

Cutting the Gordian Knot

Adequacy, Realism and Equity

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1 Mapping the Gordian Knot

Despite the almost impossible complexity of the climate deadlock, it is possible to map its most profound contours. They range, unsurprisingly, outside the traditional domains of climate politics, across lands defined by post-Cold War geopolitics, the struggle for development, the challenges of sustainability. For all this, however, they define a tangle – a Gordian Knot – in which three principle strands may be clearly discerned: adequacy, realism, and equity.

We do not claim to know how to untangle the knot. We are, however, convinced that each of its three strands demands concentrated attention, and, more controversially, that none of them may be deferred. As the science becomes increasingly clear, an honest appraisal of what would constitute adequate precaution is urgently needed. And if, as we will suggest, such a review shows the need for rapid and potentially expensive actions, this means that the key question – who will pay for adequate mitigation? – is no longer avoidable. In answering this question, realism as we know it today appears to come into conflict with the demands of equity.

To help map the way forward, we propose the concept of an "equity reference framework" -- a framework that allows us to ask, before we prejudge what is and isn't realistic, what would actually be fair. We do so because we believe that there is in fact no adequate way forward that does not involve a radical redefinition of realism, and that, with some actual clarity about the demands of equity, this problem becomes quite undeniable.

But before we discuss equity and realism, there is adequacy.

1.1 Adequacy

Adequacy can only be relative to some objective: in this case, the prevention of dangerous climate change. Thus, any real evaluation of whether some hypothetical policy regime is or is not adequate requires that its Parties specify the impacts that they are trying to avoid, the people or communities that would suffer those impacts, and the risks of failure that they are willing to accept – on behalf of those people and communities – if they fail.

Clearly adequacy is a value-laden concept. Clearly, too, we cannot straightforwardly appeal to science alone to tell us what does or does not qualify. However, we now actually know a fair bit more about the risks of dangerous climate change than we did even seven years ago when the Kyoto Protocol was negotiated. In fact, we are now in a position to draw some quite strong, and quite disturbing, conclusions. To do so we need only start with one very basic premise: there are some catastrophic climate impacts – such as the melting of ice caps and interference with the thermohaline circulation – that *really must be avoided*.¹ Adequacy therefore requires, at a minimum, preventing not *dangerous* but *catastrophic* anthropogenic interference with the climate system.

This is a problematic requirement, not because most people wouldn't agree that catastrophic climate change should be prevented, but because it seems to grant the inevitability of severe harms, particularly to people in developing countries and to sensitive ecosystems, harms that will become extreme before temperatures rise to the level that threatens global climate catastrophe.² Indeed, with recent droughts, heat waves and storms consistent with the anticipated impacts of a warming climate, and with new evidence of drastic impacts in the Arctic (ACIA 2004), it is quite clear that, with the global mean surface temperature increase still less than 1°C, we are already experiencing dangerous climate change. Still, despite all this, we unenthusiastically adopt the modest precautionary premise that an adequate climate policy is one that at a minimum ensures a high probability of preventing catastrophic climate change.

The science increasingly suggests that catastrophic climate change can result from a temperature rise as low as 2°C.³ From this it follows that an adequate climate policy is one that preserves a high probability of keeping the temperature increase below 2°C. Because of the substantial range of estimates in the climate sensitivity (i.e. the equilibrium temperature increase resulting from an equivalent doubling of CO₂), ensuring a high probability of staying below 2°C means that the allowable remaining greenhouse-gas budget is small. Very small.

This is not a technical paper, so we will only briefly relate the results of more detailed analyses provided elsewhere.⁴ Recent climate modeling gives us good reason to believe

¹ See for example Oppenheimer and O'Neill (2002), Hansen (2004) and Rahmstorf and Jaeger (2004), for cogent descriptions of catastrophic climate impacts.

² See Volume II of the IPCC's Third Assessment Report (McCarthy et al., 2001); also Grassl et al. (2003) and Hare (2003) for reviews covering more recent research.

³ See Note 1 *supra*, also Grassl et al. (2003), Hare (2003) for helpful summaries.

⁴ The calculations are spelled out in some detail in the technical notes to Baer and Athanasiou, *Honesty About Dangerous Climate Change*, (2004), at www.ecoequity.org/ceo/ceo_8_2.htm. See also Wigley (in press) and Hare and Meinshausen (2004).

that there is at least a 10 percent chance that the climate sensitivity is over 4°C.⁵ If we allow ourselves the optimistic assumption that there is only a 10 percent chance of this being the case, then, to preserve a 90 percent chance⁶ of staying below 2°C, greenhouse-gas concentrations must be stabilized at or below 400 ppm CO₂-equivalent.⁷

Given this, it is bracing to know that the current concentration of CO₂ (~380 ppm) together with other well-mixed greenhouse-gases *already* amounts to about 460 ppm of CO₂-equivalent. Thankfully, the effective concentration is somewhat lower, roughly 360 to 400 ppm CO₂-equivalent, because of the negative radiative forcing⁸ (cooling effect) of sulfates and other aerosols.⁹ In the future, though – and this is a key, underappreciated problem – we will benefit less and less from the cooling effect of these short-lived aerosols, as their relatively rapid decay, coupled with efforts to regulate both traditional air pollutants and greenhouse gases, will inevitably cause their concentrations to decline.

In any case, we are left finally with this: to have a high probability of keeping the temperature increase below 2°C, the total global 21st century carbon budget must be limited to about 400 Gigatonnes. This figure will vary depending on assumptions about non-CO₂ gases and the projected rate of uptake of CO₂ by the oceans and terrestrial biosphere. But all things considered, 400 GtC is a reasonable estimate, and it leads to some very difficult conclusions.¹⁰ Like this one: global emissions will almost certainly have to peak before 2020 and decline thereafter. If they don't, the 400 GtC budget will so soon have been exhausted that impossibly rapid reductions will be needed.

⁵ In fact, several recent studies suggest that the climate sensitivity has a 20% or greater chance of exceeding 4.0°C (Andronova and Schlesinger 2001, Forest et al. 2002, Gregory et al. 2002, Knutti et al. 2002). Note that measuring the climate sensitivity is not like rolling dice, with the outcome represented by a single, well-defined probability distribution (the distribution of outcomes as the number of trials approaches infinity). Our climate system has only one “true” empirically measurable value, which we would learn if we “ran the experiment” once (which we certainly hope not to do!). The uncertainty of the climate sensitivity represents the limits of our knowledge and our confidence in the evidence, which constrain its value. However, for the purpose of policymaking, it is possible – and arguably necessary – to consider the climate sensitivity in the same way one would think about a die roll, in terms of a probability distribution. Doing so allows one to calculate the likelihood of a given greenhouse-gas scenario staying under a desired temperature threshold, given the current limitations of our knowledge of the climate system’s response to human disturbance.

⁶ The necessary public discussion how high the probability of preventing catastrophic climate change would have to be before it was acceptable is only just beginning. We use 90 percent here to make our argument concrete, and also because we believe *prima facie* that it is a reasonable definition.

⁷ To be more precise, the total radiative forcing of all forcing agents, both positive and negative, must be at or below 400 ppm CO₂-equivalent. See the next paragraph for a discussion of aerosols, etc.

⁸ Radiative forcing measures the change in the earth’s energy balance from changes in GHG concentrations, and is measured in Watts per square meter (W/m²). Doubling of CO₂ would result in a positive radiative forcing of about 3.7 W/m².

⁹ See Working Group I of the IPCC’s Third Assessment Report (Houghton et al. 2001), for the canonical discussion, or Baer and Athanasiou (2004) for a quick tour of aerosols and other forcings.

¹⁰ A 400 GtC carbon budget from 2000-2100 is consistent with stabilization at about 370 ppm CO₂ if the combined oceanic and terrestrial sink averages about 4GtC over the century. This would require net non-CO₂ forcings to be held to 30 ppm CO₂-equivalent, which is difficult but probably achievable.

Time, in other words, is running out.

There are of course an infinite number of trajectories that meet a global 400 GtC budget. We are going to show you two such trajectories, both designed to display a global emissions peak followed by a constant rate of emissions decline. The difference between them is that in the first case the decline starts in 2020, while in the second it starts in 2030. It is a difference that makes a difference. In the first case, the rate of decline needed to remain within the 400 GtC budget is about 3.7 percent per year; in the second, it nearly doubles to about 7 percent per year.

