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Henry Shue
University of Oxford

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Transboundary Damage in Climate Change: Criteria for Allocating Responsibility

Henry Shue[*]

'It could therefore be argued that the lack of effective federal action in the United States to mitigate climate change constitutes a breach of its customary obligation to prevent transboundary damage (...) In the absence of carbon-neutral states, all states contribute to climate change through the emission of greenhouse gases and the degradation of greenhouse gas sinks. The international community tolerates this (...) An injured state can therefore only invoke the responsibility of states whose contributions to climate change exceed the standard of tolerance.'[1]

1. Introduction: damage and excess

What exactly constitutes the transboundary damage caused by the failure to take effective action to avoid making climate change worse than it otherwise would be? The quoted observations by Lefeber indicate that what will be considered damage under international law is relative to which causal contributions to climate change are judged to be excessive – damage and excess go together. Implicitly this invokes a picture of the climate situation that we do well to make explicit. The conceptual picture is constructed around two zones, respectively, of resignation and indulgence, the first planet-wide and the second country-specific. First, it is accepted that a certain amount of climate change beyond what has already happened is going to occur. Second, it has been accepted that every state may continue to contribute to a certain extent to further climate change in a manner that does not count as excessive, and is therefore not to be considered as a source of transboundary damage.

The former planet-wide zone of resignation is not entirely a product of the latter country-specific zones of indulgence and arises partly out of necessity, not policy. One part of the explanation of

[*] Senior Research Fellow, Centre for International Studies (Department of Politics and International Relations, University of Oxford); Senior Research Fellow (Emeritus), Merton College, University of Oxford. This Chapter has benefitted from comments by Anja Karnein, Dov Jacobs, André Nollkaemper and Luke Tomlinson.

[1] R. Lefeber, 'Climate Change and State Responsibility', in R. Rayfuse and S.V. Scott (eds.), *International Law in the Era of Climate Change* (Cheltenham: Edward Elgar, 2012), 321, at 340, 346.

additional climate changes fated to come is the 'commitment' already built into the planetary system by greenhouse gas (GHG) emissions that have already been injected into the atmosphere, but are yet to play out their full effect. Sea-level rise, for example, will continue for centuries as a result of emissions that have already occurred.[2] This means that, leaving aside dangerous hubristic experiments like the extreme varieties of climate engineering,[3] we must because of necessity allow for some degree of additional climate change – at least a minimal zone of resignation.[4] In addition, some continuing emissions are inevitable for a few years. But how extensive that planetary zone of resignation must be also depends very much in fact on the extent of the zone of indulgence we choose as a matter of policy to grant to states in the future – where we draw the line beyond which the production of emissions and the destruction of sinks count as excessive, and are judged to cause transboundary damage.

I shall argue that we must specify the planetary zone of resignation first on the basis of the seriousness of the damage at risk for everyone, and then must specify any national zones of indulgence accordingly, so that the chosen planetary zone of resignation is not exceeded through extravagant claims for national indulgence on the basis of out-moded notions of state sovereignty. The interpretation of international law should rest on a policy adopted toward acceptable risks of damage, especially severe damage to the defenceless.

Hence, before we reflect on the line-drawing issues raised by the specification of 'excess', we must grasp the kinds of damage that excess in this realm produces. The twinned causes, excessive degradation of sinks and excessive emissions, produce in combination twinned sets of effects. First, of course, they directly cause the various interrelated phenomena that are referred to as climate change itself. These phenomena, singly and in multiple combinations, then yield multiple

[2] J.A. Church, P.U. Clark, A. Cazenave, et al., 'Sea Level Change', in T.F. Stocker, D. Qin, G.-K. Plattner, et al. (eds.), *Climate Change 2013 – The Physical Science Basis*, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: CUP, 2014), 1137; S. Solomon, G.-K. Plattner, R. Knutti and P. Friedlingstein, 'Irreversible Climate Change Due to Carbon Dioxide Emissions', (2009) 106 PNAS 1704; and M. Schaeffer, W. Hare, S. Rahmstorf and M. Vermeer, 'Long-Term Sea-Level Rise Implied by 1.5°C and 2°C Warming Levels', (2012) NCC, online at www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1584.html (last accessed 5 June 2014).

[3] See C. Hamilton, *Earthmasters*: *The Dawn of the Age of Climate Engineering* (New Haven and London: Yale University Press, 2012), at ix: '[f]or sheer audacity, no plan by humans exceeds the one now being hatched to take control of the Earth's climate. Yet it is audacity born of failure, a collective refusal to do what must be done to protect the Earth and ourselves from a future that promises to be nasty, brutish and hot.'

[4] This is made more palatable if one assumes that adaptation can be successful in response to this degree of change. Human lives – and entire species of plants and animals – will, however, be lost.

indirect effects on human societies, including crop failures, destruction of dwellings and other property, threatening changes in disease patterns (like the northern movement of 'tropical' diseases and their vectors) and in temperature patterns, and much else, including some locally positive effects. I shall not elaborate this first set of damages – physical changes and their social effects – here, since they are increasingly appreciated.

These changes in the climate threaten, if they continue far enough, to undermine the most fundamental conditions of human welfare and modern human societies, which is highly significant legally. The levels of wealth to which developed societies cling and developing societies aspire were possible because human societies had gradually adapted more and more successfully to the current conditions on this planet, which had remained as they were for about 10,000 years, but are now being changed by us. The Agricultural Revolution that occurred at the dawn of this period in the history of the earth's climate made possible surplus food and consequently expanding human settlements that have turned into the metropolises, mega-metropolises, and nation-states that have hosted the Industrial Revolution, the Information Revolution, and the other developments that have created the wealth many of us currently enjoy and the social infrastructure that has allowed the human population to explode several times over.

