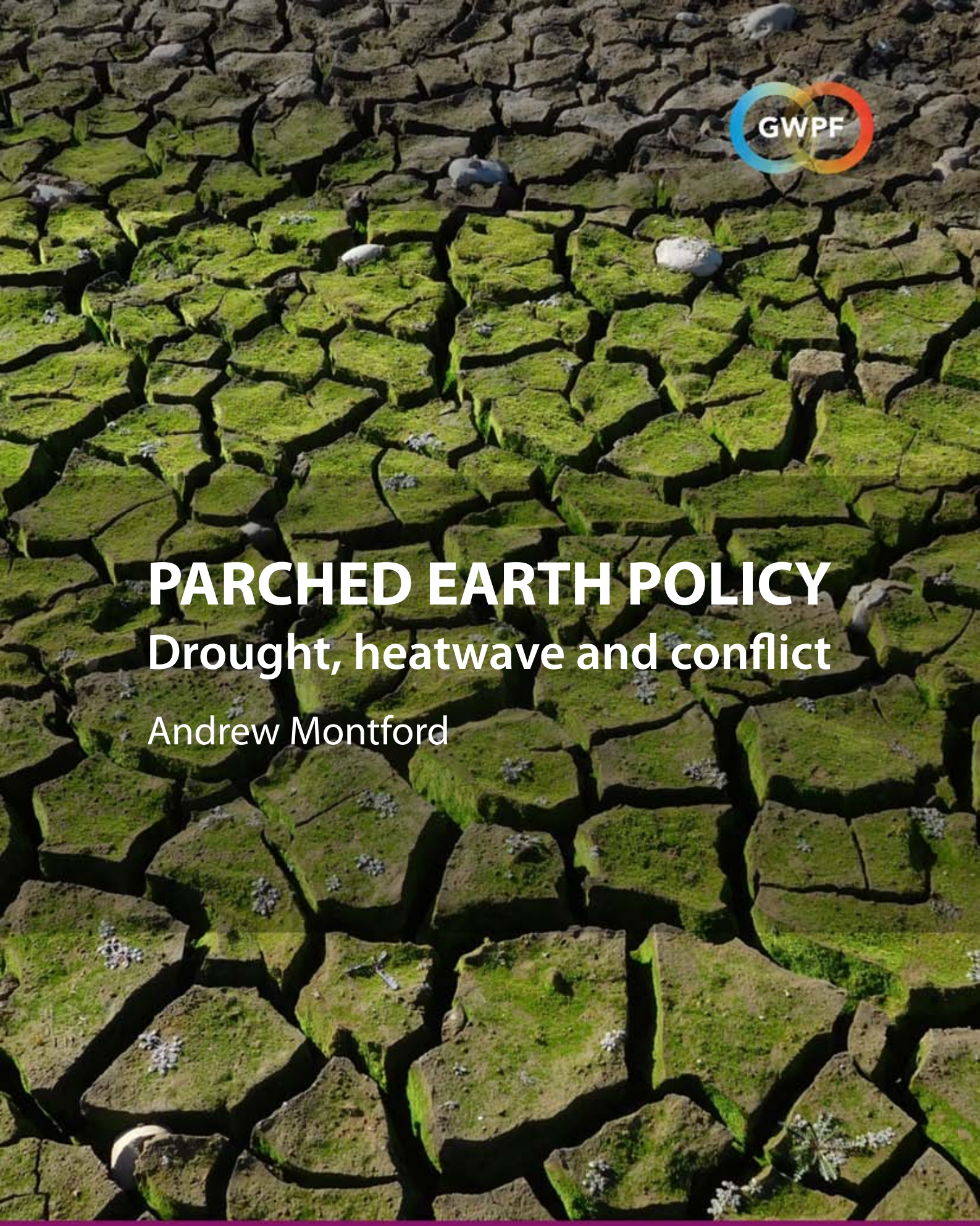

PARCHED EARTH POLICY

Drought, heatwave and conflict

Andrew Montford

The Global Warming Policy Foundation

GWPF Briefing 21

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About the author

Andrew Montford is a writer and blogger specialising in climate change issues and is best known as the author of *The Hockey Stick Illusion*. He is the author of several reports for GWPF, including its first one, on the Climategate inquiries.

1 Drought and heatwaves

The British Isles have always suffered from episodes of drought. Environmentalists have claimed that manmade global warming has created an increased risk that such events will be experienced more often in future, both in the UK and overseas. This paper examines the credibility of such claims. It will also look at whether drought causes war and conflict and the parallel issue of heatwaves and their related death toll.