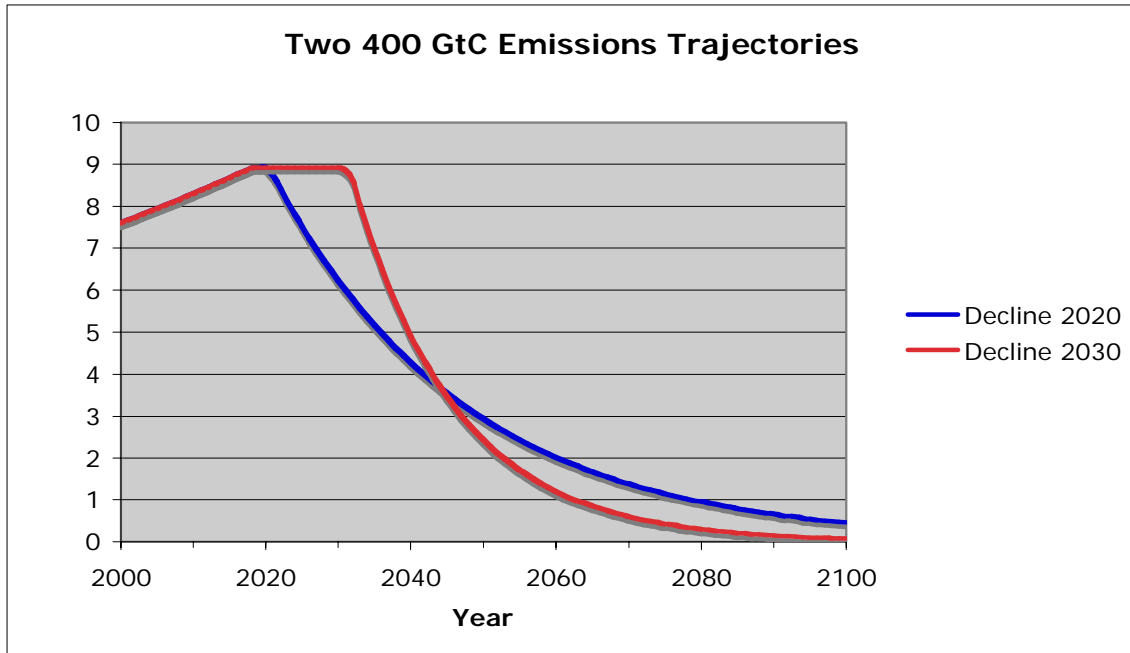


Figure 1: Two trajectories totaling 400 GtC total emissions between 2000 and 2100, both peaking at 120% of 2000 levels in 2020, one declining immediately at 3.7% per year, the other declining starting in 2030 at 7% per year.

These trajectories clearly demonstrate the need to start reducing soon, but they make a further point as well. In both trajectories, emissions drop below 4 GtC annually – about half of today's global level – before 2050. And, even under an optimistic scenario in which global population stabilizes at 8 billion in 2050, this implies global per-capita emissions around 0.3-0.4 tonnes of carbon per capita in that year – roughly one-third of today's per-capita emission rate. If we are to hold to an adequacy trajectory, then Southern countries can never reach today's Northern levels of per-capita emissions. To the degree that emission levels remain correlated with development and wealth, Southern countries will remain forever in a second class world.

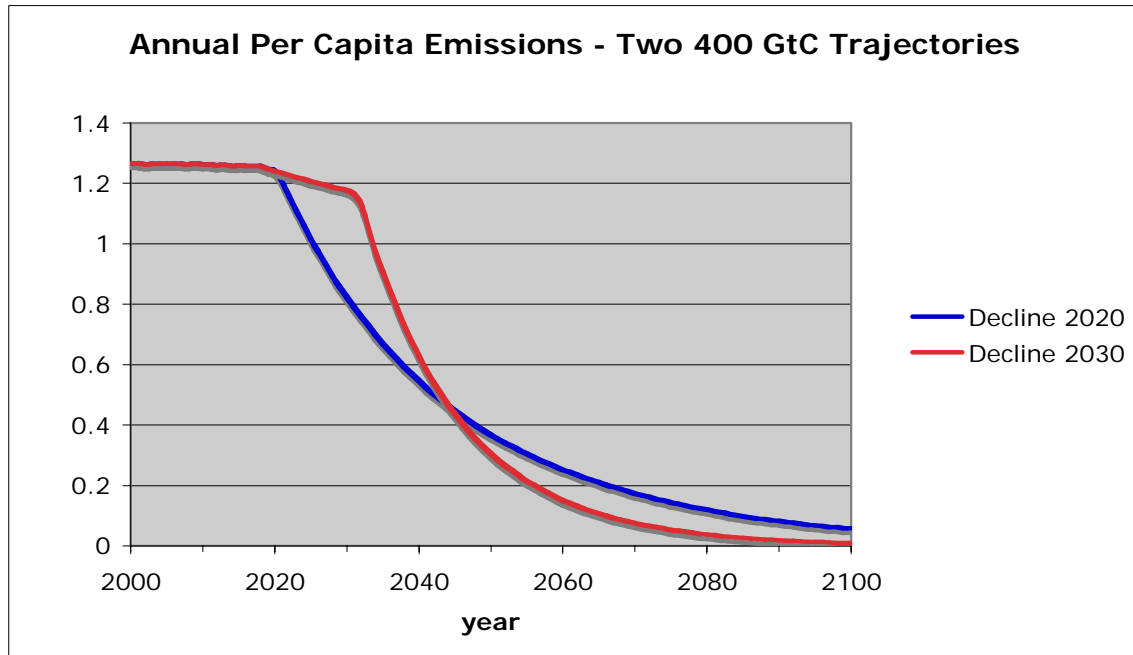


Figure 2: Per-capita emissions associated with global carbon emissions trajectories shown in Figure 1, population stabilizing at 8 billion in 2050.

The implications are clear, and given that these curves embody conservative parameter choices for both climate sensitivity and the size of global carbon sinks,¹¹ they are certainly compelling.

The situation is dire.

There is, of course, some uncertainty, and the surprises could be good ones. But we can't plan on them. Right now the science is telling us that if we want a high probability (say 90 percent) of preventing climate catastrophe we have to keep within a global carbon budget of about 400 GtC. Whatever we do, we cannot accept a path forward that will make it *impossible* to keep within a 400 GtC budget. From these simple facts, two conclusions must be very publicly drawn.

First, hedging strategies¹² are necessary, but any honest hedging strategy has to keep 400 GtC within reach. So they don't actually allow us to defer significant reductions while we wait for more information. The scientific uncertainties are real, and there is no consensus on adequacy, but none of this means that we should soft-peddle the truth. To be precautionary, hedging must faithfully keep *the lowest* of the plausibly necessary future concentration targets within reach. And given the strong case for a 2°C maximum

¹¹ As mentioned above, several published probability distributions for the climate sensitivity have 25% or more of the distribution over 4.0°C, and one carbon-cycle model (Kheshgi and Jain 2003) estimates that the average sink over the century may be as low as 1.75GtC/yr for low-emissions scenarios (compared to approximately 4 GtC annually assumed in our estimate of a 400 GtC budget).

¹² See, for example Pershing and Tudela (2003).

warming, and the real possibility that the climate sensitivity is high, the precautionary principle does not offer much flexibility at all.

Second, even if the 400 GtC budget estimate turns out to be overly conservative (as we hope it will), and even if we learn this fairly soon, the situation remains unchanged. If we had a budget of 500 GtC¹³, the South would still have to sharply reduce its emissions long before it is fully developed. As we will show in the next section, the problem is that the 400 GtC scenario is so restrictive that *all* trajectories consistent with honest hedging – keeping the 400 GtC future open – are *also* trajectories that require developing countries to cut back *soon*. It is really just as simple, and just as bad, as that.

1.2 Realism (or at least acceptability)

Realism, despite all the connotations (both heroic and unsavory) that cling to the term, is the proper name for the second thread in the climate policy knot. Its demands, too, must be satisfied, but not without first identifying and examining the roots of those demands. To assume them immutable is to risk sacrificing either adequacy or equity in order to satisfy some strongly held prejudice about what is realistic and acceptable.

In the climate context, judgments about realism are first of all judgments about what commitments various countries will accept. The strongest version asserts that countries will only accept international treaties that are in their own narrow economic self-interest. A somewhat more qualified definition allows that countries have a broader definition of self-interest than, say, simply maximizing GDP growth, and this one is, perhaps, more true to the mainstream of realist theory. Still, the key premise of the realist stance is that countries will pursue their narrow self-interest in the international arena, with, at best, secondary regard for their impact on other countries.

1.2.1 Realism and the North: Willingness to pay for mitigation

The issues here are many, and tangents beckon, but the central challenge of climate realism is simply that today's Willingness to Pay for climate mitigation is extremely limited, and incommensurate with the scale of the threat. Thus, and inevitably, the financial acceptability of any given regime proposal is the key to judging its realism. Certainly this is how negotiators are compelled to think about the matter, and anyone who imagines him- or herself to be thinking seriously about the ongoing climate regime negotiations must do the same.

It would be defeatist to accept the current level of willingness to pay as inherent or immutable, for doing so would seem to require us to abandon the goal of preventing catastrophic climate change. Yet necessary levels of willingness are presently lacking, and unless we are very clear about this we cannot expect to conduct a coherent debate on the post-2012 regime. This is true because there will be no adequacy without rapid action, and rapidity will necessarily be more expensive than gradual change. These reasons, moreover, are particularly relevant today because the developing world is on the cusp of massive energy-sector expansion.

¹³ The extra 100 GtC would buy the South only ten years before it would have to start the 3.7 percent per year crash diet.

There are good reasons to believe that once the necessary components of a global climate regime are in place the actual costs of decarbonization will be far lower than those predicted in today's various worst-case scenarios. But there will be substantial costs nonetheless. The pivotal question is: what conditions must be in place before they will be paid?