The agriculture at the base of this social pyramid is, however, strikingly fragile, and the weather cannot change beyond certain points without disruptions in the supply of food that would initially yield price fluctuations and subsequently produce scarcities, to neither of which the poorest humans would be able to adjust.[5] Any 'standard of tolerance' in this area deserves sharp scrutiny, as does any interpretation of state sovereignty that would grant license to undermine the very pre-conditions of the viability of the units claiming it. Any suggestion that state sovereignty ought to include license to engage in activities that risk undermining such fundamental conditions of life would be absurdly self-defeating. It is clearly vital that the customary prohibition on transboundary damage be considered *jus cogens* in the case of damage that risks undermining the essential physical underpinnings of human agriculture and the rest of the human economy.

[5] See J.R. Porter, L. Xie, A. Challinor, et al., 'Food Security and Food Production Systems', in V. Barros, C. Field, K. Mach, et al., *Climate Change 2014: Impacts, Adaptation, and Vulnerability*, Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: CUP, 2014), ch. 7.

Indeed, one might plausibly posit 'a primitive social contract at the international level whereby the international community, as a reified entity, owes a sort of sovereign duty to protect its subjects, in the same way that a state must protect its citizens against crime. In this sense, the duty is clearly a shared obligation and owed by the international community as a whole (...) and by all states constituting that community, irrespective of their special relationship to the injured state'.[6] As we shall see, this would have powerful implications for who could bring legal actions.

2. Cumulative carbon: the science

The second kind of damage produced by sink-destruction and emissions-production is quite different from the first set, and more profoundly socially mediated. The standard way of specifying the extent of what I am calling the planetary zone of resignation is to say that we will attempt to prevent an increase in average global temperature, compared to the average temperature prior to the Industrial Revolution, of more than two degrees Celsius (2°C), which of course means accepting a temperature rise of 2°C. In effect, a line is being drawn between two degrees of 'tolerable' worsening of the climate and further intolerable worsening. It is generally understood that the first two degrees of rise is far from unproblematic, but this is widely believed to be the most ambitious goal that might be politically feasible. The goal of 2°C informally adopted in Copenhagen and formally embraced in Cancun rests on drawing this line here.[7] Leaving aside the question whether 2°C is the best place for the line, we must choose some number. We must specify how much climate change is too much, and thereby how much, and which kinds of, damage we accept (in trust for the future generations who will mostly be the ones who suffer it).

An impressive number of recent scientific analyses have converged on the suggestion that once a political decision has been reached about the amount of temperature rise that will be accepted, we

[6] P.A. Nollkaemper and D. Jacobs, 'Shared Responsibility in International Law: A Conceptual Framework' (2013) 34 MIJIL 359, at 427.

[7] See 'The Cancun Agreements: Outcome of the Work of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention', Decision 1/CP.16, in *United Nations Framework Convention on Climate Change (UNFCCC), Report of the Conference of the Parties on Its Sixteenth Session, Addendum, Part Two: Action Taken by the Conference of the Parties*, UN Doc. FCCC/CP/2010/7/Add. 1 (2011), para. 4.

can best think in terms of a cumulative carbon budget for that amount of temperature rise.[8] The single factor that predicts most accurately the most likely amount of temperature change beyond the pre-Industrial Revolution temperature is the cumulative amount of carbon emitted since the beginning of the Industrial Revolution – since, say, 1750. The total *cumulative* amount of carbon emissions since 1750 is what matters – rather than, say, the current annual global emissions – because of the extraordinarily long atmospheric residence time of carbon dioxide. Once carbon dioxide is injected into the atmosphere it remains for a lengthy period – for many molecules, the residence time in the stratosphere is millennia – so the atmospheric total continues to swell decade after decade.[9] The strong correlation between total cumulative carbon emitted since the Industrial Revolution began and rise in average global temperature since the Industrial Revolution began means that for any amount of temperature rise chosen as the political goal of efforts to deal with climate change, the atmospheric scientists can calculate the approximate cumulative carbon budget that makes it more likely than not that the temperature goal will not be exceeded. For a rise of no more than 2°C, for instance, the cumulative carbon budget is around one trillion tonnes. This budget is already more than half used up – emissions from 1750 to date are over 580 Gigatonnes – and if emissions continue on the trajectory of the last 20 years, the remainder of the budget will be exhausted in 26 years, in 2040.[10]

[8] This determination is of course probabilistic: the concentration makes a given temperature the most likely one. Other factors are also at work. Two companion studies converged upon the conceptual point: M.R. Allen, D.J. Frame, C. Huntingford, et al., 'Warming Caused by Cumulative Carbon Emissions Towards the Trillionth Tonne' (2009) 458 *Nature* 1163; and M. Meinshausen, N. Meinshausen, W. Hare, et al., 'Greenhouse-Gas Emission Targets for Limiting Global Warming to 2º C' (2009) 458 *Nature* 1158 (with supplementary information online). The conceptual point was first laid out in an accessible manner in M.R. Allen, D.J. Frame, K. Frieler, et al., 'The Exit Strategy' (2009) 3 NRCC 56, at 57. A policy relevant follow-up study is N.H.A. Bowerman, D.J. Frame, C. Huntingford, et al., 'Cumulative Carbon Emissions, Emissions Floors and Short-Term Rates of Warming: Implications for Policy' (2011) 369 PTA 45. A further analysis of the policy implications of carbon dioxide's lengthy lifespan relative to other greenhouse gases is: H.D. Matthews, S. Solomon and R. Pierrehumbert, 'Cumulative Carbon as a Policy Framework for Achieving Climate Stabilization' (2012) 370 PTA 4365. For a more sophisticated discussion of the science than mine in the text, see R.T. Pierrehumbert, 'Cumulative Carbon and Just Allocation of the Global Carbon Commons' (2013) 13 Chic JIL 2. The significance of the cumulative carbon budget has now been confirmed by the IPCC – see M. Collins, R. Knutti, J.M. Arblaster, et al., 'Long-term Climate Change: Projections, Commitments and Irreversibility', in T.F. Stocker, D. Qin, G.-K. Plattner, et al. (eds.), *Climate Change 2013 – The Physical Science Basis*, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: CUP, 2014), 1029, at 1033.

