gases go back as far as 1861,[37] and since 1990, when the first IPPC-report on climate change was published,[38] it can be assumed that the interested public definitely had knowledge of the risk. In this respect one must, however, consider that the fact that the emitter was aware or must have been aware of the risk does not yet amount to unlawfulness of the emission, because, according to the Learned Hand formula, unlawfulness is only established if the emitter could not have prevented the damage at reasonable cost. All these considerations need to be measured by objective standards.

In civil law it is not always necessary to resort to this comprehensive balance of interests to reach a verdict on unlawfulness. This holds particularly true, if specific prohibitions or requirements are breached, because unlawfulness can already result from such a breach alone. Such requirements may evolve out of case law. The Ger-

36 Developed by Judge Learned Hand in *United States v Carroll Towing Co*, 159 F.2d 169 (2d Cir 1947); see also e.g., Richard Posner, *Economic analysis of law* (9th edn, Wolters Kluwer Law & Business 2014) 191ff; Hans-Bernd Schäfer and Claus Ott, *Lehrbuch der ökonomischen Analyse des Zivilrechts* (6th edn, Springer Gabler 2020) 182f; Monika Gimpel-Hinteregger, *Grundfragen der Umwelthaftung* (Manz 1994) 51ff and 94ff.

37 John Tyndall, 'On the absorption and radiation of heat by gases and vapours, and on the physical connexion of radiation, absorption, and conduction' (1861) 151 Philosophical Transactions of the Royal Society of London 1. For a comprehensive overview see David Archer and Raymond Pierrehumbert (eds), *The warming papers: The scientific foundation for the climate change forecast* (Wiley-Blackwell 2011).

38 Intergovernmental Panel on Climate Change (IPCC), *Intergovernmental Panel on Climate Change 1990 (First Assessment Report)* <https://bit.ly/3tNCvzu> accessed 29 March 2022.

man Supreme Court, for instance, repeatedly ruled that polluting companies have to monitor, document, control and adapt their emissions according to the local environmental conditions.[39] Because of the well-known risks of climate change this obligation must, despite its global character, now also relate to the emission of greenhouse gases. Specific requirements of conduct may also arise out of public law regulations governing the levels of emissions of plants and activities. It is generally held that the operator who violates emission limits provided by statute, regulation or operating licence acts unlawfully and can be subject to civil liability for the resulting harm. Increasing regulation concerning the emission of greenhouse gases by public law thus has an important effect on the emitter's future civil liability obligations.[40]

Compliance with emission limits, however, does not automatically exonerate from liability. Most European jurisdictions accept that compliance with public law standards does not exonerate damaging parties from civil liability.[41] This is only the case if public law regulations expressly authorise the infringement of a property right (which is usually connected with the duty to indemnify the injured party), or when damage is the direct result of compliance with a mandatory order from a public authority.[42] Public law regulations do not usually have this effect. Their goal is rather to control the risks of certain activities and to prevent harm. If harm occurs despite these efforts, civil liability of the operator towards the injured party remains. This also applies to existing public law regulations concerning the greenhouse gas emission limits under the EU Emissions Trading System,[43] because this system is not directed at the protection of private rights of individuals but establishes an economic instrument in order to cut the overall amount of greenhouse gas emissions by use of market forces.

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39 BGH 16.12.1977 – V 91/75, Neue Juristische Wochenschrift 1978, 419; BGH 18.9.1984 – VI ZR 223/82, Entscheidungen des Bundesgerichtshofs in Zivilsachen (BGHZ) 92, 143; BGH 6.2.1986 – III 109/84, BGHZ 97, 97.

40 The UNFCCC and its protocols (Kyoto and Paris Agreement) are addressed to the contracting States and do not contain such rules.

41 Monika Hinteregger, 'Comparison' in Monika Hinteregger (ed), *Environmental liability and ecological damage in european law* (CUP 2008) 591; Monika Hinteregger, 'Liability for terrorism-related risk under member state law' in Lucas Bergkamp et al. (eds), *Civil liability in europe for terrorism-related risk* (CUP 2015) 105; Michael Faure and André Nollkaemper, 'International liability as an instrument to prevent and compensate for climate change' (2008) 43 Stanford Journal of International Law 123, 151-157; recently for German law: Erik Pöttker, *Klimahaftungsrecht* (Mohr Siebeck 2014) 118ff.

42 See Dir 85/374/EEC (1985) OJ L210/29, Article 7 lit d; Dir 2004/35/CE (2004) OJ L143/56, Article 8 § 3 lit b.

43 Erik Pöttker, *Klimahaftungsrecht* (Mohr Siebeck 2014) 124ff; Marjan Peeters, 'The regulatory approach of the EU in view of liability for climate change damage' in Michael Faure and Marjan Peeters (eds), *Climate change liability* (Edward Elgar 2011) 116ff, 122f. For English law see Giedre Kamiskaité-Salters, 'Climate change litigation in the UK: Its feasibilities and prospects' in Michael Faure and Marjan Peeters (eds), *Climate change liability* (Edward Elgar 2011) 181ff.

