

Fair Adaptation? Insurance as Adaptation Strategy

Göran Duus-Otterström¹ & Sverker C. Jagers²

- *Work in progress* -

Abstract

No matter how efficient and robust mitigation measures are or will be, a certain degree of climate change seems inevitable due to atmospheric accumulation of historical emissions and inertia in climate and ecological systems. Thus, even with radical mitigation in developed countries, approaching zero emission at the end of this century, atmospheric CO₂ stabilization will take hundreds of years and temperature stabilization several centuries. This fact clearly demonstrates that any mitigation strategy must be matched with adaptation measures. Insurance is increasingly considered as one part of a comprehensive set of responses designed to adapt the world to future climate change. Insurance is believed to provide resources needed to rebuild societies from adverse effects of extreme weather events but do so in a way which encourages preventive, risk-reducing action. The paper argues that in the light of the international injustice which signifies the problem of climate change, a commercial model of insurance is a poor idea - insurance here needs to be supplied and paid for in ways which do not exacerbate the unfortunate fact that the least wealthy states are also the most vulnerable. The paper evaluates a recent insurance scheme to this effect from the Munich Climate Insurance Initiative (MCII) We argue that while MCII's proposal has many merits, it also suffers from a number of flaws: it risks underfunding the insurance costs of the developing world, introduces a questionable distinction between impending and more distant risks, and fails to provide a clear guideline for burden-sharing among net-payers to the insurance pool. These points of contention need to be addressed satisfactorily by any fair and feasible future climate insurance scheme.

Keywords: climate change, adaptation, insurance, fairness, feasibility

¹ Research Fellow, Department of Political Science, University of Gothenburg.

goran.duus-otterstrom@pol.gu.se

² Associate Professor, Department of Political Science, University of Gothenburg. sverker.jagers@pol.gu.se

I. Introduction: Insurance as adaptation response³

Intuitively, when facing a development that brings with it an impending harm we can do either of three things. We can address the causes of the development, to make sure that the harm never happens or is mitigated. Or we can change our behaviour and adapt to the development, to make sure that the potential harm it brings about does not affect us adversely. Finally, we can allow the harm to happen but compensate those who suffer it *ex post facto*. There is a clear order of desirability here. Other things being equal, it is reasonably best to make sure that the harmful development never happens. Second best is to make sure that the development is not harmful, or less harmful than otherwise. Least desirable is to allow the harm to happen and then compensate for it. Prudence and morality seem to converge on this ranking (Baer 2006).

Given this background it is perhaps not surprising that the UNFCCC process on climate change so far has predominantly discussed ways to mitigate the harmful development of climate change (Paavola & Adger 2006). However, increasing importance is now being attached to adaptation as a response to climate change risk. Whatever we do now, some climatic changes are unavoidable, and we have an imperative to adapt to them in order to make them less harmful. Moreover, it takes only a minimum of political realism to conclude that any future mitigation regime may well be too ineffective to avoid further dangerous climate change. At any rate, it would be irresponsible to assume that stringent enough emission cuts will take place. Considerations like these presumably explain why issues related to adaptation are now considered of “equal importance” to those of mitigation.⁴

Adaptation to climate change can be understood as “measures which enable [persons] to cope with the ill-effects of climate change” (Caney 2005: 752). Coping can here be seen as a matter of degree, ranging from full coping (where the ill-effects cause no harm at all) to increasingly insufficient coping (where harms are felt, but not as severely as would have been the case without adaptation). Paradigmatically, as argued above, adaptation consists in *proactive* or *preventive* measures, such as improving flood defences, diversifying economic activities, or moving vulnerable settlements in order to cope with the predicted effects of climate change. But there may also be forms of *reactive* adaptation (Paavola & Adger 2006).⁵ Reactively adaptive measures include systematic possibilities to access funding or other resources to rebuild society after already experienced harms. Such measures leave a lot to be desired because, just like pure compensation, they do not prevent the harm in the first place. But there is every reason to believe that many countries will need, or would benefit from, such adaptation measures. They might not be normatively or financially ideal, but are nevertheless necessary in a comprehensive set of responses to climate change.

³ This paper is part of a larger research project, called *Fair and Feasible Climate Change Adaptation*, jointly funded by the Swedish Research Council and Formas.

⁴ The “equal importance” was mentioned in the Bali Action Plan of 2007. See Persson et. al. (2009)

⁵ Paavola & Adger (2006) also mention *inaction* as a form of adaptation. We will not consider inaction as adaptation here.

The focus of this paper is on one particular form of reactive adaptation, namely *insurance*. Insurance instruments have been brought forward with increasing frequency as a viable and desirable adaptation measure. The idea is that countries should be able to insure against some of the adverse effects of climate change or related phenomena, via some insurance mechanism that pools resources and enables risk-transfer. Our aim is twofold. First, we will point out some of the conceptual or normative problems that insurance instruments look destined to face when applied to climate change. In this process, we will review what seems to us the best worked out proposal of an insurance instrument out there, namely the recent proposal from the Munich Climate Insurance Initiative. Secondly, we will suggest in what ways this and other insurance instruments could be improved to be considered as fair as possible. We will argue that the main problem of insurance against climate change effects is the unfortunate fact that the most vulnerable countries also tend to be the poorest, and thus unlikely to be able to afford premiums. To top it off, the same countries also tend to be the least responsible for the eventuation of climate change. The solution we propose is that premiums should be set according to a formula which is sensitive to both vulnerability, ability and responsibility.

In section II we give a brief description of the general concept of insurance, and mention some of the merits associated with it. In section III we review the concept of insurance against the adverse effects of climate change and show why an entirely market-based insurance model would be manifestly unfair. Based on the identified shortcomings, we derive four criteria an insurance model would have to satisfy in order to be considered fair and feasible. In section IV we review some alternative proposals and especially the so called MCII proposal, designed to fare better than the pure market-based approach. Based upon our four criteria, we suggest a number of challenges that this proposal has yet to deal with. In the concluding section V we suggest an insurance model which solves at least some of these problems. We end by briefly assessing the justice of this model compared to more standard donor-aid approaches.

II. Insurance

Insurance is technically the transfer of risk of a loss from one party to another in exchange for a fee, called a premium. A *risk* is understood as the probability of an outcome times its value. This yields the *expected value* of an outcome. The term “risk” connotes that the value is negative: when discussing insurance we are dealing with potentially harmful outcomes. We thus should separate risk from the magnitude of harm as such. A very likely but less harmful outcome can pose a higher risk – carry with it a lower expected value – than a less likely but more harmful outcome. A risk goes up, other things being equal, the higher the likelihood and negative value of an outcome.

