

THE UNIVERSITY OF  
WARWICK

**Original citation:**

Page, Edward, 1968-. (2008) Distributing the burdens of climate change. Environmental Politics, Vol.17 (No.4). pp. 556-575. ISSN 0964-4016

**Permanent WRAP url:**

<http://wrap.warwick.ac.uk/935/>

**Copyright and reuse:**

The Warwick Research Archive Portal (WRAP) makes this work by researchers of the University of Warwick available open access under the following conditions.

This article is made available under the Creative Commons Attribution 3.0 Unported (CC BY 3.0) license and may be reused according to the conditions of the license. For more details see: <http://creativecommons.org/licenses/by/3.0/>

**A note on versions:**

The version presented in WRAP is the published version, or, version of record, and may be cited as it appears here.

For more information, please contact the WRAP Team at: [wrap@warwick.ac.uk](mailto:wrap@warwick.ac.uk)

warwick**publications**wrap  
  
highlight your research

<http://go.warwick.ac.uk/lib-publications>

This article was downloaded by: [137.205.202.200]

On: 24 June 2013, At: 08:13

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954  
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH,  
UK



## Environmental Politics

Publication details, including instructions for authors  
and subscription information:

<http://www.tandfonline.com/loi/fenp20>

### Distributing the burdens of climate change

Edward A. Page<sup>a</sup>

<sup>a</sup> Department of Politics and International Studies,  
University of Warwick, UK

Published online: 08 Aug 2008.

To cite this article: Edward A. Page (2008): Distributing the burdens of climate change,  
Environmental Politics, 17:4, 556-575

To link to this article: <http://dx.doi.org/10.1080/09644010802193419>

PLEASE SCROLL DOWN FOR ARTICLE

For full terms and conditions of use, see: <http://www.tandfonline.com/page/terms-and-conditions>  
esp. Part II. Intellectual property and access and license types, § 11. (c) Open  
Access Content

The use of Taylor & Francis Open articles and Taylor & Francis Open  
Select articles for commercial purposes is strictly prohibited.

The publisher does not give any warranty express or implied or make any  
representation that the contents will be complete or accurate or up to  
date. The accuracy of any instructions, formulae, and drug doses should be  
independently verified with primary sources. The publisher shall not be liable  
for any loss, actions, claims, proceedings, demand, or costs or damages  
whatsoever or howsoever caused arising directly or indirectly in connection  
with or arising out of the use of this material.

## Distributing the burdens of climate change

Edward A. Page\*

*Department of Politics and International Studies, University of Warwick, UK*

Global climate change raises many questions for environmental political theorists. This article focuses on the question of identifying the agents that should bear the financial burden of preventing dangerous climate change. Identifying in a fair way the agents that should take the lead in climate mitigation and adaptation, as well as the precise burdens that these parties must bear, will be a key aspect of the next generation of global climate policies. After a critical review of four rival approaches to burden sharing, the paper argues that only a principled and philosophically robust reconciliation of at least three of these ('contribution to problem', 'ability to pay' and 'beneficiary pays') can generate a satisfactory mix of theoretical coherence and practical application.

### Introduction

How should the costs of climate change mitigation and adaptation be spread across countries and generations? This question has become a key aspect of the ongoing debate about climate change, yet it has resisted tidy solution in the face of a number of accounts (Shue 1999, Neumayer 2000, Singer 2002, p. 32ff, Caney 2005, Meyer and Roser 2006). At first glance, it might seem obvious that the present generation should bear the primary burden since existing persons, and the states to which they belong, are the only agents in a position to act now to prevent dangerous climate change. Past generations may have been irresponsible in their use of carbon and other greenhouse gases but are now dead; and leaving the problem for future generations to solve seems grossly unfair. Allocating the responsibility to the present generation, however, merely postpones the problem that there is a wide range of existing agents to which responsibilities of justice might be allocated, including individual countries, multinational corporations, international institutions, and, most abstractly, the existing generation as a whole. It also fails to address the more concrete issue of

---

\*Email: [e.a.page@warwick.ac.uk](mailto:e.a.page@warwick.ac.uk)

how much can be demanded of each of these agents. Climate change, then, poses profound 'level of analysis' and 'burden allocation' problems (Caney 2005, p. 754).

Confronted with the problem of the level of human agency responsible for combating climate change, much of the literature focuses on the unique responsibility of the developed world and the sovereign countries it comprises. The focus on national responsibility is central to the United Nations Framework Convention on Climate Change (UNFCCC), for example, which endorses the principle of 'common but differentiated responsibilities' (CBDR) according to which 'the developed country Parties should take the lead in combating climate change and the adverse effects thereof' (United Nations 1995, p. 5). It is also a key feature of Article 10 of the 1997 Kyoto Protocol to the UNFCCC (Grubb *et al.* 1999, p. 289) and Principle 7 of the 1992 Rio Declaration on Environment and Development (United Nations 1992).

In what follows, I examine a range of ethical principles that have been invoked in support of CBDR. These principles have often been invoked in support of common and differentiated responsibility and which have often been thought of as sufficiently supportive of it that any differences between them are merely objects of philosophical curiosity with few or no policy implications (Shue 1999, Singer 2002, p. 26ff). I argue, first, that there is far more divergence here than is often supposed; and, second, that only a principled reconciliation of burden-sharing principles can generate a satisfactory synthesis of theoretical coherence and practical relevance.<sup>1</sup>

### Contribution to problem

Since the beginning of the nineteenth century, over 2000 billion tonnes of carbon have been released into the atmosphere as a result of human activities such as fossil fuel burning (Stern 2007, p. 221). The global concentration of carbon dioxide (CO<sub>2</sub>) has increased from 280 parts per million (ppm) in the atmosphere (in 1760) to 379 parts per million (in 2005) (Alley *et al.* 2007, p. 2). The concentrations of other greenhouse gases (GHGs) have also risen substantially in this period such that total greenhouse concentrations reached 430 ppm CO<sub>2</sub>-equivalent (CO<sub>2</sub><sup>e</sup>) in 2007 and are currently growing by at least 2 ppm every year (Stern 2007, p. xvi).<sup>2</sup> The simple idea behind the 'contribution to problem' principle is that countries should contribute to the costs of managing climate change in proportion to their share of global cumulative greenhouse emissions; and the unique ethical responsibility of developed countries reflects the fact that they lead the world in terms of ongoing and cumulative emissions (Shue 1999, p. 533ff, Neumayer 2000, Singer 2002, p. 27ff, Caney 2005, p. 752ff). This relatively simple account of burden sharing can be developed in terms of three sub-principles. First, countries should compensate identifiable victims of their past and present climate-altering activities. Second, countries should reduce, and ultimately cease, activities that transform the climate system. Third, countries should fund

measures to reduce the human costs of climate impacts they caused which are no longer avoidable.