3 Causation

3.1 The problem

Another major obstacle for the application of tort law liability to climate change damage is the proof of a direct causal link between the emission of greenhouse gases by one specific emitter and the harm sustained. The reasons for this lie in the characteristic properties of greenhouse gases. Gases like carbon dioxide, methane and nitrous oxide do not directly affect plaintiffs, but cumulate in the atmosphere and cause over time the temperatures of the earth to rise. Direct cause of the harm is actually a natural event (storm, heat, rainfall, drought etc) triggered by the accumulation of these substances. The other fundamental difficulty lies in the specific nature of climate change damage because harm caused by man-made climate change can very often not be distinguished from harm caused by natural events without any connection to human emissions. In these cases, only part of the damage, namely the part of the damage caused by the increase in the occurrence of such incidents or by the increase in their intensity is man-made. A good example for such a causality scenario is the formation of hurricanes. Hurricanes are a natural phenomenon, but climate science shows that global warming makes them more frequent and more destructive. This argumentation was brought forward in the case of *Comer v Murphy Oil*,[44] where victims of Hurricane Katrina sued a number of energy companies for compensation for the damage caused by the hurricane. They argued that the defendants had considerably contributed to global warming by emitting greenhouse gases, thereby increasing the destructive power of Hurricane Katrina.

In the following I will examine the significance of the requirement of causation for tort law claims. I will show that the traditional methods of establishing causation, the 'but for'-test of the common law and the '*conditio sine qua non*'-formula applied in the civil law systems, have inherent weaknesses which require additional deliberations to ensure fair results for the individual case. I will first describe the strategies courts traditionally apply in order to meet the structural deficits of the 'but for'-test, and then I will highlight some cases where courts developed even more far-reaching strategies when victims encountered typical and unsurmountable difficulties in proving causality. From this I will try to draw some conclusions for climate change damage.

44 585 F.3d 855 (5th Cir 2009).

3.2 'But for'-test and '*conditio sine qua non*'-formula

3.2.1 The rules

Legal doctrine provides that the causal link is established according to the 'but for'-test (common law) or the *conditio sine qua non*-formula (civil law) which qualifies any circumstance as cause of the damage if the damage would not have occurred without it. This method of damage attribution has a long tradition and enjoys widespread recognition.[45] Compensability of harm under tort law requires a sufficient causal link between the defendant's activity and the harm sustained by the victim. This is apparently a fundamental question of justice as it would be utterly unfair to burden a person with a loss to which this person has no sufficient connection. This is complemented by the economic deliberation that in order to pursue the optimal allocation of resources it is essential to allocate damage costs to the person who is in the best position to minimise these costs (cheapest cost avoider) which requires that the liable person is able to influence the cost of potential damage by his behaviour, namely by the applied level of care.

3.2.2 Causation by synergistic and progressive effects

The 'but for'-test and the *conditio sine qua non*-formula are suitable instruments for the attribution of damage in most causality scenarios. For climate change damage it is essential to see that these deliberations even ensure appropriate damage attribution when damage is caused by synergistic effects of two or more interacting substances. Such effects can be of a different nature. If the harmful effect is only created because of the interaction of otherwise harmless substances, the tests indicate full causation by both substances (and therefore joint and several liability of both emitters, provided that the incident is covered by an applicable cause of action). The same solution applies if the noxiousness of a substance is only triggered by its reaction with the natural environment or a natural substance, and also in case of the chemical or physical interaction of two harmful substances. In all these constellations the tests show that the damage would not have occurred without the emission of these substances into the natural environment.

Things get a bit more complicated when the interaction of two harmful substances has a *progressive effect* that is when the common effects of the harmful interacting substances are greater than the sum of the individual effects of any of them. Here the result of the 'but for'-test, like the application of the *conditio sine qua non*-formula,

45 Reinhard Zimmermann, 'Comparative report' in Bénédict Winiger et al. (eds), *Digest of European tort law, Volume 1: Essential cases on natural causation* (Springer 2007) 99.

indicate the part of damage that was caused by each substance and, in addition, the common increase in damage. Again, given that there is an applicable cause of action, this can lead to joint and several liability of each polluter, or, if the damage is divisible liability can be split according to the shares. This would mean that each emitter is severally liable for the individual share and has to bear joint liability for the common increase.[46]

3.2.3 Concurrent, cumulative, alternative, intervening and minimal causation

All tort law systems traditionally provide for diverse strategies to cope with specific cases where the causal link does not pass the 'but for'-test. Typical constellations are the cases where (i) two or more separate acts cause harm to a third party without the possibility of apportionment (concurrent causation); (ii) two or more separate acts cause harm when each would have been in itself sufficient to cause the harm (cumulative causation); or (iii) it cannot be established whether the harm was caused by the tortious act of person A or person B (alternative causation). In most jurisdictions the answer to such causality constellations is joint and several liability of each tortfeasor.[47] The defendant who has compensated the victim has a right of recourse against the other defendants. When one cause has taken effect before the other (intervening causation), however, it is predominantly held that only the person who caused the damage first is liable.[48] For the case of minimal causation, another causality constellation which is traditionally discussed by tort law theory, causation cannot be established according to the 'but for'-test or the *conditio sine qua non*-formula, but needs further considerations in order to avoid unjust results. When damage is caused by a large number of people, the tests work for the whole group, because they correctly indicate that all the members of the group caused the damage, but they are not appropriate for the adequate attribution of damage to the individual members of the group. Due to the minimal effects of each contribution for the development of the damage, both tests would in most cases lead to the conclusion that no member of the group has caused the damage. As causation by the whole group is, however, a proven fact, this result is apparently not correct.

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46 See Monika Gimpel-Hinteregger, *Grundfragen der Umwelthaftung* (Manz 1994) 199; Erik Pöttker, *Klimahaftungsrecht* (Mohr Siebeck 2014) 140.