Insurance is best understood as trading the possibility of a loss for a guaranteed cost in the form of a premium. Home insurance may serve as an illustration. Suppose there is a 20 % probability of your house being burglarized, which would yield a big loss for you. To insure

against burglary means paying a set premium to another party, who in turn promises to compensate you to a certain degree in the event that you are burglarized. There is always a chance that the insurance is for naught. But a rational agent will insure when the expected utility of getting insured is greater than the risk being insured against. Suppose the probability of being burglarized is .2. The best outcome is not to buy insurance and not being burglarized (0). The second best is not being burglarized and being insured (-5) followed by being burglarized and being insured (-10).⁶ The worst option is being burglarized while being uninsured (-40). As illustrated by Figure 1, a rational agent should insure in this situation. The expected utility of buying insurance is greater than the expected cost of not buying it.⁷

Figure 1. An insurance decision

Choice	Outcome	Value	Expected value
Buy insurance	Burglarized ($p = 0.2$)	-10	-2
	Not burglarized ($p = 0.8$)	-5	-4
Do not buy insurance	Burglarized ($p = 0.2$)	-40	-10
	Not burglarized ($p = 0.8$)	0	0

Comment. Expected value of an outcome is calculated by its probability multiplied by its value. Expected value of a choice is the sum of the expected value of the respective outcomes of the choice. In this example, the expected value of buying insurance is -6, whereas the expected value of not buying insurance is -10. Therefore, buying insurance is the rational thing to do.

The size of the premium – monetary or otherwise – is in purely market-based insurance schemes determined by the size of the risk the insured is insuring against. Other things being equal, this means that the greater the negative value and/or probability of a loss, the more expensive the premium. Insurers will not take on insurances that are very likely, unless the premium paid is so large as to approximate the prospective cost of the party seeking insurance.⁸

⁶ These values reflect the fact that insurance is here only assumed to cover part of the cost of being burglarized. Whereas it is a cost to pay for a service that turns out to be unnecessary (-5) this cost is therefore smaller than the cost of being burglarized (-10).

⁷ For a concise description of expected utility theory, see McCarty & Meirowitz (2007: 27-38). We here assume that the agent is not terribly risk-acceptant.

⁸ E.g., due to more intense and damaging extreme weather events in the Caribbean region (plus increased prospecting) during the last 15-20 years, it has become increasingly difficult to insure property along the coasts of Florida.

The merits of insurance are generally believed to be the following. First, as already mentioned, insurance can involve paying a manageable sum instead of risking an unmanageable cost. Moreover, by pooling resources, insurance schemes can collectively manage to take losses that would overwhelm any individual member of the insurance scheme. Secondly, by being a way of transferring risk, insurance schemes can limit the need of each individual to take costly individual action. Third, by being paid by predictable premiums, insurance represents a predictable cost which facilitates planning, in a way unexpected costs of risks that fall out badly do not. Fourth, since the premium is risk-based, there is normally an incentive for the insured to take preventive steps to lower his or her risk, as this will mean less expensive premiums. Thus, insurance provides a clear, self-interested reason to be prudent.

On the negative side, insurance is sometimes charged with leading to *moral hazard* (cf. Arrow 1971; Linnerooth-Bayer & Mechler 2006). The term moral hazard denotes that insurance might change the behaviour of the insured in problematic ways. According to *ex ante* moral hazard, the insured will be less concerned about avoiding risky behaviour because her potential losses are at least partly insured. According to *ex post* moral hazard, the insured raises her demands simply because there is now an insurance to cover them. A typical example is an individual who raises her demand on being healthy just because she has a health insurance, seeking treatment she would not seek otherwise. Other potential problems include *adverse selection* (only those at highest risk buy insurance) and *correlated risks* (simultaneous losses among the insured may exhaust the scheme's ability to cover losses) (Persson et.al. 2009: 138; Jagers & Stripple 2003).

Furthermore, from an ethical perspective there is always the risk that insurance systems are not sufficiently covering. The danger is that those in most need of insurance will not be able to afford insurance, precisely because their vulnerability translates into steep premiums. From an insurer's perspective, to insure such "uninsurable" individuals is simply a bad deal. Yet it might be precisely those people that we have the greatest obligation to insure. This problem is illustrated with particular vividness by climate change and the possibility to insure the least developed countries (LDC). We will return to this below.

III. Commercial insurance and Climate Change

The idea that insurance devices may play a significant part in a future climate change regime is given increasing attention (Mace 2006; Linnerooth-Bayer & Vári 2006; Persson et. al 2009). The UNFCCC makes some mention of insurance as an adaptation device. Article 4.8 states that parties are to give full consideration to actions that are necessary to meet the specific needs of developing parties that arise as a result of climate change. Among the actions that the parties in this respect is encouraged to consider is insurance.⁹ The reference to insurance is due to The Alliance of Small Island States (AOSIS), who proposed the creation of

⁹ Other actions that are mentioned are funding and transfer of technology.

an international insurance device to compensate damages from sea level rise (Linnerooth-Bayer & Mechler 2006). The Kyoto Protocol also mentions insurance. Article 3.14 of the Kyoto Protocol calls for the consideration of insurance as a climate change response (UN 1997).

The real breakthrough for insurance as a viable form of adaptation arguably happened with the enactment of the Bali Action Plan of 2007. Adaptation is there given greater priority, and insurance is explicitly mentioned as a mechanism of adaptation to be considered by the parties to the Convention. According to Persson et. al. there are in principle two reasons why a future climate change regime is likely to include some form of insurance mechanism.

“First, the [insurance] tool could conceivably help developing countries deal with emerging financial risks associated with climate change, and hence support adaptation. Secondly, there are significant barriers that are likely to prevent the development of a purely private sector climate insurance market that would provide, for instance, disaster support for developing country governments” (Persson et. al. 2009: 137)

In other words, because climate change presents risks, and because the developing world are unable to afford private insurance to manage those risks, there is a need to introduce some form of public insurance mechanism where the parties are to live up to their special responsibility to assist the least developed countries. Apart from this consideration, there also remain the general benefits of insurance. As Gurenko notes, to pool resources in a risk-sharing and risk-transferring system simply makes sense in the face of a risky future, because “for a fixed premium payment, countries can cap the amount of fiscal loss caused by natural disasters in the future” (2006: 602). Moreover, insurance provides clear incentives to manage risk; something that at times have been thought to be lacking when it comes to pure developmental aid (Hoeppe & Gurenko 2006)

Exactly how an insurance mechanism is to be designed and implemented remains very unclear. Many believe that they will build on public-private solutions, where insurance against the adverse effects of climate change is largely subsumed under insurance against extreme weather events. This in itself makes sense, because we cannot say, for any extreme weather event, whether it was caused by human GHG-emissions or happens for non-anthropogenic causes. But it is important to note that any insurance against the adverse effects of climate change will require us to relax the condition, so common within commercial insurance schemes, that one often cannot expect an insurer to cover a loss one has brought about recklessly or intentionally. In addition to these considerations, there are many unresolved issues concerning the administration of insurance, its composition, etc.