[9] P. Ciais, C. Sabine, G. Bala, et al., 'Carbon and Other Biogeochemical Cycles', in T.F. Stocker, D. Qin, G.-K. Plattner, et al. (eds.), *Climate Change 2013 – The Physical Science Basis*, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge: CUP, 2014), 465, at 472-473.

[10] See TrillionthTonne.org, http://trillionthtonne.org (last accessed 20 June 2014).

3. Cumulative carbon: the significance

For our purposes particular numbers are primarily illustrative. The significance lies in the basic logic: for any given total of cumulative carbon emissions – any given cumulative carbon budget – there is a most likely temperature rise. As humanity exceeds that cumulative carbon budget, the probability of lower average global temperatures than the target falls, and the probability of higher temperatures rises.

So far, as the observation initially quoted from Lefeber indicates, we have tended to believe that for each state in the international system a national zone of indulgence could be specified in terms of permissible additional GHG emissions: '[a]n injured state can therefore only invoke the responsibility of states whose contributions to climate change exceed the standard of tolerance.'[11] If we frame our challenge in terms of the global carbon budget, however, we begin to see that the current pattern of thinking nation-by-nation is highly problematic.

Above all, the cumulative carbon budget is global. Emissions must be summed not only over time since 1750 but over all nations. This reveals one of the dangers of thinking in terms of national zones of indulgence: it allows it to seem appropriate to do calculations from the bottom – national (or in the case of the European Union (EU), regional) – level up. But this is a mistaken procedure. It is the global total of emissions that must be restricted to the cumulative carbon budget for whichever goal of temperature rise has been chosen. There is no guarantee – indeed, no real prospect – that bottom-up allowances will sum to only the maximum global total compatible with the desired temperature rise. This would require some truly miraculous 'Invisible Hand'. Failure in the mitigation enterprise is certain unless the allowances for nations/regions are reached with a view to a global total that is fixed first on the basis of the temperature rise to which human agriculture and other human enterprises can successfully adapt rapidly enough. Emissions targets must be viewed from the top down – from the chosen global goal to the national/regional allowances that will in fact lead to that goal.

This is by far the lesser stringency, however. The greater discipline lies in the fact that the remaining balance of 'allowable' emissions, whatever the appropriate total budget is, is rapidly diminishing through our currently undisciplined carbon emissions free-for-all. The point is not to

[11] Lefeber, 'Climate Change and State Responsibility', n. 1, at 340, 346.

delay the day on which the trillionth tonne of carbon is emitted, but to keep that day from coming – ever. This is not a political constraint that can be fiddled – this is a feature of planetary dynamics.

Obviously, then, in order to avoid the infliction of the transboundary damages inherent in further climate change we need to specify national/regional emissions allowances, at least some of which decline so rapidly that total global cumulative carbon emissions into the atmosphere never reach one trillion tonnes, if we are serious about the goal of a temperature rise no greater than 2°C. In short, net injections of carbon dioxide into the atmosphere must reach zero before the atmospheric total reaches one trillion tonnes. Basically, we must promptly find an exit from the fossil-fuel/carbon regime that now dominates the planet and has brought us both industrial society and climate change.

Yet contemporary societies cannot function without massive supplies of energy. Exiting the carbon regime, then, requires entering a non-carbon regime. The transition to an alternative energy regime will require courageous leadership and great exertion because it will be constantly attacked by fossil-fuel interests, the value of whose capital assets – the proven reserves of coal, oil, and gas – will turn out to be a financial bubble if humanity acts against climate change.[12] This is not the place to analyse alternative paths for the energy transition, and I have considered one strategy elsewhere.[13]

4. Profligate emissions: four allocation principles

Here the question is: what in the circumstances that the international system of states confronts constitutes the transboundary infliction of damage? And it should now be evident that the damage

[12] See Carbon Tracker Initiative, *Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?* (2011) at http://www.carbontracker.org/wp-content/uploads/downloads/2012/08/Unburnable-Carbon-Full1.pdf; and Carbon Tracker Initiative and Grantham Research Institute on Climate Change and the Environment, *Unburnable Carbon 2013*: *Wasted capital and stranded assets* (2013) at http://carbontracker.live.kiln.it/Unburnable-Carbon-2-Web-Version.pdf (both last accessed 5 June 2014). Carbon interests tend instead to support climate engineering, which would allow the fossil-fuel regime to continue business-as-usual – see Hamilton, *Earthmasters*, n. 3.