2 Scientific background

There are several different types of drought. In considering how this aspect of the climate is changing, it is important to understand the distinctions. The website of the UK Groundwater Forum has a useful summary:

> …a distinction may be drawn between meteorological droughts (defined essentially on the basis of rainfall deficiency), hydrological droughts (where accumulated shortfalls of runoff or aquifer recharge are of primary importance) and agricultural droughts (where the availability of soil water during the growing season is the critical factor).[1]

Most of the UK enjoys generous rainfall for most of the year and in fact it is mainly the south-east of England where meteorological drought causes problems on a regular basis. However, this tends to cause fewer problems to society than might be expected because of the use of groundwater, which is extracted from underground aquifers, and which can maintain a flow of clean water even during prolonged dry spells.

Clearly there are frequent problems with water supply over the summer months, but it is important to recognise that weather and climate are only one of the contributory causes. The dense population of the southeast of England, the relatively limited scope for water storage, and leakage from water pipes are also important. Any claims about drought and global warming need to be analysed in the light of such considerations.

3 Drought history

In the UK

For as long as there have been records of the weather in the British Isles there have been records of drought. There have been some lengthy dry periods, most notably the 'long drought' of 1890–1910.[2] However, as an important study on the history of UK drought makes clear, there is little sign in the records of any increase in the UK's

tendency to drought (see Fig. 1). The short dry periods in the late twentieth century are dwarfed by the decades-long droughts that afflicted the country in the previous century.

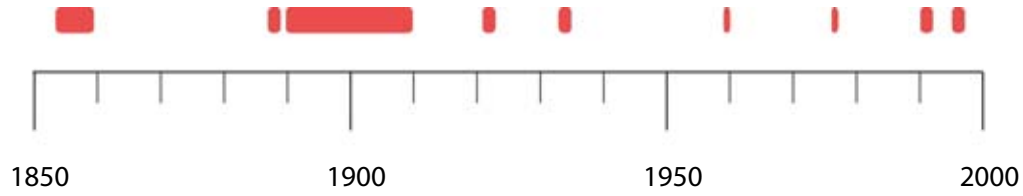

Figure 1: Drought periods in recent UK history

Data per Marsh et al 2008

Global

Evidence that droughts have become more prevalent on a global scale is equally hard to come by. Despite this, there have been some heroic attempts to claim otherwise.[3] In particular, in 2007 the Fourth Assessment Report the Intergovernmental Panel on Climate Change (IPCC) declared that droughts had become more common worldwide, although since that time it has resiled from this position. The Fifth Assessment Report of 2013 noted that academic studies in the area were giving conflicting results and concluded that it was very hard to say if there had been any changes in drought levels worldwide at all:

> Confidence is low for a global-scale observed trend in drought or dryness (lack of rainfall) since the middle of the 20th century, due to lack of direct observations, methodological uncertainties and geographical inconsistencies in the trends.[4]

There are few signs that any clear picture will be forthcoming in the near future. Since the time of the Fifth Assessment, a new study by scientists at the University of California found, if anything, a slowly declining trend in drought since 1982 (see Fig. 2).[5]

With evidence of any change thin on the ground, the IPCC has found it equally difficult to attribute blame to humankind, concluding that at a global scale it was almost impossible to say anything about an anthropogenic influence:

> …there is low confidence in detection and attribution of changes in drought over global land areas since the mid-20th century.[6]

For those looking for evidence to support positions of climate alarm, the IPCC offered only a few crumbs of comfort, noting that there had been changes in drought levels in particular regions. However, it also suggested that these were not outwith the very wide range of natural variability.