Just now, the underdeveloped nature of the discussion about who pays the costs of global decarbonization is one of the most striking features of the climate debate.¹⁴ And it is impossible to imagine that any adequate regime – let alone an equitable one – can be created while this remains the case. Unfortunately, and in sharp contrast, it is quite easy to imagine a series of nominal climate agreements that create the appearance of progress, while actually deferring real action. This is, in fact, a real and present danger.

The question then is: Can willingness to pay be increased, and if so, how? There are many answers. Here, briefly, are a few of the most important:

- Willingness to pay is, in the language of the SRES scenarios, storyline dependent. It depends, that is, on the cultural and political priorities of the moment. Today, for example, the people of the United States are, it seems, willing to pay for a fantastically expensive missile defense system that is entirely irrelevant to the principal security threats (e.g., dirty nukes in cargo containers) which they as a nation confront. Why? Whatever the reason, it has little to do with a documented and rationally debated cost/benefit analysis.
- Any viable way forward must make the costs of business-as-usual more visible. Indeed, a great deal could be accomplished simply by *ceasing to pay* for, say, counter-productive fossil-fuel subsidies. More generally, replacing standard macroeconomic indexes like GDP with more holistic indexes that take social and environmental factors into account (from natural resource stocks to childhood mortality to the military political costs of oil dependency) would help make the costs of BAU more apparent.
- People will be more willing to embrace change, and to accept the costs of change, if these costs are distributed fairly. The rule here, to borrow the language of the US Environmental Justice movement, is that people must be afforded a just transition, one that avoids burdens so unfair, immediate, and extreme as to be manifestly illegitimate, and ultimately unacceptable. The challenge of providing a just transition arises especially with regard to particular sectors or professions, such as coal miners, and with respect to countries that have become heavily dependent on fossil fuel resources¹⁵, but the rule is a general one.

¹⁴ For example, both the CAN and South-North multi-stage proposals (see Section 2) go right to the brink of discussing the financing discussion, then stop short, in spite of the dependence of their proposals on Northern financing for decarbonization in the South.

¹⁵ A less justifiable position is that countries should be compensated for the declining value of their fossil reserves as the climate regime makes them increasingly unneeded. The initial distribution of fossil reserves was inequitable, so they have no equity-based claim to receive compensation as decarbonization renders that inequitable distribution irrelevant. The climate problem raises high stakes, for it involves allocating a resource which *prima facie* should be distributed equally (i.e., the atmospheric commons) and additionality

- Finally, the climate regime must provide incentives for countries to join, and to earnestly participate. And these must come as both carrots and sticks. This, really, is the challenge, and it applies to countries of all levels of development. As the developing countries must be motivated to decarbonize as rapidly as possible, the developed countries must not benefit from defection or free riding. Beyond a certain point, free riding will not only cripple, but will actually destroy, the climate regime.

Conventional realist wisdom has it that, given the nature of national sovereignty, international environmental agreements must be self-enforcing. The gains from participating must outweigh the gains from defecting, since no country, it is said, can be compelled to participate. Yet sovereignty is not absolute, and there is no reason that free riders could not be subjected to trade-related sanctions and border charges against embodied carbon. Such measures might, in fact, be invaluable, particularly since competition is a favorite justification for insufficient willingness to pay, particularly on the part of EU, Japanese, and Canadian Parties concerned about unfair US competition.

The bottom line here is that states have agreed to cede sovereignty to some international instruments, such as the WTO, because they (rightly or wrongly) saw it as in their interests to do so. They may well do so again, for there is no good reason to suppose that an effective global climate regime can be otherwise put in place.

Willingness to pay, the key term in the realist equation, can be increased. But while the environmental movement has generally sought to do so by highlighting the costs of inadequacy, equity is also essential. It is, for example, hard to imagine that the people of the North will soon be willing to pay the incremental costs of decarbonization in the developing world if they do not see the justice in doing so. To be sure, appeals to justice will not sway everyone, and may not even be decisive – that role is probably reserved for necessity – but the climate regime must at least be defensible in clear ethical terms.

1.2.2 Realism and the South: Willingness to engage on commitments

The other half of the question, of course, is what would be acceptable to the South.¹⁶ And here, while there is some value to considering willingness to pay, the practical matter is somewhat different. For, as we will discuss in the Equity section below, there is little ground for expecting any but the richest countries in the South to pay for climate mitigation in the short run. It is no accident that most serious proposals for a post-Kyoto climate regime involve forms of commitments for developing countries that protect them from incurring substantial costs, at least in the near term.

In spite of this, the G77/China negotiating block, and the most powerful individual countries within it (especially China and India), have refused to engage in any serious discussion of post-Kyoto mitigation targets. Indeed, they have actively rejected even the long-overdue review of adequacy, and opposed any UNFCCC-official discussion of the

revalues other resources which are not distributed equally and whose unequal distribution is largely unquestioned (i.e., fossil fuels).

¹⁶ It is important to realize that the South, like the North, is quite heterogeneous, and thus what individual countries want or would accept in a climate treaty will actually vary widely. We nevertheless plunge ahead with the usual simplistic North/South model because it allows us to make our points quickly, as befits this brief paper.

scientific evidence, knowing that it would inevitably draw attention to the need for mitigation in developing countries.

To say that the South has not engaged on discussions of commitments is not by any means to accuse it of not engaging in other ways. Southern countries have devoted valuable scientific resources to the climate problem and political resources to the climate negotiations. They have worked to fulfill their obligations under the Climate Convention, and are keen to collaborate on the Kyoto flexibility mechanisms. Most importantly, many have taken impressive strides toward implementing policies to promote energy efficiency, support renewable energy, and slow deforestation. (See for example, Chandler et al, 2002). Still, when it comes to engaging on discussions of commitments, the South has been reluctant to the point of obstinacy.

Given the likelihood of disproportionate climate impacts on developing countries, this position may seem counter to their self-interest. But notwithstanding the immediate and extraordinary risks to small island states and low-lying countries like Bangladesh, it is not hard to see why most developing countries see mitigation, rather than climate change, as the greater threat to their most immediately pressing objectives: economic growth and the reduction of poverty.

This half of the question concerns the South's *willingness to engage on commitments*.

The South's policy of non-engagement is not a species of self-defeating obstinacy, as so many Northern environmentalists think. It is, rather, a species of realism. Unconstrained emissions in the South will soon no longer be consistent with an adequate trajectory, and this is clearly obvious to Southern negotiators, who draw their own conclusions. They seem particularly insistent on noticing that Northern proposals for growth targets and other apparently no-regrets options, proposals that appear to promise room for Southern emissions growth, are only going to be able to honor that promise in the very short term. After that, the space will be gone.

The size and shape of this problem are shown in Figures 3 and 4 below. Figure 3 shows a trajectory for annual global emissions in Mt/C per year. It is divided between North and South, calculated to be consistent with a 400 GtC budget and achieved via a global decline of 3.7 percent annually, starting in 2020. (Recall figure 1, above). In the scenario illustrated, emissions in the North are forced to decline extraordinarily rapidly, reaching zero by 2033. The entire remaining portion of the carbon budget is allocated to the South, and is sufficient to allow its emissions to rise at 2 percent per year until 2020 and to remain stable thereafter for about ten years.

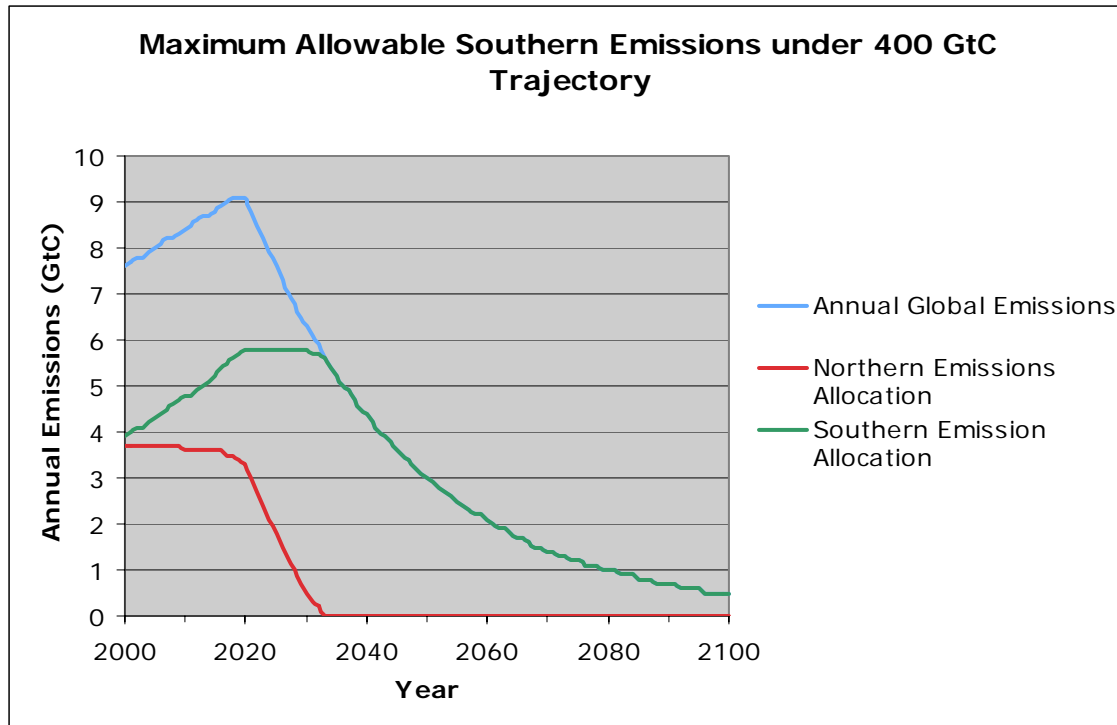


Figure 3: Global emissions allocations under a 400 GtC scenario, global emissions decline in 2020, Southern emissions stabilization from 2020-2030.