Here we will focus on the *normative* issues that pertain to insurance as an adaptive response. In particular, we will focus on the normative considerations that have to do with its *fairness*. We have argued elsewhere that the issue of fair climate change adaptation raises two principal questions: first, how the resources that are required to engage in adequate adaption is to be raised; and second, how those resources are to be allocated

(Jagers & Duus-Otterström 2008). Insurance as a form of adaptation represents a particular kind of answer to the second question. Resources are to flow to those who (a) are covered by insurance against events of a particular type, and (b) are hit by such events. There are more questions here, which we will return to below. But it seems to us that the more pressing question when it comes to insurance is the first one concerning fair burden sharing. We have argued that a fair scheme of burden sharing when it comes to the costs of adaptation is sensitive to both causal responsibility of the kind one has on the basis of polluting, and the relative ability to help that stems from being well off. In other words, we believe that fair burden-sharing will reflect a combination of the polluter pays principle and the ability to pay principle.¹⁰ The upshot is that there is a strong obligation on part of the wealthy, polluting developed countries to take a great portion of the burdens.

That a fully market-based insurance system would fail miserably to live up to these normative requirements should be apparent to all. It might nevertheless be instructive to see just how badly such a system would perform, because it provides us with clear suggestions or *criteria* as to on what points an insurance system would have to be altered.

As we have seen, a purely market-based insurance system will set premiums based on risk. The riskier someone's prospects are, the more costly the insurance. Moreover, since the insurers are private parties, the premiums will always cover expected costs in excess – a rational insurer, out to make a profit, will not accept insurance that is expected to bring about a loss. One of the signifying things about climate change is its *doubly unfair* nature. The most vulnerable countries are also those who are least developed and least responsible for climate change (see e.g. Paavola et al. 2006; Page 2006). Thus, climate change compounds already existing injustices by affecting the worst those regions that are already struggling, and therefore have difficulties adapting. To add insult to injury, those regions are - and even more so, will be - comparatively badly off as a consequence of the developed countries' excessive GHG emissions.

A market-based insurance scheme would only exacerbate this unfortunate situation, in particular if it were to become the dominant adaptation mechanism. The most vulnerable would face comparatively high premiums, which they presumably could not afford. Indeed,

¹⁰ See Jagers & Duus-Otterström (2008). Our debt here to Caney (2005) is undeniable. We believe that ability to pay, understood as relative wealth, is relevant in two ways. First, there is often a humanitarian obligation to assist that comes simply from the fact that one can assist. Secondly, it is difficult to imagine the emergence of a wealthy agent whose wealth is not largely dependent on once having polluted heavily. If we believe that historical emissions matter to current duties, it will not do to cite one's current low emissions as a reason to escape climate duties if one has a long history of causing the problem. So, if we restrict ourselves to states here, a future green state cannot escape climate duties if it has a grey past. On some versions of climate justice this might mean that one has a duty to lower one's emissions even though one is now under the pollution level. It may be so because one compensates one's past overuse of the commons by a period of underuse, possibly for reasons of "diachronic fairness" (Sher 1987). Historical responsibility is a very tricky idea, however, both in terms of its substance and its implementation (Caney 2006). It is arguably a good idea to mostly disregard pre-1990 emissions in a future climate architecture. For a defense of the appropriateness of taking account of historical emissions, see Gardiner (2004) and Neumeyer (2000). For a valuable treatment of the intergenerational issues of climate change, see Page (2006).

some regions may well be “uninsurable”, representing deals a private sector insurer would never agree to insure. This is because some countries are very likely to suffer from climate change in predictable ways. For example, it is predicted that low-lying countries such as Bangladesh and some Pacific island states will be severely affected from rising sea levels. Those countries can be seen as the equivalent of a 55-year old man with congenital propensity for heart disease who turns up at the insurance office, applying for a life insurance: it is a deal no commercial insurer will accept.

Meanwhile, since the developed countries appear less likely to be as badly affected by climate change - and are more able to cover their adaptive needs by themselves - they seem to have little reason to be part of an insurance pool. If they do choose to take part, their premiums may be comparatively low. The upshot is that a market-based insurance scheme might have too little funding to cover damages as they are felt in the developing world, or that it fails to include the wealthy at all. In either case resource redistribution from the developed to the developing countries is too scant to be fair. The unfairness is only exacerbated by the fact that the developed countries largely caused the problem in the first place by using a greater share of the atmosphere’s absorptive capacity than they are entitled to.

IV. Criteria for fair and feasible climate change insurance

A commercial model would fail on a number of grounds. It would leave uninsured those in most need of insurance, and it would not allow resources to flow from the Annex I to the non-Annex I countries. More specifically, it would not adhere to the normative demands that burden-taking should reflect a balance of ability and causal responsibility as grounding of obligations to assist, preferring instead to let each actor insure against its own losses based on the risks it faces. On the basis of what we have said earlier about fairness in adaptation and the commercial model’s failures, we can now identify a few principles that an attractive insurance scheme should adhere to: It should not stand alone as the only ingredient in an adaptation regime, nor should it fail to involve either the polluting countries that are able to insure themselves commercially or the least developed countries who cannot fend for themselves here. Furthermore, it should make resources flow from the former to the latter in a fair way, and make them flow in a clear and predictable way.

Let us here state these desiderata more explicitly. We believe they should govern the design of an insurance scheme when it comes to climate change. In the forthcoming section will use these desiderata to evaluate the attractiveness of one of the most current and complete insurance proposals to be negotiated during the COP15 meeting in Copenhagen later on in December, namely the proposal of the Munich Climate Insurance Initiative (MCII). We would argue that any plausible insurance scheme would have to:

- (a) *Play only a part in a larger set of adaptive responses.* Insurance should not exhaust the action pursued, but could play a part in a larger set of policies designed to adapt

the world to climate change. In particular, there is a moral imperative to prevent harm where we can, rather than to compensate for it. Moreover, some risks are hard to insure, such as slow onset or foreseeable risks. These risks should be adapted to in other ways.