47 See e.g., Austria: § 1302 ABGB; Germany: §§ 830(1) (2), 840(1) and 426(1) BGB; Greece: Article 926 Civil Code; Italy: Article 2055 Civil Code; Portugal: Articles 490 and 497 Civil Code; Ireland: pt III of the Civil Liability Act 1961; Netherlands: Article 6:102 Civil Code (*Burgerlijk Wetboek*). See Jaap Spier (ed), *Unification of tort law: Causation* (Kluwer Law International 2000); Bénédict Winiger et al. (eds), *Digest of European tort law Volume 1: Essential cases on natural causation* (Springer 2007).

48 See the discussed cases in Bénédict Winiger et al. (eds), *Digest of European tort law Volume 1: Essential cases on natural causation* (Springer 2007) 479 and 505.

From a theoretical point of view, minimal causation constitutes a special subcategory of concurrent causation. The fact that not only two or several persons, but a multitude of persons, contributed to the damage, makes it difficult, or even impossible, to determine the individual share of each contributor, which, according to the theory of concurrent causation, would lead to the finding of joint and several liability for each contributor. It is again apparent that this result is disproportionate to the detriment of the individual tortfeasor and thus not justifiable. In legal doctrine, therefore it is generally accepted that the 'but for'-test is not suitable for cases of minimal causation. When a large number of people cause specific damage, doctrine suggests that each contributor should only be liable for a part of the damage. If the individual case gives no further indications for the determination, or at least estimation, of the individual share, the incurred damage must be equally divided among the members of the group.[49]

A look at various legal systems, however, shows that courts find even more sophisticated solutions when the causality situation becomes more complex and plaintiffs encounter structural problems with respect to the proof of causality.

3.3 Specific court solutions for complex causality constellations in other areas

3.3.1 DES-cases and beyond

In the famous case *Sindell v Abbott Laboratories*,[50] the Supreme Court of California created the theory of market share liability. In this case, the plaintiffs could show that their harm was caused by a specific drug (Diethylstilbestrol, DES) prescribed to their mothers during pregnancy in order to prevent miscarriage. What the plaintiffs could not ascertain was the relationship between the individual plaintiff and defendant because the product was generically marketed by several manufacturers and there was no way for them to show which company had produced or distributed the drug taken by the individual plaintiff's mother. In *Sindell* the court referred to the doctrine of alternative liability in the case of *Summers v Tice*,[51] where the court held that the burden of proof is upon the tortfeasors. Where the conduct of two actors is tortious, and it is proven that the harm has been caused to the plaintiff by only one of them, but there is uncertainty as to which one of them has caused it, the burden is upon each such actor to prove that he has not caused the harm. This solution for cases of alternative liability, as was shown above, is shared by many other jurisdictions. In

49 See Article 3:105 Principles of European tort law. Bernhard Koch, 'Comparative report' in Bénédict Winiger et al. (eds), *Digest of European tort law, Volume 1: Essential cases on natural causation* (Springer 2007) 541 indicates that case law dealing with this problem is scarce.

50 607 P.2d 924 (Cal 1980).

51 199 P.2d 1 (Cal 1948).

Sindell the court expanded the theory of alternative liability to the constellation that not only two but several tortfeasors could have caused the harm in question. It held that the burden of proof shifts to the defendants, if the plaintiff joins manufacturers of a substantial share of the DES produced and marketed in the relevant area and if the plaintiff is able to prove a prima facie case on every element of the cause of action except identification of the direct tortfeasor. It is then up to defendants to prove that they did not cause the plaintiff's injuries, and those defendants failing in this proof are held liable for the percentage of damages approximating their share of the relevant market. This means that each defendant's share of the damages would approximate the probability that it caused the plaintiff's injuries.

In *Sindell* the court thus set up several requirements for the application of the theory of market share liability. These requirements are the following: (i) The defendants in court must constitute substantially all of the market. (ii) All the defendants must have been in the market within the critical timeframe. (iii) The marketed products must be of the same composition and thus interchangeable, and (iv) it must not be the plaintiff's fault that the individual tortfeasor cannot be identified.

Subsequent court decisions concretised the burden of proof for the defendants. In *Martin v Abbott Laboratories*,[52] the Washington Supreme Court supported the plaintiffs with regard to their obligation to join defendants with a substantial share of the market in the action by introducing the presumption that all the defendants who cannot exculpate themselves (by showing that DES ingested by the individual mother did not come from their production) have equal shares of the market ('presumptive share liability'). It is then up to the individual defendant to prove a lower share. This approach was also adopted by the Florida Supreme Court in *Conley v Boyle Drug Co*.[53]

In *Collins v Eli Lilly & Co*,[54] the Wisconsin Supreme Court went an important step further. Because of the practical difficulty of defining and proving market share the court allowed the plaintiff to bring a cause of action against one single defendant, and, in full application of the alternative liability rule in *Summers v Tice*, it shifted the burden of proof as to causation fully to the defendant.[55] The defendant was thus obliged to show that it did not produce the DES taken by the plaintiff's mother. For