But emissions must begin to drop after 2030, and, as shown in Figure 4, per-capita emissions never exceed about 0.9 tonnes of C annually.¹⁷ Even with a moderately optimistic economic growth projection, given as a 3 percent annual increase in per-capita income, the South will still be far from wealthy when per-capita emissions rates must begin their steep decline. Per-capita income will have risen from today's average of a little under \$4000 (PPP adjusted) to just over \$6000.

This scenario, which – given the limited 400 GtC budget – is as generous as possible to the South, requires large investments in mitigation, and requires them when average incomes in the South are still quite low: roughly the current income of Thailand, Panama or Algeria. These investments are of a scale that would severely affect economic growth if not overwhelmingly funded by the North. Would they be? Given the evidence that the North, including Europe, currently has little willingness to pay even for domestic mitigation, the South has ample reason for skepticism.

¹⁷ Population growth in this scenario drops fairly rapidly, stabilizing at a global level of about 8 billion by about 2050.

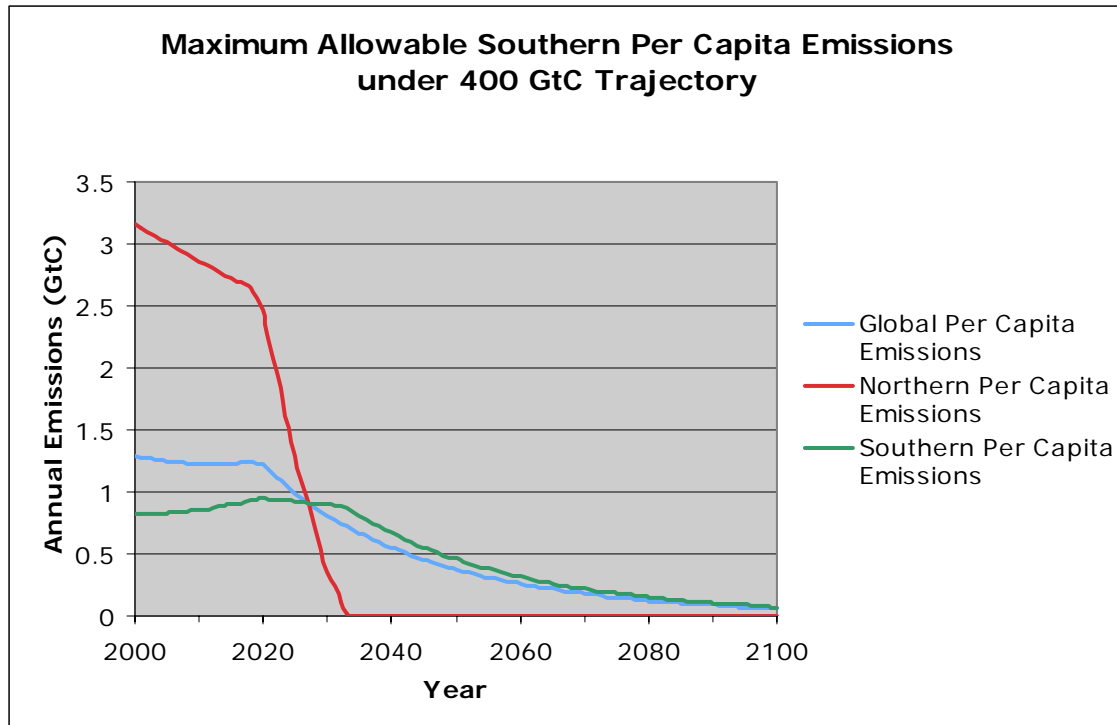


Figure 4: Global per-capita emissions allocations under a 400 GtC scenario, global emissions decline in 2020, Southern emissions stabilization from 2020-2030.

The problem here, one that the South seems to recognize far more clearly than most Northern environmentalists, is sometimes called “abate and switch.” That is, there is a real risk that the South would be lured by fairly generous near term targets to participate in an international climate regime (while the North is still profligately emitting) only to find itself, within a startlingly short period of time, being pressured to cut back its emissions to economically painful levels.¹⁸ That is, Southern decision makers, seeking above all else to preserve and improve their prospects for economic growth and development, fear that a global mitigation regime that requires them to adopt emissions targets, even one that initially protects them from costs, will subsequently cripple those prospects. And, given the scientific trend, they are entirely right to do so. Thus our conclusion: any truly *realistic* regime must be explicitly designed to preserve the right to development, or, more particularly, the right to sustainable development. If it does not do so, the developing world will not seriously engage with any global mitigation regime, not in time.

Certainly, this problem would not be so pronounced under a less constraining global emissions trajectory. However, to be blunt, less constraining global emissions trajectories are at this point mere academic exercises, and dangerous ones at that. Any conclusions based on them are of little relevance to the problem of preventing catastrophic climate change.

¹⁸ The reference here is to the idiom “bait and switch” – a typical ruse by retailers who “bait” customers by advertising some product at a fabulously low price, but (for example) don’t have it in stock when the customer arrives, and subsequently convince the customer to “switch” to a similar but higher priced product.

1.2.3 A word about the powerful

Realistic is a word with many meanings, but in the context of the post-2012 debate one of them, in particular, deserves special attention, the one in which realism means acceptability to the powerful. In this sense, to simply say that a proposal based upon an honest reading of the science is unrealistic is to nod to an incipient despair. Time is running short, but if the Americans and their allies are currently unwilling or unable to recognize this, and to act appropriately, does this make rest of the world helpless?

It cannot be allowed to.

In this regard, we are forced to a realism that we would not have chosen. With the US locked into a refusnik posture, the willing must go on ahead. And if, strangely, this gives us the opportunity to negotiate a better regime architecture than would otherwise have been possible, then there is really nothing to do but to seize the opportunity. If we are very lucky – or, rather, very clever – we will be able to contrive a regime architecture that the US will someday be able to rejoin. That it will, in fact, want to rejoin, when it can finally recognize its actual interests. Indeed, doing just this should be one of the goals of the negotiations.

1.3 Equity

Equity is not the bottom line, at least not in the climate regime. That special status is reserved for the policy knot itself, and in this knot the necessity of adequacy, and thus honest realism, looms larger than any ethical abstraction. Fortunately, the climate challenge does not require that we solve the problem of justice in the broader sense. Our goal, then – one we have pursued with as much discipline as we could muster – is to focus on equity only insofar as it is an essential factor in the design of a viable climate regime, one that can actually put us on the low carbon trajectory needed to protect the climate. Nevertheless, we are extremely sympathetic to those who prioritize equity. We believe, in particular, that a central issue at stake in the climate crisis is ensuring that the South has a fair opportunity to develop, despite the now critically scarce nature of the global carbon commons.¹⁹

1.3.1 General equity principles

Clearly, we must discuss the general principles that define equitable access to a scarce global commons. But let us first admit that, by so doing, we are entering an extremely contentious realm. It is, after all, commonplace to note that countries generally advocate principles of equity that coincide with their short-term national interests. From this unfortunate reality, most analysts conclude that there will never be agreement about what is and is not fair. Our position, on the contrary, is that it is possible – even necessary – to separate legitimate from illegitimate arguments about what is equitable.

¹⁹ We are, however, no longer convinced that a literal focus on equitable emissions allocations is the best way to operationalize equitable access to the global atmospheric commons, despite its conceptual clarity. We will explain why below, with reference to what can be called “The Problem with Per Capita.”

The obvious, and instructive, example is the sovereignty principle – the claim that historic use constitutes a right – that is frequently enlisted by high-emitting countries as an equity principle that justifies the grandfathering of emission rights. This so-called equity principle cannot be defended as fair on the basis of any ethically coherent argument, and is, in fact, only a legal principle that defends a patently unfair historic allocation of a key common resource. As such, it is really only a factor in the calculus of realism.²⁰

There is a substantial consensus about the real equity principles that are relevant to the allocation of emissions rights.²¹ These are:

Equality: the principle that all humans have an equal right to the benefits of the global commons;

Responsibility: the principle that those who have created a problem have the responsibility to solve it and make amends (the basis of the polluter pays principle);

Capacity: the principle that common burdens should be shouldered more heavily by those with the greatest resources; and

Need: if there is a resource to be shared, priority goes to those who are most in need.