- (b) *Include clear and equitable criteria for payouts.* Insurance against the adverse effects of climate change is often believed to involve insurance against extreme weather events. Whichever event is insured against (flooding, excess or lack of precipitation, hurricanes, etc.) there need to be clear criteria for when the insured is entitled to a payout from the insurance. There is a separate issue here as to whether the criteria should be (i) the incidence of a certain type of weather event or (ii) the harm caused to economic or human values as a consequence of that event.
- (c) *Entail substantial and fair redistribution from the developed to the developing world.* As argued above, climate change is doubly unfair in that those who are least in need of insurance are those who have primarily caused the problem. In order for an insurance scheme to be fair, it would have to entail that resources flow from these countries to the most needy countries in the developing world (in particular the LDC). It would furthermore have to make sure that the resources are raised in a fair way, i.e. in accordance with defensible ethical principles of burden-sharing.
- (d) *Cover as many countries as possible.* Assuming that we are here discussing country-level actors, an insurance scheme is better the more actors are involved. In concrete terms, an attractive climate insurance scheme would involve as many net-payers and net-beneficiaries as possible. In other words, the more developed countries are taking part to cover the insurance needs of a maximally large set of developing and least developed countries, the fairer the insurance system.¹¹

These principles do not exhaust the demands on an attractive insurance scheme, but they do point to some necessary features of it. In what follows we will evaluate how well the MCII proposal can be expected to meet in particular criteria (c) and (d), which both have to do with whether and to what extent the financially able and polluting part of the world assist the vulnerable and least responsible part of the world. The evaluation follows after a brief review of some previous insurance proposals and a more detailed description of the MCII proposal.

V. Insurance proposals

Given the shortcomings of fully market-based models, it is not surprising that an increasing number of proposals have been made concerning how the insurance scheme could be

¹¹ We say this while recognizing that some political regimes pose legitimate questions about whether any funding, climate change related or otherwise, should flow in their direction. This is because such funding may exacerbate human rights violations or other morally problematic action being undertaken by those regimes.

designed to include the most vulnerable in an effective and fair way. Some are already in practice, such as a variety of *micro-level* programs, mainly offering help to establish public/private safety nets, e.g., in the form of collecting and disseminating weather data, financing risk assessments, investing in weather station infrastructure, or supporting delivery systems (MCII 2008: 22). Such support is provided to farmers, property holders and smaller businesses, but also systems aimed at transferring risks that governments are facing, e.g., in relation to the international capital market. Examples highlighted in the literature (see Linnerooth-Bayer *et al.* 2006 and 2009 for broader reviews) are support to index-based crop and livestock insurances in Malawi and Mongolia (Suarez *et al.* 2007; Hess and Syroka 2005), property insurances in Turkey (Gurenko *et al.* 2006), a regional catastrophe insurance pool for vulnerable island states in the Caribbean (Ghesquiere *et al.* 2006) as well as a catastrophe bond issued by the Mexican government (Cardenas *et al.* 2007).

There are also proposals of more *macro-level* oriented systems. One example is the Climate Impact Relief Fund (CIRF), which - contrary to the original AOSIS insurance proposal from 1992, which only addressed gradual sea-level rise – also comprises sudden weather events such as floods and hurricanes (Müller 2002). According to this proposal, the fund ought to be regularly funded by Annex II countries that should contribute in proportion to their current average post-disaster assistance spending and administered by UNFCCC.

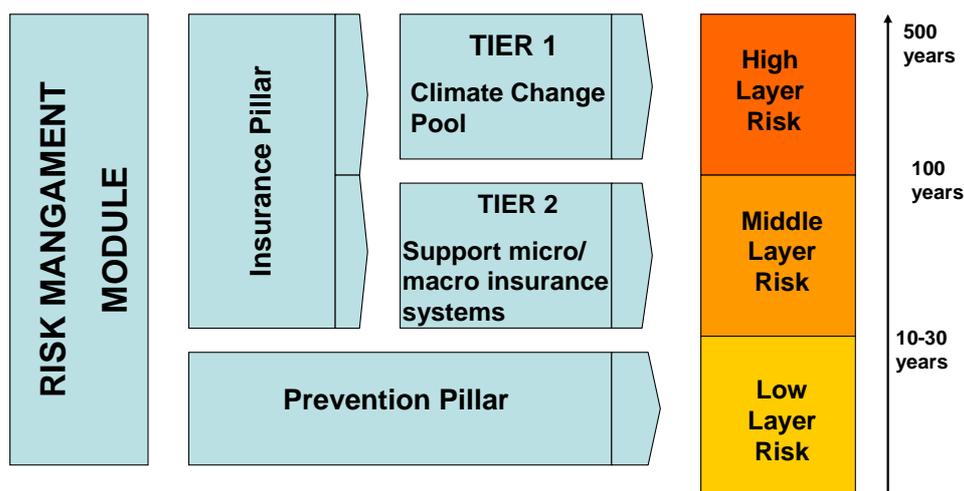
Another example is the so called Germanwatch proposal of a Climate Change Funding Mechanism, building on both the AOSIS and the CIRF proposals. The guiding idea is a global catastrophe insurance system financed by the developed countries and administered by a public/private body. The primary aim of the insurance would be to cover costs caused by climate change, mainly in the form of damage to public infrastructure in the least developed countries (Bals *et al.* 2006).

The last example, the Swiss submission to COP12 in Nairobi 2006, is a complex and ambitious proposal covering several aspects of risk management. It is based upon a national Climate Change Fund and a Multilateral Adaptation Fund where the latter is based upon two pillars, one focusing on prevention and the other one on insurance (Linnerooth-Bayer *et al.* 2009).

In this paper we are, however, particularly interested in a proposal developed by the Munich Climate insurance Initiative (MCII), which partly draws on the Swiss submission to COP12. The MCII model is the most updated one we have found in the literature. It is furthermore explicitly adapted to the UNFCCC demands expressed in Article 3.1. of the Framework Convention (Linnerooth-Bayer *et al.* 2009) stating that “Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities”. Just like the Swiss submission and as illustrated in figure 2, the MCII proposal is a risk management module consisting of two pillars, one founded on insurance and one on prevention.

The proposal is based on the assumption that adaptation funding will be available to pay for the necessary cover for participating (developing) countries (MCII 2008: 11). The insurance pillar is materialized through two Tiers. Tier 1 is a climate Insurance pool and Tier 2 primarily refers to *support* for micro and macro insurance systems. Tier 1 aims at coping with so called High level risks while Tier 2 is designed for Middle level risks. The Prevention pillar, in the bottom of the figure, solely targets Low level risks that can be gradually dealt with via more traditional adaptation such as fostering vulnerability-reducing investments, improvements in physical systems (e.g., flood defenses), shifts in social systems (e.g., relocation of livelihoods) and mitigation of underlying vulnerabilities (e.g., improving productivity which enables savings for future disasters) (cf. Linnerooth-Bayer *et al.* 2009: 393). High level risks refer to risks that exceed the ability of any country to pay in case an extreme event is occurring. Middle level risks are assumed to be within the ability of a single country – given that a well functioning facilitating framework is in place.