At first glance, the empirical basis of 'contribution to problem' reasoning seems undeniable. While all countries emit GHGs, the physical responsibility for current atmospheric greenhouse concentrations is unevenly spread. Since one unit of any GHG has an equal climate-forcing effect wherever it is emitted and since scientists have developed clear, if not infallible, protocols for measuring the source and quantity of each country's emissions over time, it is relatively straightforward to assign responsibility for a country's physical contribution to present and future climate change. According to a number of studies, the developed world (defined as OECD North America and Europe, Eastern Europe, Former USSR, Japan, Australia and New Zealand) is responsible for at least 60% of current greenhouse emissions (Baumert *et al.* 2005, p. 31).

Yet this only gives half the picture. Climate change is not caused by any particular year's greenhouse emissions but rather by the atmospheric accumulation of greenhouse gases over hundreds of years. In this sense, the gases that are responsible for the climate change are 'stock pollutants'; and this has a significant bearing on questions of responsibility and policy (Parry 2005, p. 235). Current year-on-year emissions of CO<sub>2</sub> add perhaps 4% to the atmospheric stock of the gas with the result that past emissions are absolutely crucial when it comes to assigning physical responsibility for climate change. From an historical perspective, developed countries are once again the key players since they were responsible for roughly 75% of total anthropogenic CO<sub>2</sub> emissions from 1750 to 2005 (Baumert *et al.* 2005, p. 31). Although there are various ways of assessing the impact of a country's cumulative emissions on the climate system (equal weight for all country emissions; marginal change in global temperature caused by a country's past emissions; or marginal change in GHG concentrations caused by a country's past emissions) it is clear that the emissions of the developed world have been decisive in the emergence of anthropogenic climate change.

It is worth noting that, as the causal responsibility for greenhouse concentrations changes, future 'contribution to problem' analyses will modify the burdens of each country. Economic growth, as well other socio-economic drivers such as urbanisation and population increases, mean that China, India and other developing countries are fast increasing their contribution to (and thus causal responsibility for) climate change. A number of studies suggest that the developing world's collective emissions will surpass the developed world's within 30 years; and developing countries are projected to be responsible for over 75% of the global increase in emissions between now and 2030 (Stern 2007, p. 200). Meanwhile, recent research shows that in 2006 China surpassed the US to become the world's top greenhouse emitter (Auffhammer and Carson 2008).

While the causal responsibility of the developed countries seems clear, the case for linking cumulative emissions with climate burdens is more complex.

One reason for this is that the approach splits into two forms depending on whether causal responsibility is sufficient for burden attribution (*strict liability*) or whether an extra ingredient needs to be added to generate liability, such as that the original emitter acted knowingly and therefore wrongly (*conditional liability*). Some writers, such as Neumayer (2000, p. 188), hold that the conditional liability approach is implausible in the case of climate change, while others hold that the absence of calculated wrongdoing weakens historical accountability to the point where the emissions of all countries before the late twentieth century should be discounted (Caney 2005, pp. 761–762). I will not try to resolve this troubling issue, except to say that there are problems with either form that question the power of an exclusively contribution-based approach to climate burden sharing.

First, neither form can explain a number of widely held beliefs concerning the limits of responsibility attribution. Suppose that climate change could be traced entirely to natural climatic variations. In such cases, ‘contribution to problem’ reasoning could not explain why the victims of climate change should not be abandoned to their fate even if measures could be undertaken by wealthy countries to limit their suffering. The focus on historical responsibility, that is, clears the way to a ‘polluted pays’ approach when there are no identifiable polluters. While this conclusion could be finessed by appealing to substantive principles of justice, this would mean abandoning the theoretical parsimony provided by focusing on historical responsibility.<sup>3</sup> Suppose, next, following an example devised by Simon Caney (Caney 2005, p. 763), a developing country was shown to have been a major historical greenhouse emitter of a similar level to the UK. The ‘contribution to problem’ approach implies that this country should bear a heavy burden, on a par with the UK, to finance climate mitigation and adaptation policies despite its poverty.<sup>4</sup> ‘Contribution to problem’ reasoning, then, upsets the convention that the resources available to a country alter its environmental responsibilities. The problem here is not merely that the approach ceases to apply in the absence of anthropogenic causality or wrongdoing, or that it denies that a country’s wealth is relevant in isolation of its historical responsibility, but that it can often only be reconciled with our intuitions by rejecting the core thesis that climate burdens should reflect historical emissions activity.

A second problem for both forms emerges from the historical nature of the problem. At the individual level, it seems obvious that the ‘contribution to problem’ approach cannot deal well with the fact that many of the individual citizens and policymakers responsible for their countries’ historical emissions are now dead. Shouldering their descendants with the responsibility for financing climate policy would be to require compensation from the *wrong people*. Such problems re-emerge, albeit subtly, at the national level since there have been numerous changes in international boundaries since 1750 thus questioning the fairness of holding developed countries responsible for the greenhouse emissions of their prior incarnations (Caney 2005, pp. 58–60). It has been suggested that this problem could be solved if we restrict historical

responsibility to the period from 1900 onwards (Neumayer 2000, p. 189). Yet this indicates as much an abandonment of historical responsibility as it does its revitalisation since any victims of pre-1900 emissions would thereby go uncompensated. We must also remember that, while many national boundaries have remained more or less unchanged since 1900, many have not. Suppose, next, that a carbon-neutral nation was successfully invaded and subjugated by a carbon-intense nation. It seems absurd that the population of the former country could be required to share the historical greenhouse responsibilities of the latter, yet this is exactly the implication of the 'contribution to problem' approach when applied at the collective level.<sup>5</sup> This is a problem for strict and conditional historical responsibility since the scope of both in these cases seems radically curtailed so long as we assume that only agents that actually *caused* an environmental problem should be held responsible for its solution.

Third, a problem for the conditional form of climate liability flows from the fact that, until the late twentieth century, there existed widespread ignorance of the causes and effects of climate change. The injustice inflicted on the developing world by the developed world's externalising some of the costs of industrialisation seems to be tempered by widespread ignorance of the nature and scale of global climate change until the 1990s. The first IPCC report, for example, was not published until 1990; the UNFCCC was signed only in 1992; and the Kyoto Protocol to the UNFCCC was negotiated in 1997, and only came into force in 2005. Unless we subscribe to the strict form, which insists that a country should always pay the full costs of its environmental activities even if these could not have been reasonably foreseen by the relevant actors, it seems unfair not to discount, or even disregard entirely, a country's historical emissions record (for a contrary view, see Neumayer 2000, p.189, Gardiner 2004, p. 583).