Each of these principles supports the conclusion that the wealthy and high-emitting countries should, in the conveniently ambiguous words of the UNFCCC, take the lead in reducing greenhouse-gas emissions. Or, more explicitly, that because the Annex I countries²² are more responsible for greenhouse-gas emissions, and because their wealth is intimately linked to those emissions, they have both greater responsibility and greater capacity to pay for mitigation. The developing countries, for their part, have used less than an equitable share of the global carbon commons and have clear economic needs – development and poverty reduction – that take legitimate priority over paying for climate mitigation.

²⁰ Another factor in the calculus of realism is what the WBGU (Grassl et al. 2003) called the "principle of constancy," according to which abrupt measures leading to drastic impacts should be avoided, as these may have severe consequences affecting the economies of all nations. This claim is a reasonable defense against climate regimes that would impose abrupt and economically crippling obligations. It is in fact a claim against an unjust climate transition, and should be honored in operationalizing a climate regime. We should recognize, however, that it is too readily used as an excuse for the unwillingness of the North to pay significantly to address the climate problem.

²¹ The UNFCCC itself not only references the abstract principles of "equity" and "common but differentiated responsibilities," but offers an implicit interpretation of these principles. Recent general discussions of equity principles in the policy literature include Ringius et al. (2002), Ashton (2003), and Den Elzen et al. (2003). Classic treatments include Agarwal and Narain (1991), Shue (1993) and Grubb (1995).

²² We adopt here the Annex 1 / non-Annex 1 language of the UNFCCC, notwithstanding the real diversity of countries in those coarse categories.

Principles do not by themselves provide determinate answers to the very specific question that really matters: *Who should pay, and how much?* Yet the history of the climate negotiations is, frankly, a history of efforts to finesse these questions. Even the core division between Annex I and non-Annex I was made, not on the basis of any objective, principle-derived index but rather on an available historical basis – the UN division of developed and developing countries – which was thought fair enough to serve as a first cut.

This finesse, which sufficed while the mitigation burden to be shared was still modest, will no longer work. As the figures in the previous section make uncomfortably clear, the rapidly shrinking greenhouse-gas budget demands that strenuous mitigation efforts start very soon, in both the North and the South. In the post-Kyoto world, the question “who pays, and how much?” no longer lurks in the wings. Nor, if we are looking for an equitable answer, can we look to the per-capita approach to answer it, because it fails to do so.

1.3.2 The Problem with Per-capita

Equity, within the climate negotiations, is almost intuitively equated with the notion of per-capita emission rights. More so than even the Brazilian Proposal,²³ per-capita approaches²⁴ have become the default interpretation of equity in the climate context, most notably in their “Contraction and Convergence” incarnation.²⁵ The problem with per-capita, though, is that it falls far short of satisfying the key equity principles listed above. In fact, in implementation, it becomes just another abate and switch proposal.

The promise of per-capita is that, as the greenhouse-gas budget shrinks, there will be equality of access to the little space that remains. And, certainly, this seems an attractive promise indeed, since atmospheric space will be valued at a higher and higher premium. But is this promise enough? And is it real?

Under a very low emission trajectory, such as any trajectory consistent with the 400 GtC budget needed to prevent a climate catastrophe, developing countries could in fact enjoy emission rights in excess of their needs... in the early years. But the honeymoon comes to a quick end. As Figure 4 showed, even if Northern per-capita emissions plummet precipitously from their current level above 3 tonnes/year, Southern emissions can never rise much above 1 tonne/year, and would have to start declining very soon, around 2030. And the Figure 4 trajectory is *more generous* than a strict per-capita allocation would be. If, as Contraction and Convergence proposes, per-capita allocations were

²³ The “Brazilian proposal” would have allocated the *share of a global reduction target* on the basis of historical contribution to global temperature increase. It was designed to allocate reduction targets to Annex I countries; it never answered the question “when do countries graduate” and cannot be taken as a serious post-Kyoto proposal without such an addition.

²⁴ Per capita approaches have a long history, going back at least to Krause et al. (1989) and Grubb (1989), but reached prominence with the publication of Agarwal and Narain's famous “Global Warming in an Unequal World” in 1991.

²⁵ While Aubrey Meyer and the Global Commons Institute did not invent the per capita idea, with “Contraction and Convergence” they have been the most persistent in injecting it into the policy debate. Indeed, C&C has done a great deal to keep the idea of rights in play in a negotiation generally hostile to rights-based approaches. For this they deserve a great deal of credit.

phased in gradually, the situation for the South would be worse yet. The fundamental equity problem, once again, is that in *any* adequate transition, the South is quickly cast into a world where it is forced to radically curtail its emissions, long before it has reached a level of wealth even vaguely comparable to that which the Northern countries enjoyed when they first started to curb their emissions. And, to stress the point, it is the Northern bankrupting of the greenhouse-gas budget that has put the South – and the world – in this position.

All of this presents a strong challenge to the hope that rights-based approaches can help to solve the abate and switch problem: a strong challenge, but not a decisive one. For the apparent failure of per-capita to produce a developmentally fair result may not betoken a problem with rights-based approaches *per se*, but rather with the attempt to conceive of environmental rights in terms of equal *emissions rights*. It may be that what is really needed is recognition of a quite different sort of equality -- that is, equality in the opportunity to use the atmospheric commons as a factor in development.

The actual right that a climate regime should preserve, then, may be the right to development. Or, much more precisely, the right to a climate transition that does not compromise sustainable development. Emissions, *per se*, are only a means, not an end.

1.3.3 Equity as realism

What would empower the South to actually demand equity in the climate realm, and to win a climate transition that does not compromise sustainable development? The answer, paradoxically, lies in realism.

To prevent climate catastrophe, the North *needs* the South. And, conversely, the South *needs* development. For far too many of its residents, development is a matter of life and death. Development, simply put, is the South's first priority, and this is likely to remain the case even at the risk of a collapse in the climate negotiations and the virtual inevitability of a climate catastrophe in the indefinite future.

The reality is harsh, and should be put harshly. The South is almost certain to reject any climate proposal that does not acknowledge, and ensure, its right to development. Of course, if we accept this right we immediately face questions about how to put it into practice, and whether it should be further restricted to a right to *sustainable* development. But if we reject it, perhaps on the grounds of some supposed realism, it is necessary to face the fact that the South's counter-proposal – and this is no exaggeration – will likely be a suicide pact.

After all, what does it have to lose?

2 Making it to the future

Our goal in this paper is to describe the constraints that we believe any viable regime will have to meet, in terms concrete enough to be useful to both policymakers and activists. In pursuing this goal, we have come to formulate the root question of the post-2012 debate as being, "What, given the adequacy challenge, do equity and realism really mean?"

It may be helpful to briefly restate our conclusions up to this point:

Adequacy: Climate science seems to be telling us that a precautionary approach demands that greenhouse-gas concentrations stabilize around 400 ppm CO₂-equivalent in 2100, and hence that that global emissions must stay below 400 GtC over this century, peaking by 2020. We are going to be hard-pressed to make it, but this is no excuse to concede defeat and ease up on the effort to create a viable and adequate climate regime.²⁶ Adequacy is non-negotiable.

Realism: Rarely appreciated as the two-headed beast it actually is, today's realism appears as both the developed world's unwillingness to pay and, even more perversely, the developing world's unwillingness to engage on commitments. Given the intensity with which both blocs are pursuing their perceived self-interest, the all-too-likely result is that realism will vanquish adequacy. Given the stakes, this cannot be allowed to happen.

Equity: Most greenhouse policy proposals implicitly assume that equity is dispensable, trumped by adequacy and especially by realism. We, for our part, see no promise down this road. We think, in fact, that the future lies in exposing the false dichotomy between equity and realism, as they have been conceived. The South needs development. And, if there is to be any hope of avoiding climate catastrophe, the North needs the South to engage, fully and unambiguously, in the greenhouse transition. Insofar as the North/South deadlock cannot be broken unless the post-2012 regime is substantively fair, equity thus becomes a means to an end.

How, then, to move forward? By building upon Kyoto, and by facing up to times that demand both honesty and bravery. By realizing that we cannot hope to prevail with evolution, indirection, and strategic ambiguity alone, and by acting accordingly.

2.1 Cutting the Knot

Is there a plausible way forward? Or is the set of all adequate, realistic, and equitable proposals, in fact, an empty one?

We do not believe it is, for the simple reason that the climate crisis is not necessary. We have the technology, or enough of it, to blaze a path forward, and we can afford to develop and deploy it on the needed scale.²⁷ The climate crisis, in other words, is not preordained. It is only that solving it is the most difficult political challenge of all time.

²⁶ Even those that argue against acknowledging such stark limits can only justify their position by arguing that, politically, such silence increases the chances of actually meeting them.

²⁷ In a recent policy editorial in *Science*, Pacala and Socolow (2004) identify fifteen available technologies that could each displace 1 GtC of carbon emissions by 2050. Their base case suggests choosing seven such "wedges" to reduce emissions from their BAU projection of 14 GtC annually to 7 GtC, consistent with stabilization at 500 ppm CO₂. However, rather than shooting for this level, which (given non-CO₂ gases, which they do not address) could easily lead to a global temperature increase exceeding 4°C or more, there is no reason that three or four additional "wedges" couldn't be implemented to reduce emissions to a level consistent with a precautionary target.