[13] Essentially the strategy is a global version, with transnational subsidies, of the kind of feed-in tariffs pioneered by Germany – for a sketch, see H. Shue, 'Climate Hope: Implementing the Exit Strategy' (2013) 13(2) Chic JIL 381; reprinted in H. Shue, *Climate Justice*: *Vulnerability and Protection* (Oxford: OUP, 2014), 319. And for fuller details, see T. Banuri and N. Hällström, 'A Global Programme to Tackle Energy Access and Climate Change' (2012) 61 DD 264.

is of two varieties. The first set is the infliction of the phenomena constituting climate change itself and their social effects. The second is the generation of carbon emissions that exhaust an excessive share of the remaining cumulative carbon budget. Both kinds of damage result from excessive emissions, but each is revealed by viewing the excessive emissions from a different perspective. From one perspective the excessive emissions are additional causal contributors to the floods, droughts, and other disruptions that constitute climate change itself. From another perspective the excessive emissions are encroachments on the shrinking global cumulative budget, needed by others, of emissions that will most likely not produce a temperature rise of more than 2°C.

Conceptually this has the great disadvantage of making the standard of 'excessive' depend upon a question of distribution, namely, when is a nation consuming more than its share of the shrinking remaining budget? However, we cannot avoid this complication because it is a crucial element of the international situation. All states in the international system must share a single budget of carbon emissions that shrinks with every emission by every state. Excessive climate emissions are doubly damaging across borders. One kind of action – excessive carbon emissions – is both increasing the supply of supposedly tolerable climate difficulties and reducing the supply of energy that can be consumed without causing clearly intolerable climate difficulties.

What does it mean concretely for a state's emissions to exceed its share enough to inflict the second variety of damage? We can call these 'profligate emissions'. In order to specify a baseline against which to measure what is profligate we must confront a central question concerning shared responsibility: on the basis of what criteria responsibility can be allocated between multiple parties.[14] What would be the basis for a judgment that a particular state's emissions are profligate? The negative answer to the question is: no single factor establishes that emissions are profligate, because each individual measure is partial and contentious in its own ways, especially if advanced as the only factor that matters. But if all or several of the most relevant factors converge in the case of a particular state, that constitutes a compelling case. Here are the four most relevant factors.

[14] Nollkaemper and Jacobs, 'Shared Responsibility', n. 6, at 393.

First, the most important factor is how strenuous the state's efforts have been to reduce its emissions. One could not reasonably accuse a state of excessive emissions if it were engaged in ambitious, robust, and multi-pronged efforts to cut its emissions rapidly. Accordingly, a good score on this factor would count strongly against any charge of excessive emissions, perhaps even if its emissions remained undesirably high by an objective standard. No state could be found guilty of transboundary damage as a result of excessive emissions if it were basically doing everything it could reasonably be expected to do to reduce its emissions. And a bad score on this factor would count strongly in favour of the judgment of excess, especially because the standard of international law is due diligence: '[t]he obligation is a due diligence obligation (...) Compliance requires states to adopt, implement, supervise, and enforce policies and measures to achieve the objective, in this case policies and measures that prevent, limit, or reduce the emission of greenhouse gases, i.e. mitigation action.'[15] In sum, the first factor embodies the legal requirement of due diligence and is reasonable in common-sense terms as recognising good-faith effort.

Second, a further factor is what kinds of costs the state would need to impose upon its own residents in order to do more to constrain carbon emissions than it is now doing. In effect, a high score on this consideration might function as a justification for a low score on the first.[16] It would not be reasonable to expect a state to make strenuous efforts to constrain its carbon emissions if, for example, many of its residents suffer from 'energy poverty' in, for instance, being unable to afford the electricity necessary for a decent life, and the only energy that could affordably be provided to those deprived residents is carbon-based energy.

If, by contrast, the state's residents have among the highest per capita rates of energy consumption in the world, they certainly can reasonably be asked to manage with less. Indeed, it is precisely for the sake of energy-deprived people who can potentially afford nothing other than carbon-based energy that energy-rich people must not unnecessarily exhaust the remaining carbon budget in a wasteful or frivolous manner. The cumulative carbon budget is after all strictly zero-sum: whatever the rich consume becomes unavailable for the deprived.[17] In short,

[15] Lefeber, 'State Responsibility', n. 1, at 334, citing *Pulp Mills on the River Uruguay (Argentina v. Uruguay)*, Judgment, ICJ Reports 2010, 14, para. 197.
[16] I examine below some ways of measuring these factors.
[17] I have explored this more fully in Shue, 'Climate Hope: Implementing the Exit Strategy', n. 13.

the second factor embodies the legal excuse of necessity and is reasonable in common-sense terms as a form of fairness that acknowledges genuine needs.

The third factor to consider, then, is the current emissions per capita of the residents of the state in question, which are a direct measure of the extent of their ongoing appropriation of resources from the shrinking common pool. This objective measure should be qualified by the first two factors. If, in accord with the first, the state is making a maximum effort to restrict its emissions, then it is perhaps exercising due diligence even if the objective level of its members' appropriation is higher than ideal for now. Adequate effort makes up to some degree for inadequate results. Similarly, if, in accord with the second, the state could not restrict its emissions without depriving its residents of energy that they need for a decent life, it would be unreasonable to accuse it of transboundary damage even if its emissions were objectively higher than ideal. It is not fair to expect the sacrifice of the fulfilment of genuine needs.

If, by contrast, the state is neither doing its best to reduce emissions nor unable to reduce them without depriving its members of essentials, and its emissions per capita are high, this evidently indicates that its emissions are profligate, and it is inflicting both kinds of transboundary damage on the rest of the world. If emissions per capita are exceptionally high, this shows that the profligate emissions are produced in flagrant disregard of other peoples.