Fourth, and finally, there are problems for both forms of liability raised by considerations of 'non-identity' (Parfit 1984, p. 352ff). The idea is that the activities responsible for anthropogenic climate change operate as minor, but necessary, conditions of later generations of individuals coming into existence though their impact on human interaction. So, very few members of the present (or any subsequent) generation can plausibly argue that they have been made worse off by climate change since the historical greenhouse emission activities from which it arises were also necessary for their very existence. This suggests that those drawn to the 'contribution to problem' principle on the grounds that it models the standard understanding of harm and its prevention should think again (Caney 2005, pp. 757–759, Page 2006, pp. 132–142). While non-identity considerations only operate at the level of individuals due to the particular features of human reproduction, they also threaten the ethos of country-based 'contribution to problem' reasoning for this clearly operates at the national level for reasons of explication and not because it denies that the interests of individuals ultimately underpin our concern about climate change.

### Ability to pay

According to the next defence of common but differentiated responsibility, developed countries should shoulder the burden of climate justice as a result of their greater wealth and capacity to act. They should, that is, cover the cost of robust policies of mitigation and adaptation in proportion to their income or wealth. It is irrelevant, so the argument goes, that we can assign countries varying levels of responsibility for the emergence of the climate problem since justice concerns the efficient achievement of desirable outcomes and is essentially blind to the historical origins of human problems. As Henry Shue (1999, p. 537) explains, ‘among a number of parties, all of whom are bound to contribute to some endeavour, the parties who have the most resources should contribute the most to the endeavour’.

One obvious objection to ‘ability to pay’ is that, in some circumstances, possessing a *comparatively* high standard of living is not an appropriate basis to calculate a country’s ethical obligations. This is because being wealthier than others would not confer any special responsibility on a country if it only has enough resources to meet the basic needs of its own citizens. While in practice this objection does not apply to developed countries on any useful standard of basic needs, it does suggest that Shue’s articulation of the ‘ability to pay’ approach should be amended. It is not ‘the nations with the most resources’ that should lead the way in climate policy but rather ‘the nations with excess capacity’. The claim then is that the developed countries are rich *enough* to divert some of their resources to combat dangerous climate change so they should do so up to the point where this does not compromise the lives of their citizens as measured by some conception of human well-being.

One problem with the ‘ability to pay’ approach is revealed by the following thought experiment. Suppose that climate change was brought about by a very small group of countries that ignored cleaner methods of industrialisation. Suppose also that the pattern of wealth was similar to that witnessed today except that there was a large group of wealthy, yet low emitting, countries. According to the ‘ability to pay’ approach, the responsibilities of developed countries to manage climate change would be the same in both scenarios regardless of the issue of which countries were actually responsible for climate change. But can historical responsibility for a harmful outcome really be irrelevant to the task of funding the management of that outcome? There appear to be two main responses to this question. First, it might be proposed that we discount the climate burden to be shouldered by wealthy, low-emitting countries. The idea would be to introduce differentiated responsibility amongst the developed world by embracing a modest ‘contribution to problem’ principle. Second, we might instead opt to ‘outsmart’ the questioner by insisting on burden sharing in proportion to capacity at the cost of apparent unfairness to the responsible rich.

There are even more troubling scenarios. Imagine that advances in climate science revealed that there was a much greater connection between the

geographical source of emissions and the impacts of climate change such that those countries emitting the most greenhouse gas would later come to suffer the most from climate changes. After several centuries, the result might be that the prospects of the developed and developing could reverse. Would the 'new developed world' be under a strong obligation of justice to aid the 'old (now disadvantaged) developed world' despite the latter having brought most of its misery on itself? Suppose we thought that it would. Would this responsibility be as strong as the responsibility we intuitively believe present-day developed countries have to address the climate problem? So long as we hold that the level of burden in these two scenarios fails to converge it seems that 'ability to pay' approaches derive some of their plausibility from the implicit assumption that those with the ability to solve environmental problems were also responsible for their emergence. Put slightly differently, although focusing on ability to pay is undoubtedly of relevance in the construction of effective and equitable climate policies it leaves unanswered *why* those who have the ability *should* pay.

### Beneficiary pays

The fact that historical responsibility considerations can sometimes underpin and sometimes undermine 'ability to pay' arguments is suggestive of a hybrid account that gives some weight to both approaches. Yet there is a third, and comparatively undeveloped, approach to climate justice that can explain why the wealthy countries should bear the main burden of climate policy. The basic argument here runs as follows. The greenhouse emissions activities of past generations have greatly benefited countries of the developed world (without these activities, that is, these countries would now be much worse off on almost every metric of well-being). Since any agent should support, as a matter of fairness, practices that manage the negative effects of activities from which they benefit, the countries benefiting the most from greenhouse emitting activities in the past bear the greatest responsibility of climate justice. This is not, however, because these countries are held strictly, or conditionally, liable for *causing* climate change but that they are strictly liable to contribute to the costs of combating negative externalities from which they have benefited. 'Beneficiary pays' reasoning is distinct from 'ability to pay' in being concerned with how a country's wealth arose; and distinct from 'contribution to problem' in being concerned with the effects, rather than the causes, of climate change-inducing activities. I develop the approach below by showing how it deals with two obvious objections.

First, there is the *non-identity problem*. There is an air of paradox in requiring countries that have benefited from greenhouse-driven industrialisation to pay for climate policy measures when their citizens would not have been born, and enjoyed the benefits in question, in the absence of industrialisation. As we saw above, 'contribution to problem' approaches also seem to break down in the relevant timeframes since the greenhouse emissions that contributed to the emergence of climate change originated in acts and policies

that also modified the population size and composition of all countries (Caney 2005, p. 757ff). A similar problem arises in the case of ‘beneficiary pays’ since there may be no existing individual beneficiaries from which we can coherently seek payment; and it is surely incoherent to claim that a country can benefit from an activity even if none of its citizens thereby benefit. There is no straightforward response to this objection so long as the focal point of justice is taken to be the interests and rights of particular human beings. However, it is worth noting that there are some grounds for supposing that notions of intergenerational benefit are easier to handle than intergenerational harm even where non-identity considerations obtain. The idea, which I cannot expand on here, is that causing an agent to exist who thereby leads a life well worth living can be *good* for that person even if it cannot be *better* for them that they came into existence in the first place (Parfit 1984, p. 489).<sup>6</sup>

Second, there is the *non-reciprocity problem*. The vast majority of benefits received by successive generations of the developed countries were not explicitly bequeathed on the understanding that they also came with moral burdens attached. So why should the benefits received from past generations linked to the exploitation of the atmosphere be repackaged into duties of climate justice? Why not assume that past generations wanted their descendants to enjoy these benefits and disregard the interests of those who have been harmed by their production? We might call this the problem of *unintentional benefit*. An additional problem is that many benefits bequeathed by earlier generations are forced upon us in the sense that we could not have refused them and it seems unfair to hold agents responsible for the externalities of benefits that could not have been declined. This can be called the problem of *forced benefit*.