Figure 2. The MCII Proposal



Comment: Figure 1 is compiled from (1) Warner, K. (2008) *Insurance Instruments or Adaptation to Climate Risks: Moving towards Copenhagen*. Presentation held at the 4th AWG-LCA 4 Workshop in Poznan, and (2) Munich Climate Insurance Initiative (MCII) (2008) 'Proposal to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA). International Insurance Mechanism: A proposal for the Copenhagen Agreed Outcome. Submission to the UNFCCC on 6 December 2008. 4th session of the AWG-LCA, Poznan, 1–13 December', 2008 (from unfccc.int/resource/docs/2008/smsn/ngo/033.pdf, accessed 14 April 2009).

Tier 1 of the insurance pillar is designed as a Climate insurance Pool (CIP). By pooling the risks across the developing countries qualified for the scheme, considerably less capital is needed compared to a situation where each country must raise its own capital for dealing with catastrophic events. The CIP is supposed to cover an agreed proportion of a pre-defined high layer of risk in eligible countries. In principle, the scope of the CIP can be rather

comprehensive and range over, e.g., public and private property, infrastructure as well as lives and livelihoods. According to some of the founders of the MCII-model, the measure triggering system (indemnity or index-based) will “be based on negotiated criteria of risk and vulnerability, as well as an independent and objective assessment to ascertain that the event is, in fact, extraordinary in the statistical sense that it lies in the extreme percentile of the historic distribution and that country governments and their citizens would have difficulty coping with these events” (Linnerooth-Bayer *et al.* 2009: 394-95).

This means a rather strong protection for the vulnerable and poor countries, and the protection does not decrease with worsened climate change. In fact, quite the contrary is true: the payout trigger for a country (e.g., a certain type of cyclone) does not change with frequency. Thus, if intensified climate change generates more such cyclones, the result will be that the claims on the CIP increases, which simultaneously indicate that the costs for the countries obliged to pay to the CIP, will increase over time.

As of yet, the financing of Tier 1 is neither fully elaborated in the actual proposal, nor in subsequent comments of it. The documents are loaded with suggestions ranging from a financing system guided by historical responsibility to more complex variants based upon multiple principles. In the original MCII-proposal we thus find statements such as: the proposal ought to “be financed by annual contributions from the (proposed) multi-lateral adaptation fund” (MCII 2008:16) and “While the exact formula of contributions and disbursements of an enhanced adaptation fund is yet to be determined, there is a growing consensus...//..that adaptation funds will be raised according to common but differentiated responsibilities and respective capabilities of countries...//..which can be translated into criteria such as ‘ability to pay’ and ‘polluter pays’” (MCII 2008: 16). In their recent elaboration to the proposal, Linnerooth-Bayer *et al.* add on by establishing that “the CIP will be fully paid out of a negotiated financial mechanism, and presumably by those countries that have contributed to losses in the developing world owing to their emissions of greenhouse gases” (Linnerooth-Bayer *et al.* 2009: 395).

Finally, and as touched upon earlier, provision of premium free insurance is typically associated with risk for moral hazard. In the case of CIP, the risk is especially associated with *ex ante* moral hazard. It can, however, be argued that the CIP, if designed properly, can encourage risk-reduction by letting the pay-outs be based on things such as payment according to a pre-determined portion of losses, and by linking eligibility to certain compliance criteria (preferably connected to the prevention pillar in the bottom of figure 2). As a matter of fact, because of the possibilities to link the pay-outs to such criteria, the CIP is probably more successful in preventing moral hazard than for example traditional post-disaster aid.

Tier 2 is a Climate Insurance Assistance Facility (CIAF). This means a middle risk-layer entity which is not aimed at providing insurance per se, but to provide *assistance* for setting up insurance programs such as by supplying capacity building and technical support. This can include collection and dissemination of weather data, financing risk assessments, investing in

weather station infrastructure, or supporting delivery systems. All of these are examples of public goods expenditures that would hardly be sufficiently provided were the market forces to rule alone. In addition, the CIAF might provide more direct support by offering brokering pooling and reinsurance arrangements. As established in the MCII-proposal, Tier 2 could directly enable the poor to participate, if deemed appropriate, through targeted support and minimally-distorting subsidies that would not crowd out private incentives for wider market segments (MCII 2008: 21ff). As we established in the introduction to this section, there are already some, micro-level, examples of insurance projects (e.g., in Malawi and Turkey) backed up with this kind of supporting facilities.

The matter of financing, and who should take what costs, is difficult to unpack also in the case of Tier 2. First, the *scope* of the financing is uncertain and reasonably dependent on factors such as the number of countries involved and the scope of capacity building. If the activities are limited to things such as risk assessments, data dissemination and capacity building, it goes without saying that the CIAF could operate at a rather slim budget. However, providing support by absorbing layers of the risk (like a solidarity entity) and “enabling the poor to participate through more direct support” (MCII 2008: 24) considerably greater funding would be required. Second, any actual insurance capital should, as far as we understand, be generated and provided on a national basis and the ideal to “enable the poor to participate” need to both be “deemed appropriate” and should take place via “targeted support” and through “minimally-distorting subsidies that would not crowd out private incentives for wider market segments” (MCII 2008:9). In Linnerooth-Bayer (2009: 396) it is added that “the facility might in exceptional cases subsidise premiums but in ways that minimally distort incentives so as not to discourage risk-reduction activities”, i.e., activities belonging to the prevention pillar in figure 2. As we read this, the proposal is facing a difficult balancing here. On the one hand it is important to target those who cannot afford the price of insurance. On the other hand it is both (a) important to ensure necessary conditions for private insurance provision through competitive markets. Meanwhile, however, Tier 2 must not (b) lead to *ex ante* moral hazard. We return to this matter in the next section.

Discussion of the MCII

Recall the principles we previously argued that an attractive insurance scheme should satisfy: It should (a) be only one part of a larger set of adaptive responses to climate change, (b) include clear and equitable criteria for payouts, (c) entail substantial redistribution from the developed to the developing world, and (d) involve as many countries as possible. As will be demonstrated, the MCII-proposal satisfies several of our four criteria and, needless to say, fares much better than a purely commercial model.