It may be objected to the third factor that the people of different states have different needs and so it is not reasonable to expect equal per capita emissions from everyone. The content of the objection is correct, but the objection is irrelevant. The third factor neither supposes that emissions ought to be the same per capita nor that it is somehow automatically wrong for one state's per capita emissions to be higher than another's. It assumes only that if a state's emissions are among the highest in the world, it bears the burden of explanation why they should be so high, given the urgency of reducing emissions overall. If the state is making great efforts to reduce emissions (first factor) or its weather is especially extreme (example of second factor), the higher emissions might be either excusable or justifiable.

Most important, the objection ignores the fundamental point that the cumulative carbon budget is zero-sum. Each person's emissions are emissions that no one else may ever have, and this makes

the extent of emissions a profoundly distributive question – a question of fairness.[18] Some extremely good reason would need to apply to any emissions that are at all high, much less among the highest in the world, in light of the double damage high emissions are wreaking: exacerbating climate change itself and its social effects and exhausting the remaining balance of 'tolerable' emissions within the cumulative carbon budget. High per capita carbon emissions hasten the day when no significant further carbon emissions will be compatible with an acceptable limit on average global surface temperature, and they entail that fewer persons – even persons who can afford no other kind of energy – can emit before that day is reached. Emissions that are exceptionally high and are not falling rapidly are virtually impossible to justify.

Fourth, an additional important factor is the state's percentage of the cumulative carbon emissions to this point.[19] This is based on three separate but converging reasons. The first reason is simply that cumulative emissions are, so to speak, what it is all about. Because carbon resides for so very long in the atmosphere once it arrives there, the crucial factor in how severe climate change becomes is the cumulative total of carbon emitted, as we have seen above. It would consequently be exceedingly strange in assessing the international role of various states in climate change to give little weight to their performance on the dimension that matters the most: the cumulative.

The second reason is that past emissions are hardly unrelated to the stringency now required in future emissions. On the contrary, the remaining carbon budget is as small as it is precisely because past emissions have been as great as they have. A Faulkner character (a lawyer) famously said: '[t]he past is never dead – it's not even past.'[20] Nowhere is this more true than here. More carbon could be emitted in the future without driving the temperature rise beyond an additional 2°C if less carbon had been emitted in the past. The entire cumulative carbon budget is zero-sum across time. So little of the budget is left for the future because so much has been used in the past. Who used up the amount that is gone is of central significance.

[18] I explain this more fully in connection with the fourth factor, which similarly rests on distributive considerations.
[19] It is well worth considering whether the most relevant variant of this factor is per capita cumulative emissions. I leave this aside here.
[20] G. Stevens, in W. Faulkner, *Requiem for a Nun* (London: Vintage, 1996 [1950]), Act I, scene iii, at 85.

The third reason in support of this fourth factor is this: since the cumulative carbon budget is a measure of a good held in common, namely the diminishing capacity to emit carbon without contributing to an intolerably great rise in temperature, the distribution of that increasingly scarce good among states and individuals is inherently a question of fairness, or as lawyers like to say, equity. And to deprive people of their fair share of a vital good is to damage them. Distributive issues are unavoidable here because a shared good must be divided. To try to deny that this distribution raises normative issues is implicitly to make the preposterous claim that a procedure under which the richest grab whatever they want until it is all gone is a normatively acceptable procedure for the division of such a valuable scarce good. The state's percentage of total cumulative emissions is the most obviously direct measure of the extent of its appropriation so far of this good held in common by the people of all states. This standard can be interpreted in a number of different ways – as we shall see below, it may be fairer to deduct from each nation's absolute total the emissions that were essential for the provision of basic necessities to its population, or to deduct the emissions before the effects of emissions were understood. But the basic contention that cumulative emissions indicate the share taken out of the commons seems difficult to deny.

So the four allocation principles that I am proposing should be considered in order to judge when a state's emissions are profligate are: first, extent of effort to reduce emissions ('due diligence'); second, costs of possible additional reductions ('necessity'); third, current emissions per capita (actual results to date); and fourth, percentage of total cumulative emissions (national encroachment on global budget).

5. The US case: causal and moral responsibility for profligacy

By way of illustration, let us consider whether United States (US) emissions are profligate. The situation of the US with regard to the first and second factors is quite straightforward. Concerning the first, the US has exerted very little effort to reduce emissions. To this day it still lacks any national limit on emissions of GHGs in general or emissions of carbon in particular and any legislation (like a carbon tax or an emissions trading scheme) designed to reduce emissions; it has

rejected the one relevant binding multilateral treaty (Kyoto Protocol);[21] the upper level of its federal legislature (the Senate) is openly contemptuous of measures to deal with climate change; the lower level (House of Representatives) in 2011 rejected by a vote of 240 to 184 the proposition that 'Congress accepts the scientific findings (...) that climate change is occurring, is caused largely by human activities, and poses significant risks for public health and welfare';[22] and its emissions grew 4.7 per cent between 1990 and 2012, the latest year for which it gives its own statistics.[23] Concerning the second factor, it is one of the most affluent societies on earth and could easily reduce emissions significantly by reducing energy waste and curtailing entirely unnecessary uses of energy. The status of the US with regard to the first two factors requires very little discussion: it has not remotely displayed due diligence, and it has no excuse of necessity whatsoever.[24]