A full response to these problems is beyond the scope of the article, but a partial solution seems within grasp in the guise of the principle of ‘fair reciprocity’ (Page 2007). The idea is that each generation, as a matter of fairness, should manage the burdens associated with past industrialisation even if the benefits they inherited were created unintentionally, received involuntarily and operated as necessary conditions of later generations coming into existence. The notion of fairness involved, however, is somewhat different to the traditional understanding of reciprocity as repaying directly those from whom one has benefited. Instead, it builds on the idea that duties of reciprocity and fairness arise both when we provide benefits for those that have made sacrifices for us and when we provide benefits to certain third parties when the original benefactors are beyond our reach. In the present case, the duty to contribute to climate policy in proportion to how much a country has gained from historical emissions activities is owed to contemporaries and predecessors but discharged by protecting the well-being of contemporaries and future generations. Of course, if too little is done to manage climate change over the next century, the developed countries might find themselves in the position where they are unencumbered by ‘beneficiary pays’ duties for there can be no duty to pass on benefits one has not received. Yet, the task at hand is to define and explain the duties that existing countries and their inhabitants have to

protect the atmosphere; and there is much that they should do on ‘beneficiary pays’ grounds, given their privileged inheritance.

### Patterns and hybrids

While each of the approaches discussed above would recommend contrasting climate burden distributions, there does seem to be a broad convergence amongst them on some version of ‘common and differentiated responsibility’. Developed countries were *causally responsible* for climate change; they are the main *beneficiaries* of activities that cause climate change; and they have the *ability* to tackle the causes and effects of climate change. The three approaches also share the feature that a principle of burden sharing is selected independently of wider distributive concerns. According to a fourth approach to burden sharing, climate impacts are viewed as simply one of many categories of burden that should be managed according to a comprehensive theory of just distribution. In a sense, this approach reduces the question of climate burden sharing to a matter of practicality: climate policies are selected according to their fit with some ideal of distribution not because they reflect some underlying principle of climate justice (Meyer and Roser 2006, p. 232ff, Page 2006, pp. 78–98). I do not seek here to defend any one of these ideals as a unique solution to climate justice – though the sufficiency ideal promises much in this regard – but rather to show that each ideal has provided a unique approach to burden sharing.

Perhaps the simplest ideal to which one might appeal is *equality*. The idea is that benefits and burdens pertaining to any human activity should be distributed so that inequality is minimised. Egalitarians hold that equality is valuable in the sense that it does not derive its value from its relation to other values, so while departures from equality may be justified all things considered they are always bad in one respect (Temkin 1993, pp. 6–18). There is a somewhat paradoxical feature of egalitarianism, thus defined, that questions its role as a comprehensive theory of justice. This is that egalitarianism looks favourably on outcomes that reduce inequality even when this is in the interests of no one. Egalitarianism, that is, raises the ‘levelling down problem’ (Raz 1986, p. 230ff, Parfit 2000). Putting aside the levelling down problem for a moment, egalitarianism has obvious applications to climate justice: climate change should not be permitted to upset the achievement of equality of life-chances across countries or generations. Since unchecked climate change will tend to exacerbate existing inequalities between countries, the egalitarian will expect the developed countries to fund generous policies of mitigation and adaptation. This is not because of what these countries or their citizens have done in the past, or because they are wealthy as such, but rather because this is the most efficient way of achieving the desired outcome of greater equality.

One way in which those broadly sympathetic to egalitarianism might avoid the levelling down problem is to embrace the contrasting idea of *priority*. Prioritarians reject the notion that it is always bad that some people are worse

off than others through no fault of their own since they are unconcerned with the comparative properties of distributive outcomes. Instead, they think it regrettable that people are badly off as such: the lower a person's well-being, the stronger our duty is to benefit them (Parfit 1995, p. 23). The distinction between equality and priority is highly relevant for climate justice since climate change will pose different sorts of challenge to egalitarianism and prioritarianism. Climate impacts will undoubtedly affect the life-chances of the worst off even if it does not increase overall inequality. Moreover, a prioritarian approach to burden sharing will generally involve asking the developed countries to shoulder the burden of climate policy since this will be least disruptive to the goal of improving the life-chances of the worst off countries (or their citizens). But prioritarianism and egalitarianism will as likely as not diverge on the specific remedies to climate injustice reflecting the deeper disagreement between these views as to the ethical importance of the gap between the fortunes of the better- and worse-off. Prioritarians, for example, are far more likely to embrace market environmental mechanisms, such as emissions trading, which tend to increase efficiency in climate mitigation at the cost of exacerbating the gap between rich and poor.

A third distributive ideal, *sufficiency*, is also crucial to the construction of just climate policy. This holds that benefits and burdens should be distributed so that people have sufficient capacity to pursue the values they care about (Frankfurt 1987, Crisp 2003). Attaining what we really care about, for sufficientarians, requires a certain level of well-being. But once this level is reached there is no further relationship between how well-off a person is and whether they discover and fulfil what it is that they really care about. In this way, it is argued that it is not reasonable for a person to seek a higher standard of living when they have reached the 'threshold of sufficiency' even if this would mean that they would increase their overall well-being. Perhaps the central difficulty with the sufficiency theory is that the distributions it recommends are so sensitive to the existing pattern of well-being. At the same time, sufficiency analyses crave accurate information about the threshold itself that is difficult – perhaps impossible – to obtain (Casal 2007, p. 312ff). These problems aside, in many contexts sufficientarians will follow the CBDR principle by exempting developing countries from costly action so long as bearing such burdens would prevent their citizens reaching the threshold of sufficiency. But since it is not intrinsically concerned with inequality, or the plight of the worst off, a sufficientarian climate response might also require less of developed countries than its rivals if sustaining the most lives above the sufficiency level meant concentrating resources in the hands of the well-off (Page 2006, p. 85ff).

The introduction of generalised principles of distribution into the more localised debate about climate change raises two issues central to progress on the burden-sharing issue. The first is whether we should treat the problem of climate burdens independently of general concerns of distributive justice. The second is which of the rival approaches discussed above provides the most

secure philosophical underpinnings for climate change policy (on the assumption, of course, that there are no further candidates waiting in the wings). I cannot hope to answer these two questions here, but I would like to make two suggestions as to how they might be answered, both presented in the spirit of pluralism. First, the issues of ‘general justice’ at stake could be developed by an approach invoking each of the three main distributive ideals in different contexts. This call for pluralism echoes the work of a number of contemporary political philosophers in the liberal-egalitarian tradition (Daniels 1996, Buchanan *et al.* 2002). The resulting synthesis could operate in a number of ways. One move would be to match the ideal to the sphere of justice in question. For example, while we might appeal to equality when distributing goods at the domestic level, we might appeal to priority when distributing goods amongst countries; or we might seek to realise equality within generations and sufficiency between generations. A different move would be to match the ideal to the distributive context faced, for example by assigning sufficiency lexical priority when at least some lives can be made decent (Page 2006, p. 94ff).