To clarify what we mean by this, and to justify our conclusions about how we think the knot can be cut, we want to very quickly examine the various post-2012 regime architectures now under discussion in terms of the three intertwined constraints of adequacy, realism, and equity. There is, of course, no way to quickly examine several architectures unless they are tidily classified, and we propose that they be laid out on a spectrum (see Figure 5, below) between two poles that we characterize in the following way:

1) Ad hoc, hyper-realist regimes

At this end of the regime architecture spectrum, countries solely pursue self-interested strategies, rather than seeking to mobilize global cooperation to produce a meaningful global accord. The goal is to forge various bi-lateral and multilateral agreements that are narrowly win-win for the parties concerned.

2) Global, principle-based regimes

At this end of the spectrum, narrowly-defined national self-interest succumbs to enlightened self-interest. Parties recognize justice as a precondition of adequacy, and devise a strongly principle-based regime that, by reinforcing equity, provides incentives for cooperation, ranging from immediate economic and development benefits to averted climate catastrophe. To those Parties late to appreciate the value of cooperation, the threat of sanctions on free riders is invoked as necessary.

Figure 5, below shows the spectrum, and our rather subjective alignment of some already prominent proposals along it.

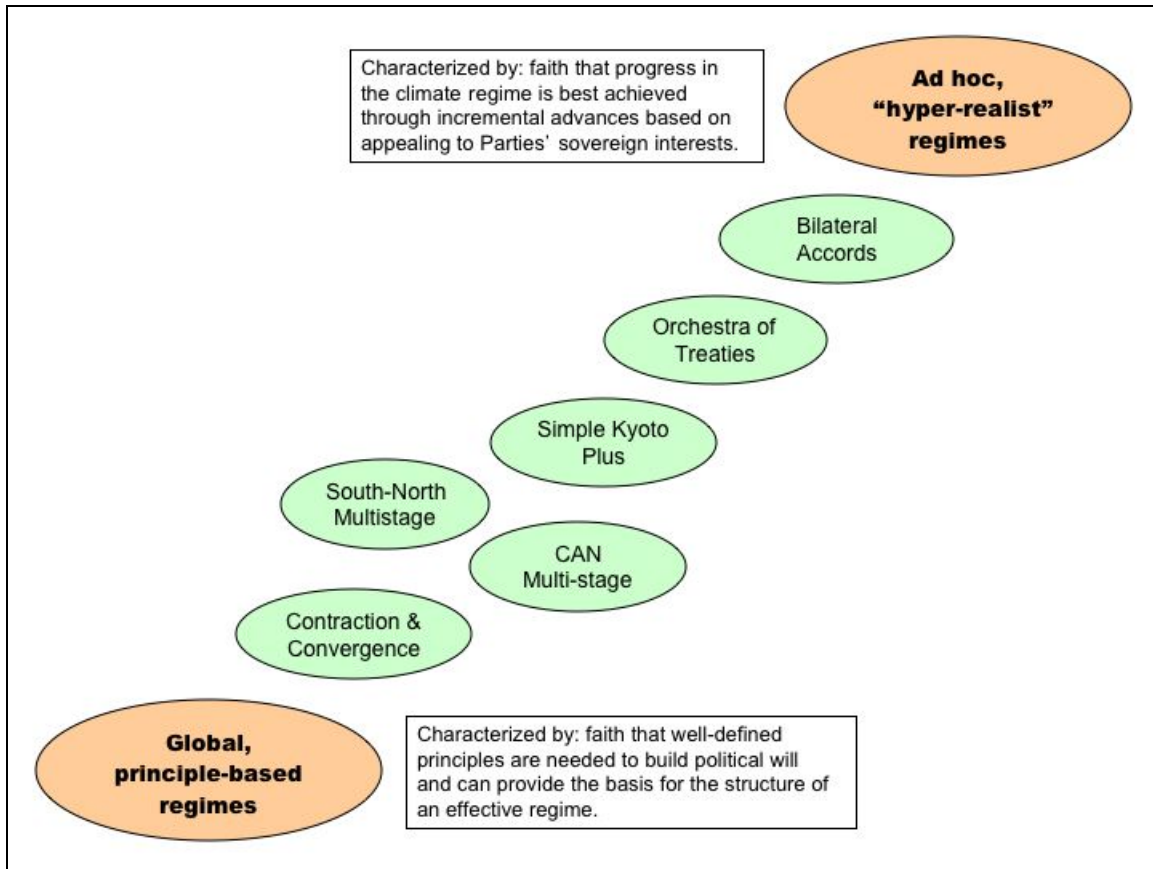


Figure 5: A spectrum of regime architectures.

On the right

Toward the right end of the spectrum, we place the "Bilateral Accords" approach popular with the Bush Administration, and also the "Orchestra of Treaties" approach in which separate, overlapping, multilateral agreements including different countries and different subjects come together – or so it is hoped – into a reasonably coherent whole. These two approaches are comparable, for both posit international action only as it can be negotiated between like-minded countries. Nations are presumed to behave, always and invariably, as sovereign states acting strictly in accordance with their national self-interest, first of all by seeking to maximize their discounted national income. This perspective stands for realism, or rather an ultra-realism that rejects any near-term possibility of strong mandatory global regimes and any broader definition of self-interest.

If, at this end of the spectrum, realism is the paramount concern, then what of adequacy and equity?

The hyper-realist perspective essentially takes national self-interest, and thus willingness to pay, as givens. It accepts that some countries have greater willingness to pay than others, while leaving the reasons for these differences entirely unquestioned. Any consideration of sanctions on free riders is ruled out. As for equity, its only real consequence is the claim that developing countries have no obligation to mitigate emissions, and will do so only if it is in their perceived self-interest to do so, for example

for the sake of co-benefits, or because they are paid to do so by mysteriously altruistic Northern countries. The South's right to development is preserved, but sustainability does not enter into the equation, and the price of development is, thus, the destabilization of the climate. The self-interest of the industrialized countries is similarly treated as fixed and unchangeable, and it is assumed that they will continue to use as much of the remaining atmospheric commons as they feel their welfare justifies. Thus, demands for adequacy matter only insofar as mitigation can pass a nationally-focused cost-benefit test, and equity consists of the right to act on this cost-benefit test.

Much can be said about this perspective, but it is difficult to see how it can lead to a regime compatible with anything resembling real adequacy, or for that matter, developmental justice. To the contrary, it almost seems to justify a grave tragedy of the commons, one inevitable to a world where independent states, each mitigating greenhouse gases based on a national cost-benefit calculus, egregiously under-react and inexorably, almost passively, fall victim to catastrophic climate change.

Still, we do live in a world of sovereign states, each disposed, in its own way, to attend first of all to its interests. This is a realism that will not be denied. Fortunately, interests are not given; like history they are made.

In the center

Near the center of the spectrum is "Simple Kyoto Plus": regimes that add new countries to Annex I on an ad hoc yet defensible basis. The ad hoc aspect of Kyoto itself is well known; indeed, it has sometimes been overplayed. Kyoto belongs in the center because, as a first-order division between developing and developed countries, it also strongly embodies the principle of common but differentiated responsibilities. Simple Kyoto Plus approaches, whatever their details, must necessarily maintain this division, and extend it, a fact that greatly restricts the list of plausible candidates for graduation. Ad hoc approaches can help, but, we think, not in any decisive way.

How will Simple Kyoto Plus approaches approach the three-thread knot?

First, they attempt to balance equity and realism by making the right to development a relatively qualitative category. Thus, individual countries can be invited to join Annex 1 without being measured against any objective index; rather, a country's targets can be negotiated on an ad hoc basis. No concrete Simple Kyoto Plus proposals have yet been advanced, so the status of adequacy in such arrangements remains an open question. Skepticism is easy, particularly given the challenges of low stabilization targets, but there is no obvious a priori reason why an Simple Kyoto Plus proposal couldn't calibrate its targets by reference to a particular, even highly-restrictive, global emissions path.

Simple Kyoto Plus proposals do face a particular challenge, because for reasons of both adequacy and realism (acceptability to Northern countries), large developing countries (i.e., China and India) must accept targets early on. Yet, by most standards, these countries have neither high capacity nor high responsibility, and thus cannot be asked to pay significantly for mitigation. Unsurprisingly, then, in the mainstream of the post-2012 policy debate, defined as it is by a Simple Kyoto Plus vision, the ideas getting the most attention are for soft commitments – non-binding targets, intensity targets, etc. – that are largely aimed at this specific problem. The fundamental difficulty, once again, is that the remaining greenhouse-gas budget is extremely small, and protecting the climate

requires a rapidly declining emission trajectory. There is little room for emissions growth, and everyone knows it. Thus, fearing abate and switch, developing countries have repeatedly insisted that their rights to development justify the rejection of any kind of binding commitments that might restrict their economic development.

Simple Kyoto Plus would have better chances if this deadlock could be broken, but we see no real prospect that it will be; on the contrary, the absence of any foundational equity principle precisely reinforces the resistance of developing countries to engage the mitigation regime on an ad-hoc basis. And why not? Their skepticism is entirely justified.