52 689 P.2d 368 (Wash 1984).
53 570 So.2d 275 (Fla 1990).
54 342 N.W.2d 37 (Wis 1984).
55 The court obliged the plaintiff to allege 'that the plaintiff's mother took DES; that DES caused the plaintiff's subsequent injuries; that the defendant produced or marketed the type of DES taken by the plaintiff's mother; and that the defendant's conduct in producing or marketing the DES constituted a breach of a legally recognised duty to the plaintiff. In the situation where the plaintiff cannot allege and prove what type of DES the mother took, as to the third element the plaintiff need only allege and prove that the defendant drug company produced or marketed the drug DES for use in preventing miscarriages during pregnancy.' *Collins*, 342 N.W.2d 37, 50ff.

justification the court referred to the Wisconsin Constitution which provides in Article I, Section 9 that '[e]very person is entitled to a certain remedy in the laws for all injuries, or wrongs which he may receive in his person, property, or character.' This allows the courts 'to fashion an adequate remedy' 'when an adequate remedy or forum does not exist to resolve disputes or provide due process.' The Wisconsin Supreme Court came therefore to the conclusion that 'the interests of justice and fundamental fairness' demand that the producers of the drug should bear the cost of injury. The court assumed that the drug company is in a better position than the victim to absorb the cost of the injury and that the cost of damages awards will act as incentive for drug companies to test adequately the drugs they place on the market.

The New York Supreme Court adopted an even broader market share theory in *Hymowitz v Eli Lilly*,[56] by relating to the risk a defendant created in the national market ('national market theory'). In this case, the court dispensed with the requirement of an individual causal relationship between plaintiff and defendant. According to this theory, the plaintiff must only show that she ingested DES and that her injuries result from the use of DES. Defendants can evade liability only by proof that they did not manufacture or market DES for pregnancy use.

It must be stressed that the doctrine of market share liability is used only in a minority of US-states. In the majority of states liability still requires that the specific product alleged to have caused the injuries is identified with particularity. Efforts to expand the market share approach beyond DES cases have been mostly rejected by US courts. In *Becker v Baron Brothers*,[57] the Supreme Court of New Jersey declined to apply the market share approach to an asbestos case because asbestos products – unlike DES – are not uniformly dangerous. They have a varying degree of toxicity and can therefore not be treated as a monolithic group.[58] In *Santiago v Sherwin Williams Co*,[59] and *Skipworth v Lead Indus Association*,[60] the courts rejected market share liability for personal injury caused by lead paint because the plaintiffs were not able to show the defendants' contribution to the market in the relevant period of time which span over several decades. The defendants were also not the actual manufacturers of the hazardous product, but only the bulk suppliers of raw material. The only judicial decision to date allowing the plaintiff in a lead pigment case to proceed under market share theory is *Jackson v Glidden Co.*[61] The theory of market share liability was also rejected in several rulings in cases concerning products containing the

56 539 N.E.2d 1069 (NY 1989).
57 649 A.2d 613 (NJ 1994).
58 See also *Robertson v Allied Signal, Inc*, 914 F.2d 360, 379-80 (3d Cir 1990).
59 3 F.3d 546 (1st Cir 1993).
60 690 A.2d 169 (Pa 1997).
61 647 N.E.2d 879 (Ohio Ct App 1995). The appeal was rejected in 868 N.E.2d 680 (Ohio 2007).

HIV virus,[62] but in re *Methyl Tertiary Butyl Ether*,[63] market share liability was applied in an environmental liability case concerning the contamination of groundwater in Orange County, California, by various oil companies. The companies used the gasoline additive methyl tertiary butyl ether in underground storage tanks from where it leaked into the groundwater.

For European lawyers the 'market share liability' doctrine has inspired many theorists of tort law over the last decades. Dutch and French courts, however, when deciding DES cases, did not follow the market share theory of the Californian Supreme Court, but found different, even more far-reaching solutions in favour of the victims. The Dutch Supreme Court,[64] lightened the burden of proof of causation for the victims and held all the defendant drug producers jointly and severally liable. In 2009,[65] and 2010,[66] the French Supreme Court also ruled in favour of the plaintiffs. It came to the conclusion that plaintiffs in DES cases only need to show that the victim's bodily injury was caused by prenatal exposure to DES. Causation is already established if medical expertise asserts that the victim suffered from a disease (e.g., cancer tumour) typical for exposure to DES and if there are no indications that the victim has been exposed to other risk factors for the development of the disease. It is then up to the defendant pharmaceutical companies who put the substance on the market to prove that their product did not cause the damage. If they fail to do so they are jointly and severally liable for the sustained harm.

3.3.2 The 'increased material risk of harm'-test of the UK Supreme Court

In *Fairchild v Glenhaven Funeral Services Ltd*,[67] the House of Lords (since 2009 'The Supreme Court') had to deal with compensation claims of workers who had been exposed to asbestos at three different workplaces. The workers suffered from mesothelioma, a specific kind of cancer which is typical for exposure to asbestos, but unlike asbestosis (another asbestos related disease) not dependent on the amount of fibre ingested which, taken to the extreme, means that already one inhaled fibre can trigger the disease. Accordingly, the claimants could show that their illness was caused by exposure to asbestos at the workplace but could not say which employer was the most likely source of the asbestos fibre which caused the harm. The court