Second, the ‘local justice’ issues as stake might be developed by a burden-sharing account that gives weight to all three of the approaches discussed above but is also sensitive to the insights revealed by analyses of general justice. The main suggestion I have here is that the method used to identify the parties who should bear the costs of tackling climate change should be separated from the method used to calculate the precise burden each of these parties should bear. This would be achieved by appealing to a sufficientarian ‘ability to pay’ principle; using the level of historical benefit from greenhouse emissions activities to establish a preliminary distribution of responsibility within this group; and finally, modifying the precise level of contribution required from each by assessing comparative historical responsibility for climate change (see Figure 1).

Much work remains to refine this approach if it is to provide a principled reconciliation of the four accounts of burden sharing outlined above in a way that is of practical use in constructing climate policy. It is, moreover, a rather modest interpretation of pluralism in that the competing principles it reconciles are applied in the same distributive context, with considerations of intergenerational and international justice being dealt with only indirectly. Some development of its implications for global climate change policy, however, can be achieved through a revealing contrast with three recent approaches to burden sharing pluralist origins. These are, first, Oxfam International’s *Adaptation Financing Index*; second, Simon Caney’s *Hybrid*

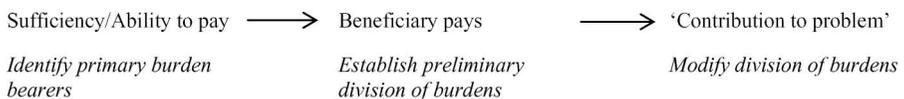


Figure 1. A pluralist approach to burden sharing.

Downloaded by [137.205.202.200] at 08:13 24 June 2013

*Account*; and, third, EcoEquity's *Greenhouse Development Rights Framework* (Oxfam International 2007, Caney 2005, Baer, Athanasiou and Kartha 2007). There are four key issues facing a comparative assessment of these approaches. First, how should the burden-sharing components be specified? Second, how should the components be reconciled: should they be equally (or unequally) weighted or should one be given lexical priority? Third, should the focus of burden attribution be individuals or the countries to which they belong? Fourth, how might we deal with emissions pre-dating scientific awareness of and/or consensus on anthropogenic climate change?

### **The adaptation finance index**

Oxfam International's 'Adaptation Finance Index' (AFI) aims to construct a fair method of allocating funding commitments for a global climate adaptation programme that would dispense \$50 billion per year by 2050 alongside an ambitious mitigation strategy (Oxfam International 2007, pp. 17–23). The AFI establishes a burden-sharing indicator comprised of an evenly weighted mix of (1) each country's physical contribution to climate change and (2) each country's ability to shoulder the costs of a global climate adaptation effort. The AFI's 'contribution to problem' element is calculated by subtracting the amount of greenhouse gas that a country could have safely emitted over the 12-year period 1992–2003 (set at 2 tonnes per person per year) from that country's actual emissions over this period. The figures resolved from the formula are then modified in order to create a climate responsibility index in percentage terms, with the top three countries being the US (51.4%), Japan (9.9%) and Germany (7.5%). The 'ability to pay' element, meanwhile, appeals innovatively to the UN Human Development Index (HDI) to create an index of capacity and also to introduce a sufficientarian 'development threshold' for the attribution of any burdens of climate adaptation. All countries with HDIs below 0.9 are exempt from any form of burden: the adaptation funding ability of the remaining countries is assessed by multiplying their respective populations by their HDI scores minus 0.9.<sup>7</sup> The resulting figures are then modified to create a simple climate funding ability index in percentage terms with the same top three countries emerging as the responsibility component: the United States (36.0%), Japan (15.9%) and Germany (6.7%).

The final AFI index (which assigns a financial burden share to every country with positive responsibility and ability scores, weighting the components equally) fits well with the CBDR principle in that the world's poorest countries are exempt from climate adaptation duties (Oxfam International 2007, p. 28). This is because these countries invariably have <0.9 HDI scores and none exceeded the annual 2 tonnes per capita safe emissions allowance in any of the base years. The index proposes that the 28 qualifying countries, by contrast, should fund climate adaptation in proportion to their AFI scores with the result that the US, EU, Japan, Canada and Australia are responsible for 95% of climate adaptation policy (Oxfam International 2007, p. 28).

There are a number of problems with the AFI that suggest it falls short of being a philosophically sound or practical approach to burden sharing. The first problem is that the authors provide no argument for their equal weighting of the two AFI elements. There is clearly some practical convenience associated with this assumption, but it does not reflect any sound philosophical analysis.

Second, the authors also do not explain the logic behind either of the burden-sharing thresholds (HDI score less than 0.9; and annual national per capita emissions of less than 2 tonnes). This is a problem as, in combination, they skew the index away from the responsibilities of the 'harmful poor' such as (1) 'Countries in Transition' (Russia, Ukraine, Kazakhstan and Romania) that were responsible for sizeable greenhouse emissions before the sharp decline of economic activity accompanying the dissolution of the Soviet Union; and (2) rapidly industrialising countries (China, Brazil, Mexico and India) which are responsible for massive ongoing emissions despite their relative poverty. Both categories are exempted on 'ability to pay' grounds, reflecting the fact that the HDI threshold is implausible in this form.<sup>8</sup> A further problem with the HDI threshold is its arbitrariness as demonstrated by the case of Portugal. Portugal is one of the countries hovering around the 0.9 HDI threshold – over in 2004 (0.904) and under in 2005 (0.897) – with the result that it is exempt from duties in Oxfam's 2004-based report but would bear a full share of the climate burden if the authors used a more recent index. In a sense, any threshold-based system will involve such anomalies, but the problem is compounded here through the use of a 12-year period for the climate responsibility component (1992–2003) while using a single year (2004) for the climate ability component. The challenges such faults bring into focus are threefold: to find a lower, yet philosophically reasoned, threshold of climate ability; to calculate the ability metric over an extended, non-arbitrary, period of time; and to explain the weightings of these components.

Third, the approach provides no argument for its 'methodological nationalism' which ignores the climate duties of individuals and which is reinforced by the use of the nationally based HDI indicator. One regrettable consequence is the marginalisation of impoverished groups residing in the developed world ('the south in the north'). Although absolute deprivation is uncommon in the developed world, the AFI ignores the role of relative poverty in developed countries. This is a problem because inequality can clearly function as a drag on a country's ability to fund international environmental agreements.<sup>9</sup> A further dimension of this problem is that the climate responsibilities of affluent individuals and groups in developing countries ('the north in the south') are also ignored despite them having benefited greatly from greenhouse driven industrialisation. The most extreme anomaly concerns the growing band of the super-rich in exempted countries. According to Forbes, a record number of the world's 1125 US\$ billionaires in 2008 were citizens of developing and transition countries, including Russia (87 billionaires), China (28), India (19), Brazil (18) and Nigeria (1) (Forbes 2008). The duties of such persons must surely be dealt with by any just approach to burden sharing.