The third factor in judging which emissions are excessive is current per capita emissions. If, following David Weisbach, one considers all six Kyoto Protocol GHGs and leaves aside the countries with the smallest total emissions, the US has the sixth highest per capita emissions in the world.[25] The three highest are oil producers, whose emissions presumably come mainly from oil production, not emission-generating consumption, each with less than one-half of one percent of global emissions: Qatar, United Arab Emirates, and Kuwait. The next three are both producers of fossil fuel and extreme emission-generating consumers: Australia [coal], Canada [tar sands bitumen], and the US [coal, oil, and gas]. Of the top twenty in per capita emissions the US produces by far the highest percentage of the world total: 15.7 per cent. On this factor, then, the US is not the worst, although it does extremely poorly. And it has neither the justification that it

[21] Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 10 December 1997, in force 16 February 2005, 2303 UNTS 148 (Kyoto Protocol).
[22] Hamilton, *Earthmasters*, n. 3, at 85-86.
[23] United States Environmental Protection Agency, 'National Greenhouse Gas Emissions Data' (April 2014) at http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Chapter-2-Trends.pdf (last accessed 28 June 2014).
[24] To be fair, it ought to be noted that this extreme level of failure is true only of the federal government. Some regions (combining several states), individual states, individual cities, and voluntary associations of citizens are working vigorously to try to counteract Washington's backwardness. For examples, see J. Garofoli, 'California, China to Link Climate-Change Efforts', San Francisco Chronicle, 13 September 2013; and M.L. Wald, '8 States Teaming Up to Support Electric Cars', New York Times, 24 October 2013.
[25] D. Weisbach, 'Negligence, Strict Liability, and Responsibility for Climate Change' (2011-2012) 97 Iowa LR 521, at 548, Table 8. The main limitation of Weisbach's discussion is that he relies largely on domestic conceptions of responsibility and liability.

is making robust efforts to cut emissions, nor the excuse that the current emissions are necessary to lift citizens out of poverty.

The fourth and final factor is cumulative emissions, which are a more controversial matter and can be calculated in some significantly different ways, three of which merit discussion. Benito Müller, Niklas Höhne, and Christian Ellermann have provided sophisticated analyses of the main issues in two complementary articles using the data-set originally assembled by the Ad Hoc Group for the Modelling and Assessment of Contributions to Climate Change (MATCH).[26] First, Müller, Höhne, and Ellermann begin by quantifying the relative causal contributions of the world's various nations to climate change, interpreting climate change specifically as 'changes in mean global temperature', and taking the relative causal contributions to be the relative sizes of the cumulative sums of emissions of all six anthropogenic Kyoto-counted greenhouse gases over each nation's sovereign territory between 1890 and 2005, weighted according to their respective constant 1995 global warming potentials (GWP) as standardly employed under the Kyoto Protocol.[27] Thus 'the share of a country's (...) contribution to climate change is given by their share in global historic GWP-weighted GHG emissions.'[28] Some selected 'causal contribution shares' are: US (19.7 per cent), EU-25 (17.8 per cent), China (10.8 per cent), Russia (6.5 per cent), Brazil (4.3 per cent), India (3.9 per cent), and Japan (2.8 per cent).[29]

One of the main conceptual points in these twin articles is that causal contribution and moral responsibility are not the same, and any given agent may have (a percentage of the total) moral

[26] B. Müller, N. Höhne and C. Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change' (2009) 9 CP 593; and C. Ellermann, N. Höhne and B. Müller, 'Differentiating Historical Responsibilities for Climate Change', in P.G. Harris (ed.), *China's Responsibility for Climate Change*: *Ethics, Fairness and Environmental Policy* (Bristol: Policy Press, 2011), 71. As the similarity of titles and identity of authors suggests, both articles cover much of the same ground, but Ellermann, et al. devotes special attention to China, while Müller, et al. provides more analysis of alternative conceptions of responsibility. Citations for further information on MATCH are provided in Müller, et al., at 594. Because the figures in this analysis are for all six Kyoto gases, they are not strictly comparable to the carbon budget, which concerns only carbon. However, because carbon is the dominant gas among the Kyoto six, they are broadly comparable.

[27] Müller, Höhne and Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', ibid., at 595, 597; Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', ibid., at 72, 76.

[28] Müller, Höhne and Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', n. 26, at 601; Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', n. 26, at 83.

[29] Ibid. (fewer countries specified). This analysis considers all the greenhouse gases covered by the Kyoto Protocol, not carbon alone. For the suggestion that the costs of, in particular, any necessary air extraction of carbon dioxide be allocated in proportion to cumulative emissions, since climate change is so closely proportional to cumulative emissions, see J. Hansen, M. Sato, R. Ruedy, et al., 'Dangerous human-made interference with climate: a GISS modelE study', (2007) 7 Atmos Chem Phys 2287.

responsibility that is either less or greater than (the percentage of) that agent's causal contribution. As a general proposition, this is certainly true. One may not be morally responsible for some effects one has caused, and one may be morally responsible for some states of affairs that one has not caused. Unfortunately, in specifying how moral responsibility differs from causal responsibility considerable complication comes in.[30] The next two calculations consider two of them respectively.

In both cases, Müller, Höhne, and Ellermann use what they call 'a (bottom-up) allowance-based methodology', which permits various allowances, based on various different factors relevant to responsibility, to be incorporated into the calculations in order to reflect facets of the difference between national causal responsibility and national moral responsibility:[31]

> The idea is that allowances may be allocated to emitters, which they can use against their emissions in calculating their level of responsibility. It is, in general terms, analogous to the system of tax allowances used in most countries in differentiating the tax burden. There can be different kinds of such 'climate change responsibility allowances', depending on the (moral) justification for their allocation.[32]

Some allowances are applied per capita, and some are not; each allowance might be set at any of many different levels, and the level chosen needs to be justified morally.[33] This becomes highly complex and contentious, and I will mention only one per capita and one national allowance.