62 *Ray v Cutter Labs*, 754 F Supp 193 (MD Fla 1991); *Morris v Parke, Davis & Co*, 667 F Supp 1332 (CD Cal 1987); *Smith v Cutter Biological, Inc*, 823 P.2d 717 (Haw 1991).
63 *Methyl Tertiary Butyl Ether (MTBE) Products Liability Litigation*, 859 F.3d 178 (2d Cir 2017).
64 Hoge Raad (HR) 9 October 1992, Nederlandse Jurisprudentie (NJ) 1994, 535.
65 Cour de cassation 2e civ, 24 September 2009, No 08-16.305, Bull 2009 I No 187.
66 Cour de cassation 1re civ, 28 January 2010, No 08-18.837, Bull 2010 I No 22.
67 (2002) UKHL 22, (2003) 1 AC 32.

held that in a case where causation cannot be established because of lack of scientific knowledge, the application of the 'but for'-test would lead to the inherently unfair result to leave the claimant without any remedy. In such cases it must be sufficient for the proof of causation that the claimants can show that the defendant's actions constituted a breach of duty and that this breach of duty had a material effect on the likelihood of injury. Accordingly, the House of Lords held that all the employers were jointly and severally liable for the damage.

This 'increased material risk of harm'-test was also applied in the mesothelioma case of *Barker v Corus (UK) Ltd*,[68] with the difference that the House of Lords decided not for joint, but only for several liability according to the increase in risk caused by the individual defendant. For victims of mesothelioma (but not for other constellations) this ruling was reversed by the legislator who provided in Section 3 of the Compensation Act 2006 for joint and several liability of each tortfeasor. In *Sienkiewicz v Greif (UK) Ltd*,[69] the Fairchild-rule was even applied in a mesothelioma case against one single defendant. The Supreme Court held the defendant employer liable for the full loss, although evidence did not show that the defendant increased the risk of harm by more than 50% (as would be required by the evidentiary standard of the common law) but, according to the judge on the facts, only by a smaller amount, concretely by 18% over the general environmental exposure.

3.3.3 Proportional liability

Many jurisdictions allow under certain circumstances for the finding of proportional liability. When damage is caused by multiple polluters courts may also apply the theory of proportionate liability and apportion liability in proportion to each polluter's contribution to the cumulative total emissions. In Chinese law this is explicitly provided in Article 67 Tort Law. Another very prominent example is the theory of loss of a chance (*perte d'une chance*). This theory does not solve the causality problem as such, but rather opens the way to circumvent the problem of causation by recognising the loss of an opportunity as compensable damage. Many jurisdictions accept this theory for compensation under tort and/or contract law, especially in cases concerning compensation for medical malpractice and against lawyers for loss of procedural chances.[70] In these cases the defendant's breach of contract or, under tort law, negligent activity was not the cause of the harm itself (the illness or the

68 (2006) UKHL 20, (2006) 2 AC 572.

69 (2011) UKSC 10, (2011) 2 AC 229.

70 According to a comparative study concerning Europe, the theory is accepted in France, Italy, Portugal, Spain, Netherlands, Ireland and Slovenia, see Helmut Koziol, 'Comparative Report' in Bénédict Winiger et al. (eds), *Digest of European Tort Law, Volume 1: Essential Cases on Natural Causation* (Springer 2007) 589.

legal problem), but only deprived the claimant of the opportunity to obtain a benefit or avoid a loss (e.g., the chance to recover from an illness or to win a lawsuit). In most jurisdictions, especially in France where this theory has a long tradition, the recognition of the theory allows for partial compensation of the incurred harm in proportion to the reduction of the chances not to suffer the loss.[71]

A concept with comparable results is applied by Austrian courts which, in application of the theory of alternative causation, find for proportional liability in some exceptional cases where it cannot be established whether the harm (e.g., personal injury) was caused by the defendant's tortious behaviour (e.g., the doctor's medical malpractice) or by a fact in the claimant's own sphere (e.g., genetic predisposition).[72]

3.3.4 Compensation despite scientific uncertainty: Hepatitis B vaccinations and the French courts

In the last two decades, the French Supreme Court (*Cour de cassation*) has been confronted with a series of compensation claims brought by persons who developed a demyelinating disease (especially multiple sclerosis) after having been vaccinated against hepatitis B. Some of these claims were based on compensation rules for work accidents, but most were product liability cases filed against the producer of the vaccine.[73] At the beginning, the court dismissed the claims for lack of sufficient scientific evidence that the plaintiffs' harm was actually caused by the vaccination, although the lower courts had stressed the fact that science was not able to show that the vaccinations were not the cause of the disease either.[74] After the *Conseil d'État*, the highest French administrative court, accepted causation in cases where the disease appeared within three months after vaccination provided that there were no other plausible causes for the disease,[75] the *Cour de cassation* changed its position. It came to the conclusion that the question of causation is a matter of fact which must be decided by the lower courts. It further held that this decision cannot be based on probabilistic evidence alone, but must be decided by the lower courts according to the facts of the individual case.[76] Since these rulings of the *Cour de cassation* several

71 See François Terré et al., *Droit civil. Les obligations* (12th edn, Dalloz 2018) 1005.

72 Bernhard Koch, 'Proportional liability for causal uncertainty' in Miquel Martin-Casals and Diego Papayannis (eds), *Uncertain causation in tort law* (CUP 2016) 67.

73 For a comprehensive account of these cases see Jean-Sébastian Borghetti, 'Litigation on hepatitis B vaccination and demyelinating diseases in France' in Miquel Martin-Casals and Diego Papayannis (eds), *Uncertain causation in tort law* (CUP 2016) 11.