Fourth, ignoring pre-1992 emissions skews the final AFI table and is not given any philosophical motivation. The problem arises not only in considering countries in decline during the 1992–2003 base period (who get an overly generous deal) but also for those such as Ireland, Finland, Israel, Switzerland and Singapore (who lose out through the neglect of historical emissions). A more coherent approach would be to extend the responsibility component at least as far back as 1900 and possibly beyond.

### Caney's 'hybrid account'

An alternative approach to burden sharing is proposed by Simon Caney (2005, p. 767ff). Caney argues that climate burden sharing should reflect both 'ability to pay' and 'contribution to problem'. The central idea, reflecting Joseph Raz's (1986) 'interest-theory' of rights, is that all persons possess a right not to suffer from climate impacts that undermine their basic interests; and all persons have burdens associated with protecting this right but those living in developed countries have the most pressing duties reflecting their wealth and carbon-intense lifestyles (Caney 2005, p. 769; see also Jagers and Otterström in this issue).

There are four elements to Caney's account of climate entitlements: the first and second target physical responsibility whereas the third and fourth target financial capacity. First, all existing and future persons are duty bound not to exceed their 'safe quota' of greenhouse emission since this would automatically violate the rights of contemporaries and future generations. Second, if a person does exceed their quota they are duty bound to try and compensate those whose rights are thereby violated. Caney holds that these two backward-looking principles, which express the most cogent elements of 'contribution to problem' reasoning, must be supplemented by two forward-looking principles of justice. Third, the global rich are obliged to mitigate and/or finance adaptation measures to protect people whose interests and rights are not protected by the first two elements (they might be victims of natural climate variation or of the imprudent behaviour of the now dead). Fourth, the global rich must also act to discourage non-compliance with the demands of climate justice: this final principle, which we might call the 'ability to further justice' principle, ensures that the most fortunate only fulfil their duty to combat climate change by behaving 'pro-actively' rather than 'reactively' (Caney 2005, p. 769).

While Caney provides a more robust argument for climate pluralism than Oxfam, there are several gaps in his development of the 'hybrid account'. First, he does not specify the weightings of (or priority rules amongst) the four principles so it is unclear how a detailed distribution of burdens could be generated even if we assume that the primary responsibilities will fall on the developed world (Caney 2005, pp. 772–774). It is also not clear how conflicts between the 'ability to pay' and 'contribution to problem' elements would be resolved if and when they occur. How might the four principles be applied to deal with the real case of persons living in poor countries with unsafe national per capita greenhouse emissions, for example, or the hypothetical case of rich

countries with safe per capita emissions? He also ignores the problem of generational conflict arising if it becomes impossible for all to lead a decent life without emitting more than their 'safe quota' (Caney does not specify this figure but it seems fair to assume that it would be similar to Oxfam's measure of 2 tonnes per person per annum). So whereas Oxfam's approach to burden allocation is transparent at the cost of excessive focus on a small number of developed countries, Caney's approach plausibly casts a wider net in terms of burden attribution but only at the cost of unclarity in the distribution of responsibility and ability to pay. The hybrid account also ignores beneficiary pays considerations, which are only dealt with indirectly through the third and fourth principles.

Second, the hybrid account views the ultimate source of justice and rights to be the interests of individual persons. In this sense, the hybrid account is not as vulnerable to 'north in the south' and 'south in the north' issues as Oxfam's AFI. Yet no real argument is offered for this methodological individualism and it is unclear how Caney's four principles would be operationalised given the national focus of the current global climate architecture, or in the face of widespread belief in the political and ethical sovereignty of individual countries. It is not clear how the four principles of the hybrid account could be harnessed to determine which individuals in the developing world should contribute, which should not, and how much can be asked of the former.

Third, Caney, like Oxfam, adopts a weaker conception of 'contribution to problem' than the UNFCCC or the Kyoto Protocol. Concerned that incorporating historical emissions will unfairly burden later generations with the costs of their ancestors' activities, Caney's responsibility component (specified in the second principle) only measures post-1990 emissions (Caney 2005, p. 774). While he gives two separate arguments for ignoring historical emissions (excusable ignorance of the causes and effects of climate change pre-1990; and unfairness of holding later generations responsible for the actions of earlier generations) he gives no specific or persuasive reason for choosing such a recent base year. The result, echoing Oxfam's RCI, is harsh treatment for the newly industrialised populations and lax treatment of those residing in countries of transition. A stricter notion of climate change liability is needed to reflect the enormous benefits that individuals and countries have gained from emissions over the 1760–1990 period regardless of the specifics of physical responsible or the emergence of the scientific consensus on climate change. Baer, Athanasiou and Kartha (2007, pp. 25–26) may be correct in thinking that a precise method to determine an appropriate cut-off point may never emerge but Caney and Oxfam are surely misguided in setting the effective start date for greenhouse responsibility as 1990 or 1992.

### **Greenhouse development rights**

To summarise the previous two sections, Oxfam's AFI is practical but philosophically simplistic, whereas Caney's 'hybrid account' is philosophically

sophisticated but lacking in policy relevance. A third approach, which seeks to give a more precise account of responsibility and ability, has been proposed under the rubric of 'Greenhouse Development Rights' (GDRs). In what remains of the paper, I outline this approach and argue that it is well placed to reconcile the twin aims of philosophical robustness and practical application.

The two central ingredients of the GDR approach are the specification of an 'emergency climate programme' (ECP) and the incorporation of poverty reduction and development goals within the global climate architecture. The ECP has the objective of limiting global warming to 2°C or less above its pre-industrial level and massive investment to help vulnerable populations cope with climate damages that are now unavoidable. The programme invokes stringent mitigation measures so that global greenhouse concentrations would peak (in 2015) at 470ppm CO<sub>2</sub><sup>e</sup> on the way to an 80% reduction in year-on-year GHG emissions on their 1990 levels (by 2050). The annual cost of such mitigation and adaptation measures is estimated as 1% or more of Global World Product or roughly \$650 billion annually (in 2005 US\$) (Baer *et al.* 2007, p. 34). More specifically, the ECP comprises three elements: (1) the fixing of a global 'greenhouse emissions budget' required to meet the 2°C goal; (2) the assignment of a proportion of the global budget to each country based on a combined index of historical responsibility (40% weighting) and ability to pay (60% weighting); and (3) a detailed national emissions budget reflecting (1) and (2) (Baer *et al.* 2007, p. 31).