Towards the left

Moving toward the Global Principle-based end of the spectrum we find, first, a range of multi-stage proposals. The proposals of the Climate Action Network²⁸ and the South/North dialogue²⁹ are well known recent versions, though similar models have been developed by RIVM³⁰ and others. The key in all these cases is differentiation among developing countries, typically on the basis of per-capita emissions and income, so that, in general, the type and degree of obligations can gradually scale from no obligations for the LDCs to full Annex I-style caps for relatively wealthy developing countries such as South Korea.

Contraction and Convergence lies further towards the principle-based end of the spectrum. This is a somewhat problematic placement, however, because while a clear ethical principle – equal emission rights – is the foundation for Contraction and Convergence, the duration of the gradual convergence period is not principle-based; it is, rather, a free parameter that is to be negotiated on some political basis. One can attempt to formulate a principle capable of fixing this period – as for example the WBGU's principle of constancy, which was conjured to justify a relatively slow convergence³¹ – but in the absence of a more coherent justification, the convergence period becomes, in practice, an ad hoc feature designed to meet, or at least attempt to meet, the acceptability concerns of the North. And further efforts to refine Contraction and Convergence into an operationalizable system – for example, recently, with regional bubbles – only serve to increase its ad hoc nature and weaken its link to its underlying per capita foundation.

How does the three-thread knot fare on this the principle-based side of the spectrum?

First, note that multi-stage proposals like CAN and South-North attempt to address realist concerns about non-participating developing countries by finding a scheme in which all developing countries, categorized by their development status, have some level of obligations commensurate with their responsibility and capacity. Both rely on Northern finance to pay for mitigation in all but the wealthiest developing countries. And

²⁸ A Viable Global Framework for Preventing Dangerous Climate Change. Available at www.climatenetwork.org/docs/CAN-DP_Framework.pdf.

²⁹ South-North Dialogue on Equity in the Greenhouse: A proposal for an adequate and equitable global climate agreement. See www.wupperinst.org/download/1085_proposal.pdf.

³⁰ See for example Berk and Den Elzen 2001.

³¹ See Grassl et al. (2003), Section 2.3. And note the discussion in the footnote above.

both allude to an adequacy trajectory, specifically to meet a 2°C maximum temperature increase. This is a promising start. So far, though, neither proposal has been elaborated to the point of spelling out an emissions trajectory or concentration target, and neither can yet be analyzed to determine what the costs would likely be, or how costs would be allocated among Northern countries.

The multi-stage approach, in other words, could work, and could preserve the right of Southern countries to develop. And given this, it is definitely interesting. We will know how interesting when we see a concrete proposal that takes explicit account of the need for a low-emissions trajectory and proposes a financing system.

Contraction and Convergence, for its part, attempted to cut the knot in one fell swoop.³² With Contraction and Convergence, the whole world would be under a global cap, so there would be no adequacy concerns and no leakage problems. And the system would, so it is said, be fair because, after convergence, each human would have equal emissions entitlements. Unfortunately, for all the reasons that we enumerated above, we believe that Contraction and Convergence's claims to be fair and adequate do not stand up to real analysis. The bottom line, in any case, is that Contraction and Convergence will never be put into effect because the large developing countries will never accept it, and they will never accept it because, frankly, it would not grant them the right to (sustainable) development that they both need and deserve. In fact, under the low-emissions trajectory that climate protection demands, their emissions budgets would be strongly and rapidly squeezed well before their legitimate developmental goals are even close to being met.

All of which leads us to the following conclusion:

The science is clear – to prevent dangerous climate change, we must stay within a very small greenhouse-gas budget. To do so, we must somehow get to the principle-based end of the spectrum. Why? Because if we are to prevent dangerous climate change, Southern emissions must be dramatically curtailed well before the South reaches anything like developmental parity with the North. This is the fundamental equity problem, and solving it is the key to genuine realism.

3 Greenhouse Development Rights

The Berlin Mandate was a necessary first step. And Kyoto was, actually, a pretty nimble second – it managed, against heavy odds, to define a path that met the demands of the Berlin Mandate, at least to a first approximation. Some nations would have to pay to mitigate, the rest would not, and the ball would start rolling. And now, against odds even heavier than those that Kyoto faced in 1997, its ratification has been won. We love it dearly, but we should not be delusional. We are going to have to be nimble again, damn nimble.

³² Much as Alexander the Great is said to have cut the original Gordian Knot – immediately, bravely, perhaps recklessly.

How then to move forward? One thing at least is clear – a strategy based upon realism-as-usual is not viable. The problem, irreducibly, is finding a route to adequacy, and what this appears to mean is finding an approach that breaks the deadlock between the North's unwillingness to pay for mitigation and the South's unwillingness to engage on commitments, and, by so doing, opens the road to a new realism. And to a global regime that can actually prevent a climate catastrophe.

The key, we have argued, lies in a regime that recognizes the South's desire for development, and its right to sustainable development. We have therefore decided to proceed by taking this right seriously, first by focusing on the equity principles that undergird it, and then by exploring the climate regime that they imply. It comes, finally, to this: 1) Adequacy is the bottom line, 2) The North developed without concerning itself with greenhouse-gas constraints, and consumed much more than its share of the atmospheric commons in the process. 3) The South deserves the right to attend first to the fundamental priority of raising its poor residents out of poverty. In this context, a climate regime can only be considered equitable if it allows the South to focus on poverty, not mitigation.

These claims can be framed in terms of the equity principles discussed in Section 1.3:

Equality: Countries deserve equal rights to sustainable development. As technology now stands, access to the global atmospheric commons is critical to exercising this right. Over time this dependence will decline as human society develops zero-greenhouse technologies and invests in infrastructure that is less fossil-fuel dependent. But in the meantime a nation's greenhouse-gas emissions correlate closely with its ability to meet basic developmental needs.

Need: The North, having already reached a high level of development, must radically curtail its emissions. It should now make available to the South a large enough greenhouse-gas budget to allow it too to prioritize development, and to pursue it without being hobbled by emissions limitations. This reflects the fact that the South has a far greater need than the North for the limited remaining atmospheric space.

Responsibility and Capacity: Alas, it is now evident³³ that there is not enough space remaining to allow the South to develop without greenhouse-gas constraints. Thus vigorous mitigation activity is necessary in the South as well as the North. The North should pay for this, and by so doing allow the South to focus on its basic development goals. The amount that any given Northern country must invest in mitigation (in both North and South) should depend on its responsibility and capacity. Once Southern countries reach a certain level of development, they themselves will have the responsibility and capacity to begin to shoulder the burden of keeping human society within the remaining greenhouse-gas budget. Until that time, their proper priority is development.

If the costs implied by this formulation seem beyond the North's current willingness to pay, this hardly makes it inequitable. Indeed, any concrete, defensibly fair climate regime is bound to strike many people as unrealistic, particularly in the short run. However, a formulation that satisfied the above principles, if concrete, compelling, and plausibly operationalizable, could have tremendous value as a kind of "equity reference

³³ See Figure 3.

framework” – a benchmark against which to compare, and judge, actual regime proposals, particularly those forged by sovereign states responding to the perceived demands of their national interests. A good equity reference framework, in other words, would offer a counterpoint to the more “realistic” proposals now flooding the climate literature, and a metric by which to measure them.

How might such an approach be more concretely translated into the language of the climate regime, to provide an explicit equity reference framework? The following three elements are necessary:

A global emissions trajectory consistent with climate protection: First, we have to establish a global emissions trajectory that is consistent with a precautionary approach to protecting the climate. This trajectory would be established in a manner that allows for revision and flexibility in the face of evolving climate science. This science, as discussed above, currently suggests that an appropriately precautionary emission trajectory would be one consistent with a 400 GtC budget.

A measurable development threshold: Second, we need a definition of the level of development to which all countries are equally entitled. That definition would provide a “development threshold”, separating those countries that will prioritize development (we call this group of countries “Annex South”) from those that are obliged to begin addressing the climate challenge (“Annex North”). Annex North would be required to provide the resources to achieve the necessary level of global mitigation, which it could do in a number of ways. For the moment, let’s just say that it would invest those resources both within its own borders and within Annex South. Annex South would collaborate with Annex North by making mitigation opportunities available, and, by so doing, would increase its overall level of development. Once an Annex South country reaches the development threshold, it will – by definition – have the capacity, and the responsibility, to begin to help shoulder the burden of keeping human society within the remaining greenhouse-gas budget. Until that time, development is its proper priority.

How would the development threshold be marked? Perhaps by aggregate national indicators like PPP-adjusted per-capita income. Or perhaps not. Aggregate national indicators, after all, are flawed measures of sustainable development, for they disguise intranational disparities, sometimes grievously. It might be reasonable, particularly when there is a fear that a country’s elite minority would hide behind the underdeveloped majority, to instead consider the income of the richest quintile of the population. The issues here need to be debated.

A transparent indicator of obligation: Finally, we need a measurable, transparent indicator able to determine each Annex North country’s precise level of *obligation to contribute to global mitigation*. This “obligation index” should reflect responsibility and capacity, but beyond this stipulation, debate on its nature is both necessary and justified. One straightforward possibility is a country’s cumulative “post graduation” greenhouse-gas emissions, that is, the sum of its emissions since it crossed the development threshold. Such an index measures responsibility more or less directly, and nicely embodies capacity as well; its value is reasonably clear for today’s developed countries, while countries who have not yet crossed the development threshold would simply be rated as zero when they do. Their obligation would then rise with their emissions, and as they grow wealthier.