74 Cour de cassation 1re civ, 23 September 2003, No 01-13063, Bull 2003 I No 188.

75 Conseil d'État, 9 March 2007, No 267635, No 278665, No 283067, No 285288.

76 Cour de cassation 1re civ, 22 May 2008, No 05-20.317 and 06-10.967, Bull 2008 I No 148 and 149. This reasoning was accepted by the ECJ in Case C-621/15 *N.W., L.W., C.W. v Sanofi*

lower courts have delivered decisions in hepatitis B cases. The rulings are diverse, but in most cases the courts ruled that the causal link cannot be established.[77]

4 Conclusions for climate change damage

4.1 Synergistic and progressive effects

There is no doubt that the establishment of causation for climate change damage is very difficult and a true challenge for any court. In the context of climate change damage all thinkable causality scenarios culminate at the same time. Damage is caused by multiple emitters. Emitters and injured parties are located far from each other. There is a considerable time lag between emissions and the harm and there is the influence of synergistic effects between the various emitted substances on the one hand and between those substances and the natural environment on the other hand. However, at least from a theoretical point of view, one can say that the matter of causation for climate change damage is difficult, but not totally unsolvable. As outlined before, tort law theory provides for some useful theories that can also have some merits for the adequate attribution of climate change related damage. Traditional tort law acknowledges not only liability in case of concurrent, cumulative and alterative causality constellations, but is even able to offer well balanced solutions for the problems of synergistic and progressive effects of noxious substances.

4.2 Minimal contribution by multiple emitters

Tort law theory also offers solutions for the more complex scenarios of climate change damage. First of all, when discussing causality with respect to climate change damage, it is necessary to emphasise the fact that climate change leads to different types of damage and that not all types of climate change damage raise the same problems of causation.[78] For those events which can be directly attributed to the large-

Pasteur MSD SNC (2017) OJ C277/10, a preliminary ruling upon request of the Cour de cassation on the interpretation of Article 4 of Dir 85/374/EEC (1985) OJ L210/29.

77 See Jean-Sébastian Borghetti, 'Litigation on hepatitis B vaccination and demyelinating diseases in France' in Miquel Martin-Casals and Diego Papayannis (eds), *Uncertain causation in tort law* (CUP 2016) 11, 26f.

78 This was already stressed by Will Frank, 'Climate change litigation – Klimawandel und haftungsrechtliche Risiken, Erwiderung auf Chatzinerantzis/Herz (NJOZ 2010, 594 = NJW 2010, 910)' (2010) 10 Neue Juristische Online-Zeitschrift 2296; Will Frank, 'Überlegungen zur Klimahaftung nach Völkerrecht' (2014) 33 Neue Zeitschrift für Verwaltungsrecht 695 and Will Frank, 'Zur Kausalitätsproblematik und Risikozurechnung bei Klimaschäden im Zu-

scale rise of the temperature of the atmosphere, like the rise of sea levels or the gradual melting of glaciers and polar caps, climate science can show that the causal link is actually quite clear: these events are predominantly caused by greenhouse gases emitted into the atmosphere due to human activities. The causal relationship between the emission of greenhouse gases and the consequences for the natural environment also includes the finding of actionable harm caused by those natural events to persons and property. Examples for such scenarios are the rebuilding cost for a village situated on a sea-cliff that has become uninhabitable like in the *Kivalina* case, or, the cost for a protective dam against the melting glacier water as was alleged by the claimants in the *Lliuya* case. With respect to these scenarios, the problem for the establishment of causation lies not so much in the scientific proof of causation as such, but in the attributability of the incurred harm to specific polluters due to the long emission periods and the large number of polluters who, over the last hundred years, have been releasing greenhouse gases into the atmosphere.

For such constellations, causation theory can offer the theory of minimal causation. In such scenarios the mere application of the 'but for'-test is not able to produce acceptable results because, due to the smallness of the contributions, it does not indicate the concrete share of the individual contributor. Although this cannot be established with certainty for the individual emitter, it is legitimate to assume that each emitter actually caused a part, albeit a very small part, of the damage. According to legal doctrine such scenarios can be qualified as cases of concurrent minimal causation. As the number of emitters is quite high and the shares that can be attributed to the individual emitters are quite low, solidary liability of each emitter would be excessive and would lead to a result that is neither just nor, due to an extreme overdeterrent effect, economically efficient. It would therefore make much more sense to hold each emitter only liable for its share. As this share cannot be established with sufficient probability, it is fair and reasonable to estimate the share according to the overall amount of greenhouse gases which the individual contributor has emitted in the past.

However, the application of the theory of minimal causation to these types of climate change damage encounters the further problem that greenhouse gases only lead to climate change if they exceed a certain threshold. Greenhouse gases, especially carbon dioxide (also methane and nitrous oxide, but not fluorinated gases) are part of natural processes and can be absorbed to a certain extent by the natural environment. It can, therefore, be assumed that emissions caused by a single person (breathing, driving a motor vehicle, heating the home) will never be sufficient to exceed this threshold. As these emitters do not even have the slightest potential to cause climate change damage, it would, already from a theoretical point of view, not be justifiable

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sammenhang mit Entschädigungs- und Schutzansprüchen gemäß Völkerumweltrecht' (2015) 8 Bonner Rechtsjournal 42.

to subject those contributors to the theory of minimal causation. The idea to hold the average person liable for climate change damage would also constitute a perversion of the tort law system which is designed for the solution of conflicts between certain identifiable persons on a case-by-case basis. Such an approach would overwhelm the system both from a theoretical and, considering the enormous number of past and actual emitters of greenhouse gases, practical viewpoint. Hence, the theory of minimal causation can at best be applied to the major emitters of greenhouse gases, such as the 'big players' in the energy generating industry, who are responsible for the emission of enormous amounts of greenhouse gases over the last decades.