The approach pursues poverty reduction and development goals by recognising the global development right of all persons to a 'dignified level of sustainable development'. The 'dignified level' is set at \$9000 year (in 2005 US\$) or 150% of the current 'global poverty income' of \$6000 (for comparison, the current global per capita income is \$8500). In other words, the approach appeals to a development threshold, similar to Oxfam's AFI, in establishing the burden of each country. The main difference is that the focus of the GDR approach is the sum of above-threshold income of *all individuals* residing in a country rather than the HDI scores or per capita income of that *country*. Persons at (or under) the threshold level – which is modelled on the minimum income required for membership of the 'global middle class' – are not obliged to make sacrifices for the sake of the climate security of others. So, while the authors argue that countries can be used as the vehicles for global climate policy, they are at a deeper level viewed as 'merely collections of unequal individuals' (Baer *et al.* 2007, p. 5). One benefit of this individual focus, as we saw earlier with Caney's hybrid approach, is that patterns of burden sharing can be modified to address inequitable intra-national distributions giving rise to 'north in the south' and 'south in the north' problems (Baer *et al.* 2007, p. 28ff).

The overall financial burden of each country to fund climate policy is calculated in terms of a 'Responsibility and Capacity Indicator' (RCI), reflecting the capacity and historical responsibility of its citizens past and present. A country's capacity is defined as national income minus the incomes of all persons below the \$9000 development threshold; and a country's

responsibility is defined as its cumulative emissions 1990–2005. The RCI for each country, which represents the percentage contribution each country should make to the ECP, is created by multiplying its capacity and responsibility scores (weighted 60/40) creating the following percentage burdens: the United States (34.3), EU (26.6), China (7.0), Russia (2.3) and India (0.3). The final step in the argument is to use the RCI scores to establish a climate change levy on each country to be raised by carbon taxes and other revenue generation. The authors calculate that, if the ECP cost 1% of Global World Product annually, the average annual climate tax bill for the key countries would be: \$780 (US), \$372 (EU), \$142 (China) and \$51 (India). The corresponding total annual bills will be circa \$212 billion (US), \$164 billion (EU), \$43 billion (China) and \$2.1 billion (India). Reflecting their negligible climatic contribution, and minimal share of the ‘global middle class’, the Least Developed Countries (LDCs) would be liable for a fraction of the ECP’s cost (\$200m per annum in total based on an average taxpayer bill of \$7) (Baer *et al.* 2007, p. 36).<sup>10</sup>

The GDR approach offers an ingenious mix of philosophical pluralism and policy-relevant index construction. It combines many of the strengths of rival approaches while providing a coherent, if not complete, response to our four problems. However, the approach stands in need of some development in the light of the following defects. First, the weighting of the two elements of the RCI is not well explained. The authors note that there are a number of weighting possibilities (Baer *et al.* 2007, p. 32) but they nonetheless settle on an insufficiently motivated 60/40 split between ability and responsibility. The authors also do not explain why a weighting approach is preferred to a mixed approach of weightings and priority rules (as suggested by Oxfam) or outline a set of philosophical principles that would underpin the weighting (as suggested by Caney).

Second, the ECP may prove to be too ambitious or undesirable. The ECP aims for an 80% cut in global GHG emissions by 2050 with a peak CO<sub>2</sub><sup>e</sup> of 470 ppm. This is based on the assumption, which has received insufficient scrutiny, that the consequences of a 2°C warming will be globally catastrophic. It is also based on the assumption that such an aim is feasible, which is in doubt given that greenhouse concentrations reached 430 CO<sub>2</sub><sup>e</sup> in 2006, are currently growing by 2 ppm per year, and show no signs of contraction.

Third, the focus on income in the calculation of the RCI leads the authors to ignore issues of relative poverty or non-income aspects of human well-being. The result is that whereas Oxfam counter-intuitively exempts Russia, China and Brazil from bearing duties of climate justice, the GDR approach is counter-intuitively harsh on these countries, reflecting its focus on income rather than a more comprehensive indicator of development. It is perhaps most unintuitive in this regard when it attributes some climate burdens to LDCs.

Fourth, like its rivals, it takes the pragmatic but philosophically questionable path of counting only recent historical emissions (1990–2005) as the basis of its responsibility component. The result is that the approach is

biased against the interests of the Least Developed Countries (slightly), the rapidly expanding developed countries (moderately) and the recently industrialised countries (greatly). It also offers an unacceptable financial concession to Russia and other economies in transition, which experienced declining emissions in the 1980s and 1990s, but were responsible for sizeable emissions hitherto. Part of the problem is undoubtedly that the authors do not recognise the 'beneficiary pays' principle or the way in which this principle captures part of the ethical relevance of historical emissions.

### Conclusion

A number of scholars have suggested that all of the main philosophical approaches to burden distribution converge so clearly on the CBDR principle that the differences between them are objects of philosophical curiosity with little policy-relevance. I have argued that this assumption is highly questionable. Subtle differences in the arguments that underpin superficially convergent approaches can lead to the selection of different climate aims and objectives, as well as different burden-sharing approaches. There is no single principle or approach at present that identifies developed countries and their citizens, cleanly and persuasively, as the entities that should shoulder the burden of mitigation and adaptation. A more sophisticated analysis is needed that reconciles competing arguments based on cumulative emissions, ability to pay or benefits received. Of the three analyses examined that shared such pluralist foundations, Global Development Rights were found to be the most philosophically robust and policy-relevant vehicle for climate burden allocation. This approach is far from perfect and far from easily reconciled with the existing global climate regime. But it is a useful starting point from which to inject fair burden-sharing principles into the next generation of climate policies.

### Acknowledgements

I would like to thank an anonymous referee from *Environmental Politics* for their useful suggestions on how to improve the text. Earlier versions of the article were presented at academic conferences in Reading, Bristol, Greifswald and at the ECPR Joint Sessions of Workshops, Helsinki University, 8–10 May 2008. I would like to thank the audiences on all occasions for their comments.

### Notes

1. In order to maintain a clear focus on principles of burden distribution, rather than the agents identified as burden bearers, I focus in the first three sections on the responsibilities of countries as opposed to their individual inhabitants. This simplifying assumption reflects the primacy of countries in a range of international environmental agreements as well as much of the climate justice literature. As the analysis of alternative principles deepens in subsequent sections, I relax this assumption to evaluate both individualist and collectivist approaches.
2. CO<sub>2</sub><sup>e</sup> is a useful unit of measurement that converts atmospheric concentrations of the six most important greenhouse gases (Carbon dioxide, Methane, Nitrous Oxide, Perfluoromethane, Hydrofluorocarbon 23 and Sulphur Hexafluoride) into