With regard to principle (a), the MCII proposal explicitly recognizes that insurance can only play a part of a larger set of adaptive responses. This is evident by the fact that the proposal’s “multi-lateral adaptation instrument” includes a prevention pillar and an

insurance pillar. In particular, it plausibly holds that foreseeable and slow onset climate impacts such as desertification and sea-level rise are not suitable for insurance (MCII 2008: 11).

Furthermore, the MCII goes *some way* to address concerns about principle (b), the demand to include clear and equitable criteria for payouts. It here makes a difference between the aforementioned Tier 1 and 2. In Tier 1, the proposal favours parametric index-based triggers: it envisions that the insurance will pay claims “based on the measurement of the intensity of a pre-defined natural event in a pre-defined area over a pre-defined period, up to a certain pre-determined limit per year” (MCII 2008: 27). In other words, insurance should be paid out based on some natural event reaching some pre-defined trigger level, e.g. rainfall reaching a certain level. There are, however, certain issues that need to be discussed here: For one thing, the proposal may face so called sorites-type objections.¹² We would argue that such concerns point exactly to the merit of using objective, definitive triggers. Equally philosophical in nature and more worrying, someone might argue that what we insure against is not an *event* but its *effects*; and if a hurricane causes no harm, then insurance should surely not be paid out. While it is in principle correct that harm should be the basis of pay-outs, the objective trigger approach represents a useful proxy for such harm. It also reduces costly surveillance, as the basis for pay-out is now relatively easily verified weather events.

What about Tier 2? This package is not aimed at providing insurance but only facilities necessary for insurance to emerge within the least developing countries. This position is substantiated in the following two arguments: First, if also Tier 2 contains externally financed insurance capital and premiums, these subsidies are risking crowding out private incentives for wider market segments. Second, such subsidies are also risking distorting developing countries’ propensity to adopt different risk-reduction activities. While sensible in essence, there is, however, a manifested risk that such defence of cost-efficiency, or worse – vindication of market opportunities – are taking precedence over issues related to human need, vulnerability and suffering. The same is basically the case regarding developing countries’ inclination to carry out preventive adaptation: The value of high morals must here be weighted against the risk that people in developing countries will be (physically, socially and/or economically) hurt by climate related factors – either because of predispositions such as having the brute (un)luck to be born in particularly weather sensitive regions, or because people elsewhere, both spatially and temporally, have emitted large amounts of GHG.

When it comes to criteria (c) and (d), we should note that the MCII proposal explicitly admits that it has not closely considered the way adaptation resources are raised. It only assumes that they will be sufficient (MCII 2008: 12) and merely points to some possible

¹² Sorites paradox is typically illustrated by the question of how many grains of wheat make a heap. It could similarly be argued that 1 millimeter of rain, give or take, makes no difference to whether there is an extreme rainfall or not. But then the same would seem to hold of 2 millimeters, and so forth.

principles of burden-sharing (ibid. 16).¹³ This means that our task here is twofold: on the one hand, we will suggest the likely burden-sharing that the proposal as it stands will lead to; on the other hand, we will suggest ways in which the proposal could be amended to make sure that principles (c) and (d) are met.

MCII's Tier 1 is essentially pure post-disaster assistance – it involves premiums being paid for by the developed countries (or similarly able actors). The only reason the proposal recommends insurance as opposed to donor-aid is that insurance is here believed to have positive consequences, such as encouraging risk-reducing action on behalf of the non-Annex I countries, which, the proposal envisions, will not pay premiums but are expected to engage in risk-management in order to be eligible for pay-outs. That means that the proposal satisfies principle (c): it involves substantial transfer of resources from Annex I to non-Annex I countries. Exactly how those resources are raised is unclear, however.¹⁴ We will therefore suggest a clear way forward in this respect:

We would suggest that contributions to the CIP are to be governed by a function which takes into account a country's historical and present pollution and financial wealth. A useful starting point here is the RCI ("Responsibility and Capacity Indicator") formula that has been developed by the Greenhouse Development Framework. The RCI calculates countries' share of the global burden to take costs associated with responding to climate change. It is country based but crucially allows for income distribution *within* countries to affect the allocation of burdens, thus capturing the plausible intuition that a wealthy and polluting individual has a greater obligation than a poor and non-polluting one, regardless of where he or she may live. As unpacked by Baer et.al. (2008), the RCI is calculated by multiplying a country's responsibility and its ability, or "capacity". A country's *responsibility* is its global share of cumulative per capita emissions of CO₂ from fossil fuel consumption since 1990. Its *capacity* is its global share of citizens whose income is above a "development threshold", designed to capture where people can relinquish "luxury" resources without tampering with resources that are necessary in order to lead a decent life. Responsibility and capacity can be weighted differently so as to account for that we may find, say, capacity of greater moral importance than responsibility.

The RCI is calculated by the following formula: $RCI = R^a \times C^b$ where R stands for responsibility and C for capacity (as defined above), and a and b are the weights attached to the respective components, where it is assumed that $a + b = 1$. We attach equal weight to responsibility and capacity by making $a = 0.5$ and $b = 0.5$.¹⁵ The RCI formula produces a

¹³ Indeed, MCII recognizes that the question of who pays for the coverage is a question which should be addresses at Copenhagen (MCII 2008: 31)

¹⁴ The proposal mentions a) that premium payment would be sufficient to cover the annual costs of the insurance scheme, and b) that the resources are to be raised according to the (very loose) principle of "common but differentiated responsibility". It here entertains that ability or level of pollution might set the level of payment (MCII 2008: 16, n12).

¹⁵ Baer *et al.* (2008) set a at 0.4 and b at 0.6 in order to up the importance of capacity.

number between 0 and 1 and can thus be taken to give the percentage of global climate change efforts that is owed by a particular agent.¹⁶

Useful as the RCI is, it should be noted that it only provides a way of calculating a country's share of the global cost to respond to climate change. It thus piggybacks on some independent account of *how large the global cost ought to be*. It follows that, were it to regulate contributions to the CIP for example, we would need to have an estimate for how much money should go in to the pool in the first place, because only then could we apportion duties to the various states. It should be noted that the RCI is intended to break the analytically problematic and increasingly outdated country based division between Annex I countries, who are expected to shoulder burdens, and non-Annex I countries, who are exempted from them (Baer et.al. 2008).

The RCI thus requires a way of determining how much money, totally speaking, should be transferred into the insurance pool. This sum would naturally be the annual cost required to cover the actual costs associated with climate change. An alternative way is to find a way of making each contributing country liable to a predetermined annual sum to the pool. The risk of such a system, however, is that the transferred sums may turn out to be insufficient to cover the actual costs of future extreme weather events.