Under the condition that the concept of minimal causation is accepted for such large-scale emitters the main problem for the allocation of the loss to the individual polluter is then not so much the matter of causation, but, as was outlined above, rather the need to find an applicable cause of action for the claim.

4.3 The concept of proportional liability for cases of mere statistical evidence

An even bigger challenge of climate change damage for legal doctrine is posed by those cases where it is only possible to establish statistical evidence between the rising temperatures on the planet and the sustained damage. Examples for this are the causation of property damage or personal injury by extreme weather events, like storms, floods or heat waves. Such events occur regularly even without climate change, but science shows that climate change increases their frequency and severity. In these cases, the causal link between the emission of greenhouse gases and the incurred damage is not straightforward, but only of a statistical nature. In order to cope with such constellations under tort law, the question arises (i) whether under these conditions full proof of causation can be dispensed with and (ii) whether it can be justified to split the damage incurred by an individual person according to the percentage of the increase in probability of the occurrence of such damage, or respectively, according to the percentage of the increase in damage caused by the human emission of greenhouse gases.

Legal doctrine, as was shown before, is not altogether reluctant to award liability in cases where plaintiffs are confronted with scientific and structural problems for the proof of causation. These examples from court practice indicate that courts are ready to address the issue and to adjust their usual requirements for the establishment of the causal link in relation to the individual constellation. The applied solutions vary. Courts may accommodate the injured party by lowering the standard of proof for the individual case, as was done by the UK Supreme Court in the *Fairchild* and the *Sienkiewicz* cases and by some French courts with respect to the hepatitis B vaccination-cases. Another method to address the plaintiff's evidentiary distress is the reversal of the burden of proof from the plaintiff to the defendant, like the courts did in the *DES*-

cases. Under both theories courts may decide for only partial liability (DES-cases, where the courts applied the theory of market share liability, the UK-case of *Barker v Corus*) or even full liability (*Fairchild*, *Collins v Eli Lilly & Co* and the DES-decisions of the Dutch and French Supreme Courts). Especially in medical cases, partial compensation of the actual damage in proportion to the reduction of the chances not to suffer the loss (theory of 'loss of a chance') gains more and more recognition.

The solution to apportion compensation according to the statistical evidence of causation is also supported by tort law theory.[79] From a theoretical point of view, liability for the increase of risk is recommended because it leads to just and efficient results: liability for the statistical increase of risk allocates each emitter exactly the damage costs the individual emitter has caused (justice argument) and would induce the emitter to reduce its future emissions to the efficient level (economic argument). Whether jurisdictions are ready to accept such theories of proportionate liability is a matter of policy. To make emitters of greenhouse gases liable for an increase in damage which is only statistically verifiable is in any case a far-reaching measure that pushes tort law to its conceptual and factual limits. In these cases, the causal connection between the individual emitter of greenhouse gases and the person who suffers specific climate change related damage is very loose. The causal connection becomes only then more obvious when it is established between the respective groups, the group of emitters of greenhouse gases on the one side and the group of injured parties on the other side. Such an undertaking requires procedural instruments that allow for the aggregation of these persons to coherent groups. A good example for such a device is the class action of US-law.[80] Another appropriate instrument would be the introduction of specific compensation funds that are fed by the greenhouse gas generating industry.

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79 Israel Gilead, Michael Green and Bernhard Koch (eds), *Proportional liability: Analytical and comparative perspectives* (De Gruyter 2013); Bénédict Winiger et al. (eds), *Digest of European tort law, Volume 1: Essential cases on natural causation* (Springer 2007). For the application of proportional liability to climate change damage, see Douglas Kysar, 'What climate change can do about tort law' (2011) 41 Environmental Law 1 and Michael Duffy, 'Climate change causation: Harmonizing tort law and scientific probability' (2009) 28 Temple Journal of Science, Technology and Environmental Law 185.

80 In the USA class action is provided by Rule 23 Federal Rules of Civil Procedure. For the application of this procedural instrument on pollution damage see for instance James Elrod, 'The use of federal class actions in mass toxic pollution torts' (1988) 56 Tennessee Law Review 243; Kenneth Rivlin and Jamaica Potts, 'Proposed rule changes to federal civil procedure may introduce new challenges in environmental class action litigation' (2003) 27 Harvard Environmental Law Review 519; Jason Betts, 'The influence of mass toxic tort litigation on class action rules reform' (2004) 22 Virginia Environmental Law Journal 249; Deborah Hensler, 'The globalization of class actions: An overview' in Deborah Hensler et al. (eds), *The globalization of class actions* (The Annals of the American Academy of Political and Social Science, SAGE 2009) 7ff. For prominent cases see: In re *Agent Orange*, 745 F.2d 161 (2d Cir 1984); In re *Three Mile Island*, 87 FRD 433 (MD Pa 1980).

5 Compensability of climate change damage

Tort liability claims require compensable damage. The mere pollution of the atmosphere with greenhouse gases and the consequent increase in temperature of air and water do not yet constitute damage according to tort law. Damage in the legal sense only arises when these events have a negative effect on persons or objects. From an economic point of view, it is essential that tort law covers a wide range of harm. Liability rules that exempt certain types of damage from liability or make it too burdensome for victims to enforce their claims are not effective because they allow for the externalisation of costs, either to the victims or to society.