Secondly, then, one might think that every nation is entitled to a certain basic level of emissions and that it would be unfair to hold a nation responsible for using its initial 'basic allowance' of emissions.[34] This is analogous to the tax-free income at the bottom of many tax tables. Müller, Höhne, and Ellermann quite reasonably assign their basic allowance per capita. Obviously, all per capita quotas serve in fact, other things equal, to reduce the responsibility of the more populous

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[30] We are of course concerned with legal responsibility under international law, which they did not attempt to consider. But I believe their discussion still turns out to be instructive for our purposes, and I come to international legal responsibility in light of their analysis below.

[31] Müller, Höhne and Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', n. 26, at 598; Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', n. 26, at 77.

[32] Ibid.

[33] My own fear is that the moral complexity will make the allowance component of the methodology collapse of its own weight in a manner that is indeed precisely analogous to many national tax codes, which desperately need simplification.

[34] I initially argued for this view in H. Shue, 'Subsistence Emissions and Luxury Emissions' (1993) 15(1) LP 39; reprinted in S.M. Gardiner, S. Caney, D. Jamieson and H. Shue (eds.), *Climate Ethics*: *Essential Readings* (New York: OUP, 2010), 200; and in H. Shue, *Climate Justice*, n. 13, at 47.

nations and increase the responsibility of the less populous ones. Consequently, the causal contribution shares given above, adjusted by their chosen basic allowance, yield shares of what they call 'strict responsibility'[35] as follows: US (25.6 per cent), EU-25 (19.1 per cent), Russia (7.3 per cent), China (6.4 per cent), Brazil (5.2 per cent), Japan (2.8 per cent), and India (0.3 per cent) – compared to the first calculation of their 'causal contribution shares', China falls below Russia, and India falls to the bottom of this list, because of its low emissions (3.9 per cent causal contribution share) combined with its large population size (16.9 per cent of world population).[36] The US moves even farther into the top spot.

Thirdly, just as one cannot be morally responsible for having engaged in basic activities everyone must engage in, it is also widely thought that one cannot be morally responsible for consequences that one neither intended nor even foresaw.[37] Thus, it might be thought that a nation whose people were excusably ignorant of the effects on the climate of their emissions cannot be held morally responsible for those effects or blamed for those emissions.[38] This assumption is the basis for what these articles call an 'epistemic allowance', which they implement, not per capita, but nationally, simply by excluding all emissions before 1990. That year is chosen 'on the grounds that after that year, which saw the beginning of the UNFCCC [United Nations Framework Convention on Climate Change] negotiations and the publication of the first IPCC [Intergovernmental Panel on Climate Change] reports, no government could reasonably plead ignorance of the problem'.[39] If one then looks only at emissions from 1990 through 2005, then compared to the second calculation of 'strict responsibility' (which adjusts causal shares for basic allowances), the share of epistemically constrained 'limited responsibility' that falls on China

[35] This is entirely distinct from strict liability and is therefore a somewhat unfortunate label.

[36] Müller, Höhne and Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', n. 26, at 603; Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', n. 26, at 85 (fewer countries specified).

[37] I have suggested that this is less obvious than it may seem in the case of climate change in 'Historical Responsibility', Technical Briefing for Ad Hoc Working Group on Long-term Cooperative Action under the Convention [AWG-LCA], SBSTA, UNFCC, Bonn, 4 June 2009, at http://unfccc.int/files/meetings/ad_hoc_working_groups/lca/application/pdf/1_shue_rev.pdf (last accessed 5 June 2014). But I ignore my own (minority) view here.

[38] I discuss this somewhat more fully below.

[39] Müller, Höhne and Ellermann, 'Differentiating (Historic) Responsibilities for Climate Change', n. 26, at 604; Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', n. 26, at 86.

almost doubles to 12 per cent, and the shares of the US and EU each fall by more than one-fifth to 20.1 per cent and 12.3 per cent respectively.[40]

Focusing exclusively on the United States and comparing the three measures, the US has a 'causal contribution share' of 19.7 per cent, a 'strict responsibility share' of 25.6 per cent, and a 'limited responsibility share' (1990-2005 emissions only) of 20.1 per cent. Rather than plunge into the myriad issues concerning which, if any, of these three measures might be most appropriate for which purposes – presumably, different measures for different purposes – and at which level each of the two allowances should be set, I would like to suggest that two facts stand out starkly.

First, whichever of these three measures of cumulative emissions one uses, the US share is always the largest in the world; and second, for all the philosophical complexities attendant upon judgments about the relative merits of (these and other) alternative calculations of shares, the US never falls significantly below 20 per cent of the total for all nations on earth. This seems to me to be basically all that one needs to know. In sum, the US has made the largest – and absolutely a very substantial – contribution to the creation of climate change and consumed the largest portion of the cumulative carbon budget (factor four), while doing very little about it (factor one) with no plausible excuse (factor two) and continuing to this day to emit at one of the highest per capita rates in the world (factor three) – the third highest among industrial nations.[41]

6. The US case: legal responsibility

Our concern here of course is specifically with legal responsibility for transboundary damage, which is not discussed as such by Müller, Höhne, and Ellermann. But I think the implication of their work is clear. Pure causal responsibility (measure 1) would be apposite only if the relevant standard were strict liability, but strict liability is not the legal standard for transboundary damage. Nor can I see any basis in international law for using their 'limited responsibility'

[40] Ibid.

[41] Cumulative emissions per capita as of 2010 show the US is emitting more than three times as much as China and more than three times the world average – see Ellermann, Höhne and Müller, 'Differentiating Historical Responsibilities for Climate Change', n. 26, at 81, Figure 4.3.