Though there are many resolved issues here, we believe that the RCI, or something equivalent, can regulate burden sharing within Tier 1 and 2. More problematic than the principles of burden-sharing is perhaps the issues that are raised in relation to the Tier 1 and 2 split. As we have seen, Tier 2 is proposed to cover some costs associated with so called Middle level risks. These risks, as we understand them, are defined substantially (they are such that developing countries, given the right support, can afford insurance) and temporally (they will happen within the next hundred years). The way MCII is designed, there are two concerns with Tier 2.

First, it is not obvious why more distant climate change-related risks are morally different from more proximate ones. It could be argued that it is equally unfair for a non-responsible country to take insurance related costs for a problem that materializes in five years as when it strikes in 50. Barring some inherently contentious social discount rate (cf. Caney 2009) which the MCII proposal does not supply, there seems to be little reason, if some distant costs are covered by Annex I countries in Tier 1 because of their ability and responsibility, that they should not take the costs associated with insurance against more proximate Middle level risks in Tier 2.

The obvious response to this idea may be that the difference between High and Middle level risks is precisely that the developing countries *can* afford to insure against the latter but not the former. But from the fact that they can afford it does not follow that they *ought* to pay. Surely considerations of fairness propel us towards the view that able and wealthy

¹⁶ For examples of the RCI being calculated for various countries, see Baer *et al.* (2008: 657-58). The formula produces numbers between 0 and 1 provided that percentages are expressed in decimals.

should provide premium-free insurance for Middle level risks too. In particular, we fail to see why the temporal perspective is of relevance here.

A second concern of Tier 2 is that it might, as far as we can see, actually worsen a country's prospects of affording insurance. A large part of the services associated with Tier 2 seems to involve technical support of the informational variety. Also here we fail to see why such information would automatically *improve* the chance of getting access to affordable insurance. After all, better forecasting might only alert insurers that a country in fact faces a bleaker future than have previously been assumed. There is an analogue here to the debate around the insurance industry's access to genetic data about individuals: This kind of information is widely held to worsen some individuals' prospects of getting insured, e.g. because it reveals some genetic predispositions to diseases that raise the premium of insurance (cf. Buchanan et. al. 2001). Structurally, similar problems could surely happen when it comes to risks of climate change too. Because of this problem, we argue that, in cases where the MCII scheme's activities actually raise a country's premiums, it owes that country compensation. Most fair would perhaps be to then move that cost over to Tier 1, and thus let the responsible and wealthy countries absorb it.

The discussion so far has concerned fairness-related issues that belong to the third of our principles: i.e. whether the proposal means substantial and fair redistribution of resources from the developed to the developing world. We have argued that it may well satisfy this principle, but we have raised some concerns about the details of the proposal. With regard to the principle (d) that an attractive insurance scheme should cover as many actors as possible – both net-payers and net-recipients – it suffices to say that the MCII may well satisfy this criterion. The proposal certainly aspires to cover all countries. Whether it would in practice is, as always, a matter of how the political game plays out, but there is at least nothing in the proposal as such which encourages or suggests a regime which is less than comprehensive in scope.

To sum up, our analysis reveal that the MII proposal fulfil both our first criterion, the one saying that insurance should only play a part of a larger set of adaptive responses and the forth one emphasising the importance of an insurance scheme covering as many countries as possible. The second criterion, i.e., the demand that the model should include clear and equitable criteria for payouts is partly being met: Although risking meeting objections from someone being theoretically schooled, the criteria for payouts in Tier 1 are relatively straight forward. Regarding Tier 2, the situation is partly different. At least the proposal has to struggle with a difficult act of balance between cost-efficiency and high morale on the one hand and human wellbeing on the other hand. Finally, the third criteria suggested that substantial and fair redistribution from the developed to the developing world should be entailed. This is certainly fulfilled in regard to Tier 1 (even though it remains unclear how the capital is to be raised). Tier 2 is more problematic. First, we are not convinced about its temporal foundation. Second, the way we see it, there is actually a risk that vulnerable developing countries will be *less* well off, because if its current design of not offering insurance but only insurance facilities.

V. Insurance as sensitive to responsibility, ability and vulnerability.

Though the MCII proposal has a lot of merits, going a long way to correct the flaws of a commercial model when it comes to insurance against climate change, there are also some remaining niggles and worries. We have raised two concerns about the proposal. On the one hand, we have pressed the need to be explicit about the way resources are raised in the two Tiers. Unless they are raised in a way that is perceived as fair, there is little hope of winning the voluntary support of the negotiating parties. The best way of a proposal to be perceived as fair, one can assume, is for it to actually *be* fair. We have suggested one way resources can be raised that takes into account causal responsibility and ability. On the other hand, we have failed to see what the moral difference is between what MCII refers to as High and Middle level risk. Middle level risk is regulated by Tier 2, and as far as we can see, this means that the costs of insurance for these risks to a large extent will be borne by those in need of insurance.¹⁷ Yet, it is not obvious why the Middle level risks, unlike the High level risks, should be borne by the developing world. In both cases, the issue is harm in which those who suffer it are the least responsible. The obvious answer on behalf of the MCII is of course that the non-Annex 1 countries *can* afford to insure against Middle level risks, if only the insurance pillar enables them.¹⁸ But it does not follow from the fact that a country *can* take a cost that they *will* also take it (and there are certainly large variations in the ability to take costs within the group of non-Annex 1 countries too).

The major risks the MCII proposal and any proposal like it face in negotiation are easily identified. The natural source of disagreement is likely to be the size of the transfer from Annex 1 to non-Annex 1 countries. If the transfer is sizeable – for example because Annex 1 countries are to subsidize premiums for Middle Level insurance as well – the net-payers can feel that they are expected to take more than their share of the costs. If, on the other hand the transfer is relatively small, the net-recipients may well feel that the assistance is insufficient to cover their needs, in particular since the current problem is largely not their fault.