These three elements – an adequacy trajectory, a development threshold, and an indicator of each Annex North country's obligation to pay for mitigation – add nicely together into the *Greenhouse Development Rights* (GDR) framework. Obviously, much more can be said about the framework, but the key point is that it directly addresses the all-important question: "Who pays, and how much?" It does so, moreover, in a transparent manner that makes it an excellent equity reference framework. That is, it postulates a regime that is adequate by design, and yet, at the same time, fully conformant with the right to sustainable development. As such, it gives us a benchmark that compromises neither adequacy nor equity in deference to some prior notion of realism. Such a benchmark, and this is our central claim, will become increasingly valuable as the air thickens with proposals for the post-2012 period, for it gives us a good way to measure the compromises that each proposal asks us to consider, and to weigh each against the other.

Further, the GDR framework offers a fulcrum by which we can hope to redefine realism. It does so by demonstrating that, to be coherent, climate equity must follow from the demands of adequacy, and that realism, so often taken as the ruling variable in the climate equation, is in fact the subsidiary term. Or, put another way, it demonstrates an approach designed to meet the demands of adequacy by increasing the South's willingness to engage on commitments, and by actually quantifying, on a nation-by-nation basis, the corresponding obligation to mitigate. By so doing, it adds something new to the equity debate – precision.

3.1 Operationalizing Development Rights

It is notable that, with only a few additional elements, it is possible to view the GDR approach as, not just a reference framework, but a proposal for a climate regime that could plausibly be operationalized. The details are outside the scope of this paper, but we would like to lay out some of the basic ideas.³⁴

First, the Berlin Mandate and the Kyoto targets can be taken as approaches to the specification of the development threshold. The Kyoto targets, in particular, implicitly specify the development threshold, by way of the income of the (subset of) Annex I countries to which it assigns emission reduction commitments (i.e., targets that require actual mitigation; not "hot air" targets). Figure 6, below, plots these targets versus per-capita income, and suggests the development threshold implicit in Kyoto is approximately US\$17,000 per-capita.³⁵ Note that the countries falling above this threshold contain about 15% of the world's population, but approximately 55 percent of the world's economy. This means, among other things, that were this line taken to define Annex North, it would immediately have the majority of the world's assets to draw upon in its efforts to meet its mitigation obligation.

³⁴ A detailed explication of this system, and its properties, is forthcoming in early 2005. To receive more information on GDRs, when it becomes available, contact the authors.

³⁵ This chart is meant to be indicative rather than in any way definitive. Because the "zero" line is relative to 1990 (or minimum emissions over the decade for economies in transition), even countries such with 0 reduction commitment must make some reduction below BAU. The \$17,000 threshold is roughly New Zealand's per-capita income. Above that level, most (though not all) countries have real reduction commitments, and below that level, most countries have growth allowances.

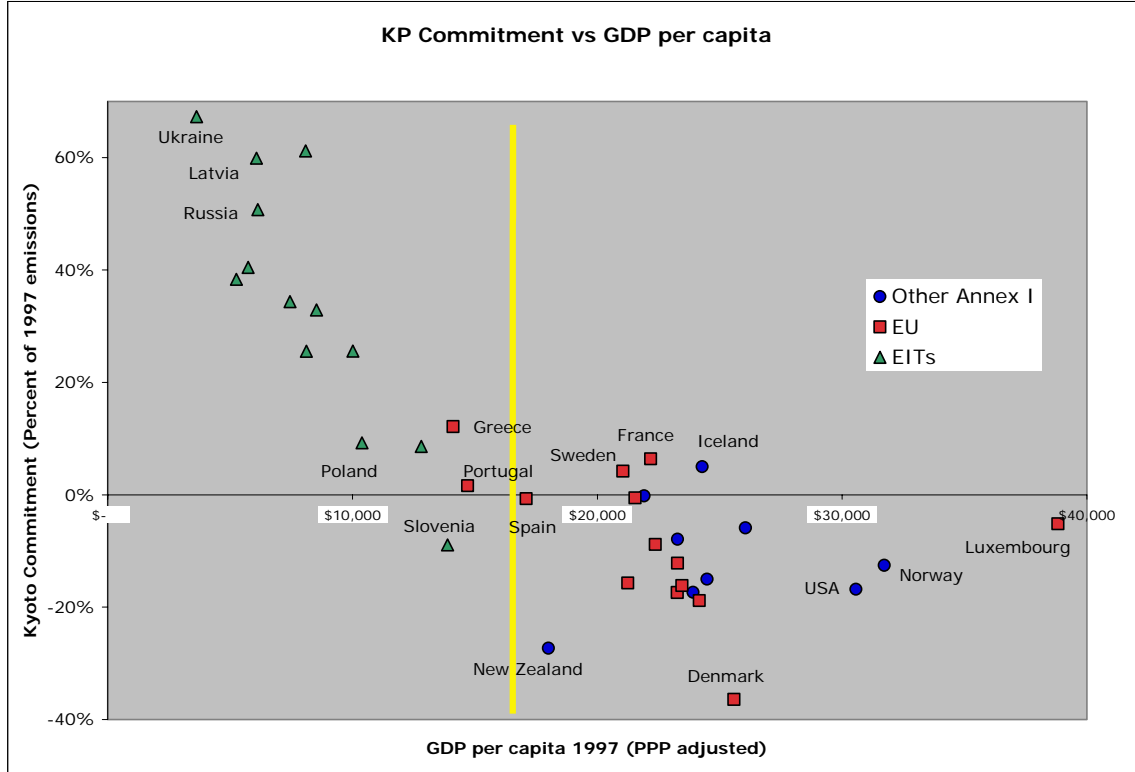


Figure 6: Kyoto Protocol emission targets for Annex I countries vs. their per-capita income. Income is 1997 PPP-adjusted, in current (2003) international dollars. Emission targets are expressed as a percentage of 1997 emissions, including differentiated targets under the EU's burden-sharing arrangement.

Second, it is possible to implement the GDR approach as a global cap-and-trade system. Very briefly, it is only necessary to define medium term budget periods (extending, say, ten years into the future) and national business-as-usual baselines. Given these, it becomes possible to define the total global mitigation requirement in any given budget period as the difference between the global BAU trajectory and the adequacy trajectory in that same period. This mitigation requirement (in say, millions of tonnes of CO₂-equivalent) can then be allocated among Annex North countries according to each country's obligation index.

Operationalized, the GDR framework would have an inherent incentive structure that is extremely attractive from the standpoint of creating a workable climate regime. Notably, and in contrast to the current Kyoto framework, Annex South countries would have an incentive to develop along a low-carbon trajectory *prior* to the point at which they themselves would take on mitigation commitments. This is because, once a country reaches the development threshold, its obligation index starts immediately to rise, at a rate that is largely determined by its emissions rate and the speed at which its emissions are rising. Given this, it is not in any given country's best interest to reach the development threshold with an inefficient greenhouse-gas-intensive economy. Thankfully, Annex South countries would develop in a context in which Annex North countries are eagerly seeking mitigation opportunities within their borders. This would

drive a large flow of decarbonization investments into Southern economies, so greenhouse-intensive development would not be their fate.

Finally, and crucially, the GDR framework would actually give Annex North an incentive to see Annex South countries develop, that they might quickly graduate into Annex North and thus join the ranks of those with obligations to pay for mitigation. This means that GDRs would not only acknowledge the South's right to development, but, properly operationalized, would shape that right along the contours of equity and sustainability, and actually drive the development process along. This is in sharp contrast to proposals, such as Contraction and Convergence, where greater wealth does not immediately translate into a greater obligation to contribute to mitigation.

3.2 Are we crazy?

There are, of course, more details, but the obvious question can already be asked – are we crazy? Progress on climate protection is all but blocked, in large part because of the North's low willingness to pay for mitigation. How, then, could it possibly make sense to advocate a regime in which the North would have to pay for all decarbonization, everywhere in the world?

But step back. Recall what the science is telling us. And consider again the claim that the cost of decarbonization – the entire cost, globally – should be paid by the Annex North countries that have reached at least some minimal standard of development. Is this claim, itself, crazy?

We do not think so. We think, in fact, that today's Annex North countries developed by using the atmospheric sink in a manner that today's developing countries simply cannot emulate, and that this matters a very great deal indeed. We think that the GDR framework really does capture what the North had and what the South legitimately wants: basic development unhampered by climate constraints. And, finally, we believe that it won't take too many more years of deadlock before even Northern environmentalists have to think, seriously this time, about the impossibility of stabilizing the climate without directly addressing this most glaring disparity.

Consider *Greenhouse Development Rights*, then, as a proposal designed to cut the knot, or at least to support a reference framework specific enough to help us understand what it would actually mean to do so, and to focus debate on ways and means.

Do not pass too quickly over this: the situation is dire, and it calls for decisive action. What else, after all, could realism possibly mean?

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