(measure 3), which qualifies causal responsibility by ignoring all emissions prior to 1990 on epistemic grounds.[42] Knowledge or lack of knowledge would be relevant only if fault needed to be established, but 'in international law, liability does not depend on fault and is established on the basis of attribution and breach alone'.[43] As I have noted already, the US is in any case the worst offender by all three measures.

Their somewhat misleadingly named 'strict responsibility' (measure 2), which qualifies causal responsibility by applying a per capita 'allowance' for emissions necessary (given the existing energy regime) for a decent life, is presented by them as one reading of moral responsibility. I would suggest, however, that it is also the core of one reasonable way to try to quantify 'excess' emissions in the sense prohibited by international law. In my terminology it could be construed as already being a reading of the fourth factor (cumulative emissions) qualified by the second factor (necessity). I would simply suggest also considering the first factor (extent of due diligence) and the third factor (results to date) in assessing the wrongfulness of state behaviour.

The most contentious aspect of using their conception of 'strict responsibility' as a reading of responsibility under international law would, I imagine, be the setting of the specific level of the allowances, an issue that I have not pursued. Some people would, I suspect, consider the level at which Müller, Höhne, and Ellermann have set their allowances too low, that is, as interpreting 'necessity' too strictly. However, it is worth observing that since the allowance is per capita and the US population is far smaller than some other, poorer nations with growing emissions (notably, China and India), the higher the allowance is set, the worse the US looks. A possible challenge would be to find non-arbitrary bases for a particular level. Nevertheless, the suggestion that some per capita adjustment should be made to the absolute amount of emissions to reflect the fact that until we escape the fossil-fuel regime a certain amount of emissions are very temporarily unavoidable – and certainly were in the past – seems sound.

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[42] D. Weisbach analyses cumulative per capita emissions since 1990 only – see Weisbach, 'Negligence, Strict Liability, and Responsibility for Climate Change', n. 25, at 562, Table 9. The US has the 10th highest per capita emissions since 1990; China ranks 107th and India 154th. Of states that are neither oil-producers nor very small, only Canada (5th) and Australia (6th) are worse than the US

[43] M.G. Faure and P.A. Nollkaemper, 'International Liability as an Instrument to Prevent and Compensate for Climate Change' (2007) 43 Stan JIL 123, at 145.

7. Conclusions

Fundamentally, the current situation is urgent precisely because so much of the cumulative carbon budget has already been used up. The single largest factor explaining why the global carbon allowance will be exhausted so soon is the percentage of the global sinks already filled by emissions from the United States: at least 19.7 per cent. The primary contributor to the exhaustion of the cumulative carbon budget is the US, whose total cumulative emissions remain to this day the largest in the world. US emissions are profligate, and flagrantly so.[44] I believe, therefore, that cases for transboundary damage ought to be brought against the US in international courts by some of the states that are, and will be, suffering the most from, for example, sea-level rise.[45]

Further, if one accepts the suggestion mentioned earlier that the thickening of the web of international norms is moving the international situation closer to a 'primitive social contract', thus heightening the aspects of shared responsibility that are analogous to domestic public law, it is natural to conceive of the obligation not to undermine the fundamental pre-conditions of human life as an *erga omnes* obligation and to see enforcement action by any state, whether directly injured itself or not, 'essentially as a public prosecutor' acting on behalf of the most vulnerable segments of humanity.[46] Humanity cannot grant an individual state a permissive zone of indulgence allowing profligate emissions and hope to have a prayer of maintaining a manageable planetary zone of acceptance. It is incoherent to think otherwise, and current extreme US interpretations of sovereignty as permitting its current reckless behaviour are insupportable in the real world of scientific laws.[47] Flagrant actors like the US may continue to make staying

[44] According to two recent authoritative reports in a series done for the World Bank by what is perhaps the most highly respected research centre on climate science, the Potsdam Institute for Climate Impact Research and Climate Analytics, the planet is currently on track for a disastrous 4°C temperature rise – double the limit adopted in Cancun in 2010 – see World Bank, *Turn Down the Heat*: *Why a 4°C Warmer World Must Be Avoided* (Washington: World Bank, 2012); and World Bank, *Turn Down the Heat*: *Climate Extremes, Regional Impacts, and the Case for Resilience* (Washington: World Bank, 2013).

[45] See R.J. Nicholls, N. Marinova, J.A. Lowe, et al., 'Sea-level rise and its possible impacts given a "beyond 4°C world" in the twenty-first century' (2011) 369 PTA 161.

[46] Nollkaemper and Jacobs, 'Shared Responsibility', n. 6, at 420. Also see H. Shue, 'Motivating Action on Climate Change: Core Practical Convergence (under consideration).

[47] I have developed the point about sovereignty a little more fully in H. Shue, 'Eroding Sovereignty: The Advance of Principle', in R. McKim and J. McMahan (eds.), *The Morality of Nationalism* (New York: OUP, 1997), 340; reprinted in Shue, *Climate Justice*, n. 13, at 142.

within a 2°C rise in temperature impossible until the costs are raised by others.[48] Litigation under customary international law by both injured states and other states acting in the global public interest to restore legality might be one useful tool.

[48] The US is not alone, of course. It is quite easy to make cases as well against, for example, Canada in light of its choice to fail to comply with its minimal legal obligations under the Kyoto Protocol and the lengths to which it is going to develop the environmentally harmful tar sands bitumen, and Poland, for its refusal to reduce its consumption of coal and its veto of leadership in this area by the EU.