With respect to climate change damage, it is apparent that there is ample room for externalisation under current liability rules. Civil liability generally covers damage to persons (personal injury and death) or objects (property damage). In many countries tort liability will also cover the costs of preventive measures taken by the injured person or by public authorities in order to prevent the occurrence or the enlargement of the damage. But already the attitude towards recovery for pure economic loss,[81] is rather incoherent in the civil law jurisdictions. While some, especially those jurisdictions that are in the Germanic law tradition, are rather reluctant to grant compensation for pure economic loss, this is not the case in countries that are part of the Roman legal family. These jurisdictions only require the plaintiff to show a personal and actual interest in the claim to have legal standing.[82] This different view has important practical consequences because climate change often affects people who are economically dependent on a natural resource without owning it.[83]

Another problematic area is environmental damage. In civil law, damage to the environment is covered if the harmed environmental good concerned can be attributed to a natural or legal person, for example when rising temperatures cause damage to a managed forest. Civil liability remedies, however, reach their limits when the harm does not concern the private sphere of a person, but the environment as such, for instance, when environmental stress on flora and wildlife leads to the destruction of natural habitats (for example, coral reefs, animal and plant sanctuaries) or the extinction of certain species. Despite some efforts in several civil law jurisdictions to extend civil liability remedies to natural resource damage,[84] one must see that the problem of changing ecological environments due to changes of climate patterns

81 Loss not connected to, or resulting from, damage to person or property.

82 Mauro Bussani and Vernon Palmer (eds), *Pure economic loss in Europe* (CUP 2003); Willem van Boom, Helmut Koziol and Christian Witting (eds), *Pure economic loss* (Springer 2004). With respect to environmental harm: Monika Hinteregger, 'Comparison' in Monika Hinteregger (ed), *Environmental liability and ecological damage in European law* (CUP 2008) 625f.

83 E.g., the owner of a skiing resort who suffers loss of income because of a lack of snowfall.

84 See Monika Hinteregger, 'Comparison' in Monika Hinteregger (ed), *Environmental liability and ecological damage in European law* (CUP 2008) 632ff.

cannot be adequately addressed or even solved by tort law remedies. Rising temperatures of water and air cause gradual and comprehensive changes to flora and fauna which cannot be categorised as compensable damage by any tort law concepts. The interest of society in the protection and preservation of these resources is thus best left to administrative law.

6 Conclusions and outlook

Climate change is happening and there is no doubt that courts will increasingly be confronted with claimants seeking compensation for the damage resulting from climate change on the basis of tort law. Very often these attempts will not primarily be motivated by the desire to actually obtain compensation for the incurred loss but will rather serve as a vehicle to draw public attention to the problem in order to induce emitters of greenhouse gases to change their future behaviour.

The compensability of climate change damage caused by greenhouse gas emissions on the basis of tort law raises, however, fundamental legal issues that cannot be answered easily. This article examined some of these problems, like the need for an applicable cause of action, the establishment of causation and the question of compensable damage. If tort law is to serve as an effective instrument for climate protection, it must be adjusted to the specific characteristics of climate change damage. This concerns the attribution of legal standing, especially with respect to pure economic loss, a considerable extension of the right to bring collective action and the comprehensive recognition of minimal and proportional liability by national tort laws.

In view of these fundamental problems, it is important to see that there are constellations where tort liability does not encounter any of the specific problems mentioned above and where tort law liability plays already an important role for the remediation of climate change damage. This is the case for all those liability claims which are not directed against the emitter of greenhouse gases, but against persons or institutions who are legally obliged to protect individuals or objects from harm caused by climate change. Providers of building services, for instance, must take the altered climatic parameters into account when rendering their services. Accordingly, architects or builders who do not consider the increasing frequency of storms, heavy snowfall or flooding in the region right from the planning stage can be made liable for their failure when damage occurs.

Another important field where tort law already governs climate change related damage is public authority liability. In our modern society the state has to a very large extent taken over the task of protecting its citizens from harm. This also com-

prises the prevention of loss caused by natural events[85] which includes those caused by climate change. Public law is developing diverse strategies in order to adapt to the changing natural environment and mitigate the negative consequences of climate change for the public. This comprises the enactment of measures to protect the public from risks related to climate change or the adaptation of legal rules, for example, land use and building regulations, to the changed environmental parameters. Failures to take action or flaws in the application of these rules may result in the liability of public authorities. Such liability may arise if, for instance, the competent public authority does not protect an area from the imminent risk of flooding, or when a municipality designates an area that is increasingly affected by flooding for residential use, or when the competent authority does not take into account that the road or railway track is threatened by landslides because of the increase of flash floods in the area. When damage has already occurred liability may arise if the responsible public authority fails to prevent further damage, or if clean-up and remediation operations are inaccurate. Public authority liability for climate change related damage has a double effect. On the one hand, it ensures that victims of climate change get compensation for their loss and, on the other hand, it induces political stakeholders to take the risks of climate change seriously in their political work and decision making. These examples show that private law in general and tort liability in particular may have a broader scope of application and higher importance for climate change related damage than expected at first sight.

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85 Member states of the European Convention on Human Rights are obliged to protect the public in case of natural disasters: see e.g., *Budayeva and Others v Russia* ECHR 2008-II 267.

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