Perhaps the core issue at stake here can be said to boil down in a trade-off between a maximally fair insurance model and one which is somewhat fair while also relatively feasible. From a purely normative standpoint, much speak in favour of a position claiming that basically all costs of adaptation – either preventive or insurance-based - at least for countries in the LDC group, should be borne by Annex 1 countries (cf. Jagers & Duus-Otterström 2008). This goes for any low, middle or high level risk, which can be associated with anthropogenic

¹⁷ Linnerooth-Bayer et. al suggests that that in Tier 2, annex I countries will subsidize premiums only in “exceptional cases” (2009: 396)

¹⁸ The same reasoning of course holds when it comes to Low Level Risks. The MCII proposal merely assumes that developing countries can take the costs of them, provided that they happen in spite of the work conducted in the Prevention Pillar. (MCII 2008: 15)

climate change. That would perhaps be rather costly¹⁹, however, and is thus unlikely to win the consent of the Annex 1 countries. It may be, therefore, that the MCII proposal is on to something when it recognizes that the developing world should pay themselves for some of their insurance. At least it appear reasonable that the developing countries should be obliged to do whatever they can to make use of the prevention pillar. The question remains whether such a deal can win the consent of the non-Annex 1 countries, who may find themselves short-changed. This is not the first time, nor is it likely to be the last, when the problem has partly to do with *incompatible standards of fairness*.

References

- Adger, N.W., J. Paavola & S. Huq, 2006: »Toward Justice in Adaptation to Climate Change«, in *Fairness in Adaptation to Climate Change*, edited by N.W. Adger, J. Paavola, S. Huq, & M.J. Mace, Cambridge, MA: MIT Press
- Arrow, Kenneth, 1971: *Essays in the Theory of Risk- Bearing*. Chicago: Markham
- Baer, Paul, 2006: "Adaptation: Who Pays Whom?", in *Fairness in Adaptation to Climate Change*, edited by N.W. Adger, J. Paavola, S. Huq, & M.J. Mace, Cambridge, MA: MIT Press
- Baer, P., Fieldman, G., Athanasiou, T. & Kartha, S., 2008: "Greenhouse Development Rights: towards an equitable framework for global climate policy", *Cambridge Review of International Affairs*, 21: 649-669
- Buchanan, A., Brock, D. W., Daniels, N. & Wikler, D., 2001: *From Chance to Choice. Genetics & Justice*. Cambridge: Cambridge University Press
- Caney, Simon, 2005: »Cosmopolitan Justice, Responsibility, and Global Climate Change«, *Leiden Journal of International Law* 18: 747-75.
- Caney, Simon, 2006: »Environmental Degradation, Reparations, and the Moral Significance of History«, *Journal of Social Philosophy*, 37 (3): 464-82.
- Caney, Simon, 2009: "Climate Change and the Future: Discounting for Time, Wealth, and Risk", *Journal of Social Philosophy*, 40: 163-86.
- Gardiner, Stephen M., 2004: "Ethics and Global Climate Change", *Ethics* 114: 555-600.
- Gurenko, Eugene N., 2006: "Introduction and Executive Summary", *Climate Policy* 6: 600-606
- Hoepe, P. & Gurenko, E. N., 2006: „Scientific and economic rationales for innovative climate insurance solutions“, *Climate Policy* 6: 607-20
- Jagers, S.C. & Duus-Otterström, G., 2008: "Climate Change Responsibility. On Moral Divergences between Adaptation and Mitigation", *Environmental Politics*, 2008 (17): 576-591

¹⁹ Everything is, however, relative. Figures in Linnerooth-Bayer *et al.* (2009:395) suggest that, at current risks, the annual allocation to the CIP in Tier 1 range from about US\$5.1 billion to somewhere around US\$8 billion. These figures should be compared with the over US\$60 billion insured loss from the single event of Hurricane Katrina in 2005.

- Jagers, S.C. & Stripple, J. 2003: "Climate Governance Beyond the State", *Global Governance*, 9(3), 385-399.
- Linnerooth-Bayer, J. & A. Vári, 2006: »Extreme Weather and Burden Sharing in Hungary«, in *Fairness in Adaptation to Climate Change*, edited by N.W. Adger, J. Paavola, S. Huq, & M.J. Mace, Cambridge, MA: MIT Press.
- Linnerooth-Bayer, J. & Mechler, R. 2006: "Insurance for assisting adaptation to climate change in developing countries: a proposed strategy", *Climate Policy* 6: 621-636
- Linnerooth-Bayer, J., Warner, K., Bals, C., Höpfe, P., Burton, I., Loster, T. & Haas, A. (2009): "Insurance, Developing Countries and Climate Change", *The Geneva Papers*, 34, 381-400
- Mace, M. J. 2006: Adaptation under the UN Framework Convention on Climate Change: The International Legal Framework", in *Fairness in Adaptation to Climate Change*, edited by N.W. Adger, J. Paavola, S. Huq, & M.J. Mace, Cambridge, MA: MIT Press
- McCarty, Nolan & Meirowitz, Adam, 2007: *Political Game Theory*. Cambridge: Cambridge University Press
- Munich Climate Insurance Initiative (MCII) (2008) 'Proposal to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA). International Insurance Mechanism: A proposal for the Copenhagen Agreed Outcome. Submission to the UNFCCC on 6 December 2008. 4th session of the AWG-LCA, Poznan, 1–13 December', 2008 from unfccc.int/resource/docs/2008/smsn/ngo/033.pdf, accessed 14 April 2009.
- Neumeyer, Eric, 2000: "In Defence of Historical Accountability for Greenhouse Gas Emissions", *Ecological Economics* 33: 185-92
- Paavola, J. & W.N. Adger, 2006: »Fair Adaptation to Climate Change«, *Ecological Economics* 56: 594-609.
- Paavola, J., W. N. Adger & S. Huq, 2006: *Multifaceted Justice in Adaptation to Climate Change*, in *Fairness in Adaptation to Climate Change*, edited by N.W. Adger, J. Paavola, S. Huq, & M.J. Mace, Cambridge, MA: MIT Press.
- Page, Edward A., 2006: *Climate Change, Justice, and Future Generations*. Cheltenham: Edward Elgar
- Persson, Å. Klein, R. J. T., Siebert, C. K., Atteridge, A., Müller, B., Hoffmaister, J., Lazarus, M. & Takama, T., 2009: *Adaptation Finance under a Copenhagen Agreed Outcome*. Research Report: Stockholm Environmental Institute. Available online at [http://sei-international.org/mediamanager/documents/Publications/Climate-mitigation-adaptation/Equitable approaches to mitigation and adaptation/adaptation-finance-copenhagen.pdf](http://sei-international.org/mediamanager/documents/Publications/Climate-mitigation-adaptation/Equitable_approaches_to_mitigation_and_adaptation/adaptation-finance-copenhagen.pdf)
- Sher, George, 1987: *Desert*. Princeton: Princeton University Press
- UN, 1997: Kyoto Protocol to the United Nations Framework Convention on Climate Change
- Warner, K. (2008) *Insurance Instruments or Adaptation to Climate Risks: Moving towards Copenhagen*. Presentation held at the 4th AWG-LCA 4 Workshop in Poznan.