- equivalent amounts of CO<sub>2</sub> so that climate forcing from all sources can be expressed in one figure.
3. Note that, even if we regard this example with suspicion, IPCC models show that up to a quarter of the 0.7°C global warming of the past century can be accounted for by natural climatic variation (Alley *et al.* 2007).
  4. This example is hypothetical but not merely conceptual: India and Canada emitted roughly the same amount of CO<sub>2</sub> between 1850 and 2002, equal to 2.2% and 2.1% of world emissions respectively (Baumert *et al.* 2005, p. 32).
  5. I am grateful to Göran Duus-Otterström for suggesting this example.
  6. By contrast, being born into a life worth living cannot coherently be described as *bad* for that person if the only alternative was not coming into existence at all, so there does seem to be some asymmetry between activities that harm, and activities that benefit, later generations. For a more sceptical view, see Caney 2005, pp. 757–758.
  7. For comparison, there were 28 countries in 2004 with HDI scores greater than 0.9. These countries shared a per capita income of \$20,000 + (in 2005 US\$); a 77 + year average life expectancy; and a 92% adult literacy rate.
  8. Note also that the UN divides the world's countries into three tiers according to their HDI performance: 1–70 ('high human development'), 71–155 ('medium human development') and 156–177 ('low human development') (UN 2008). The AFI exempts 52 of the countries in the top tier from bearing climate adaptation duties, which suggests that the ability threshold is too demanding.
  9. For comparison, 22% of the UK population (13 million people) experienced income poverty in 2006 on the basis of having an income of 60% or less of the national median (Palmer *et al.* 2007, pp. 22–50). Meanwhile, 12.3% of the US population (36.5 million people) lived in poverty in the same year (US Census Bureau 2007, pp. 11–17).
  10. The United Nations defines Least Development Countries as those with (i) very low income as evidenced by a capita income of US \$750 or less; (ii) human resource weakness as evidenced by indicators of health and education; and (iii) significant economic vulnerability (UN 2004, p. 15). At present, 49 of the UN's 192 member countries belong to this category.

## References

- Alley, R., *et al.*, 2007. Summary for policymakers. In: U. Cabasch *et al.*, eds. *Climate change 2007: the physical science basis*. Cambridge: Cambridge University Press.
- Auffhammer, M. and Carson, R.T., 2008. Forecasting the path of China's CO<sub>2</sub> emissions using province-level information. *Journal of Environmental Economics and Management*, 55 (3), 229–247.
- Baer, P., Athanasiou, T., and Kartha, S., 2007. *The right to development in a climate constrained world: the greenhouse development rights framework* [online]. Berlin: Henrik Böll Foundation. Available from: <http://www.ecoequity.org/docs/TheGDRsFramework.pdf> [Accessed 25 April 2008].
- Baumert, K.A., Herzog, T., and Pershing, J., 2005. *Navigating the numbers: greenhouse gas data and international climate policy* [online]. Washington, DC: World Resources Institute. Available from: [http://pdf.wri.org/navigating\\_numbers.pdf](http://pdf.wri.org/navigating_numbers.pdf) [Accessed 25 April 2008].
- Buchanan, A., Brock, D.W., Daniels, N., and Wikler, D., 2002. *From chance to choice: genetics and justice*. Cambridge: Cambridge University Press.
- Caney, S., 2005. Cosmopolitan justice, responsibility, and global climate change. *Leiden Journal of International Law*, 18 (4), 747–775.
- Casal, P., 2007. Why sufficiency is not enough. *Ethics*, 117 (2), 296–326.
- Crisp, R., 2003. Equality, priority, and compassion. *Ethics*, 113 (4), 745–763.

- Daniels, N., 1996. *Justice and justification: reflective equilibrium in theory and practice*. Cambridge: Cambridge University Press.
- Forbes, 2008. *The world's billionaires* [online]. Available at: [http://www.forbes.com/lists/2008/10/billionaires08\\_The-Worlds-Billionaires\\_Rank.html](http://www.forbes.com/lists/2008/10/billionaires08_The-Worlds-Billionaires_Rank.html) [Accessed on 27 April 2008].
- Frankfurt, H., 1987. Equality as a moral ideal. *Ethics*, 98 (1), 21–43.
- Gardiner, S., 2004. Ethics and global climate change. *Ethics*, 114 (3), 555–600.
- Grubb, M., Vrolijk, C., and Brack, D., 1999. *The Kyoto protocol*. London: Earthscan.
- Meyer, L.H. and Roser, D., 2006. Distributive justice and climate change: the allocation of emissions rights. *Analyse and Kritik*, 28 (2), 222–248.
- Neumayer, E., 2000. In defence of historical responsibility for greenhouse gas emissions. *Ecological Economics*, 33 (2), 185–192.
- Oxfam International, 2007. *Adapting to climate change: what's needed in poor countries, and who should pay* [online]. London: Oxfam International. Available at: [http://www.oxfam.org/en/policy/briefingpapers/bp104\\_climate\\_change\\_0705](http://www.oxfam.org/en/policy/briefingpapers/bp104_climate_change_0705) [Accessed 30 April 2008].
- Page, E.A., 2006. *Climate change, justice and future generations*. Cheltenham: Edward Elgar.
- Page, E.A., 2007. Fairness on the day after tomorrow: reciprocity, justice and global climate change. *Political Studies*, 55 (1), 225–242.
- Palmer, G., MacInnes, T., and Kenway, P., 2007. *Monitoring poverty and social exclusion 2007* [online]. York: Joseph Rowntree Foundation. Available at: <http://www.poverty.org.uk/summary/reports.shtml> [Accessed 29 April 2008].
- Parfit, D., 1984. *Reasons and persons*. Oxford: Clarendon Press.
- Parfit, D., 2000. Equality or priority? In: M. Clayton and A. Williams, eds. *The ideal of equality*. London: Palgrave, 81–125.
- Parry, I., 2005. Fiscal interactions and the case for carbon taxes over grandfathered carbon permits. In: D. Helm, ed. *Climate change policy*. Oxford: Oxford University Press.
- Raz, J., 1986. *The morality of freedom*. Oxford: Clarendon Press.
- Shue, H., 1999. Global environment and international inequality. *International Affairs*, 75 (3), 531–545.
- Singer, P., 2002. *One world*. London: Yale University Press.
- Stern, N., 2007. *The economics of climate change: the Stern Review*. Cambridge: Cambridge University Press.
- Temkin, L.S., 1993. *Inequality*. Oxford: Oxford University Press.
- United Nations, 1992. *Rio declaration on environment and development* [online]. Rio de Janeiro: United Nations. Available from: <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm> [Accessed 25 April 2008].
- United Nations, 1995. *United Nations framework convention on climate change*. London: HMSO Books.
- United Nations, 2004. *Committee for Development Policy: report to the sixth session* [online]. New York: United Nations. Available at: <http://www.un.org/special-rep/ohrls/ldc/ldc%20criteria.htm> [Accessed on 28 April 2008].
- United Nations, 2008. *2007/2008 Human development Index rankings* [online]. Available at <http://hdr.undp.org/en/statistics/> [Accessed 28 April 2008].
- US Census Bureau, 2007. *Income, poverty and health insurance cover in the US: 2006* [online]. Washington, DC: US Census Bureau. Available at: <http://www.census.gov/hhes/www/poverty/poverty06.html> [Accessed 29 April 2008].