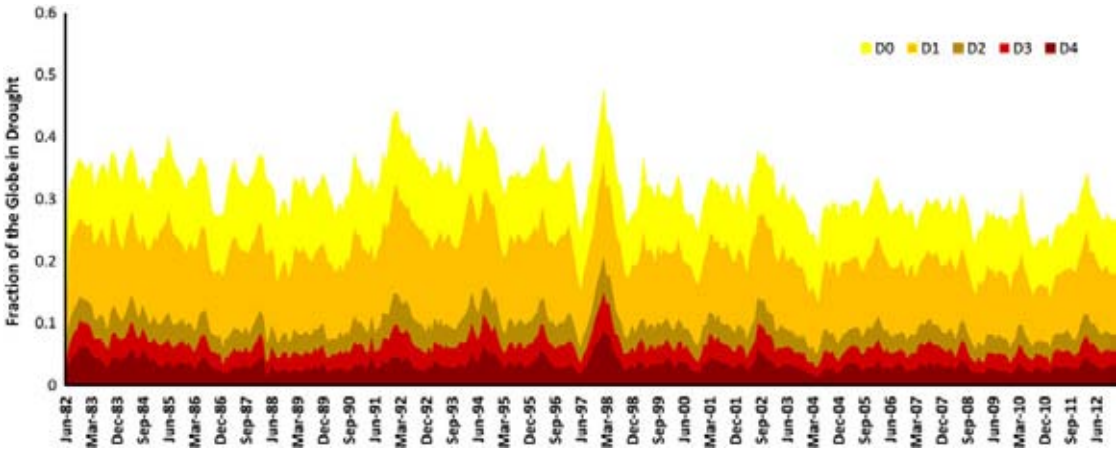

Figure 2: Trends in worldwide drought 1982–2012

D0 (abnormally dry), D1 (moderate), D2 (severe), D3 (extreme), and D4 (exceptional)

These sorts of scientific difficulties have not prevented some groups from trying to make explicit or implicit claims linking drought events to global warming. A 2011 report in the *Guardian* claimed that 'Drought in east Africa the result of climate change and conflict', a position that turned out to be based on the impressions of aid workers in the area.[7] Droughts in the Amazon are also said to be the result of climate change.[8]

The recent drought in California has also been repeatedly linked to manmade climate change,[9,10] although as other researchers have pointed out, since current conditions in that state do not appear to be part of a long-term trend it is hard to see the logic in the claims.

Perhaps most notoriously, environmentalists linked persistent drought in parts of Australia to global warming.[11] Led by Austrlia's climate commissioner Tim Flannery, they predicted that some Australian cities would need desalination plants within months:

> Over the past 50 years, southern Australia has lost about 20 per cent of its rainfall, and one cause is almost certainly global warming…
>
> In Adelaide, Sydney and Brisbane, water supplies are so low they need desalinated water urgently, possibly in as little as 18 months.[12]

Unfortunately, some policymakers took these messages seriously and billions of Australian dollars were spent on a desalination plants across the country. However, when the rainfall levels returned to normal levels in subsequent years the new plants were mostly mothballed, although taxpayers are still having to underwrite huge annual bills for interest and maintenance costs.[13]

Making claims about current droughts is fraught with difficulty for environmentalists, because of the likelihood that a return to wetter conditions will leave them

looking foolish. Attention has understandably started to focus more on the possibility that manmade climate change will bring increased levels of drought in the future.

4 Predictions of drought

Global

Despite the inability of climate models to detect any human influence on drought across the world, the IPCC is surprisingly confident about climate model predictions in this area, perhaps due to a certain consistency in the projections of a range of climate models.[14] Of course, intermodel consistency is no sort of confirmation at all – all of the outputs could be equally wrong.

As if to emphasise this point, IPCC Working Group I, the body that studies the science of global warming, says that there is high confidence that dry regions will become drier and wet regions will become wetter, despite there being strong observational evidence that the recent global warming has had the opposite effect.[15] Similarly, it says that winters will get wetter and summers drier:

> There is high confidence that the contrast of annual mean precipitation between dry and wet regions and that the contrast between wet and dry seasons will increase over most of the globe as temperatures increase.[16]

Meanwhile, IPCC Working Group II, which focuses on the impacts of climate change, reports in its summary for policymakers that:

> Climate change over the 21st century is projected to reduce renewable surface water and groundwater resources significantly in most dry subtropical regions (robust evidence, high agreement), intensifying competition for water among sectors (limited evidence, medium agreement). In presently dry regions, drought frequency will likely increase by the end of the 21st century under RCP8.5 (medium confidence). In contrast, water resources are projected to increase at high latitudes (robust evidence, high agreement).[17]

Elsewhere in the Working Group II report, the IPCC expresses great confidence about the existence of a long-term threat from drying in many parts of the world.[18] Taking Africa as just one example, it says there will be 'drought stress exacerbated in drought-prone regions…(high confidence)' and 'reduced crop productivity associated with heat and drought stress, with strong adverse effects on regional, national, and household livelihood and food security… (high confidence)'.

It is hard to square this confidence with the thin evidence for any such changes along these lines to date, and also with a recognition that all of these claims are based on the output of global climate models (GCMs). As has been documented elsewhere, GCMs have proven almost incapable of predicting rainfall levels,[19] and even the IPCC describes their abilities as 'modest'. In addition to this, there are examples of specific

problems with representations of drought by climate models. A recent paper in the journal *Nature* noted that problems with the way heat convection was represented by climate models was…

> …likely to contribute to a tendency for large-scale models to 'lock-in' dry conditions, extending droughts unrealistically, and potentially exaggerating the role of soil moisture feedbacks in the climate system.[20]

Elsewhere, the prominent climatologist James Hansen has alleged that the US midwest will return to dustbowl conditions in coming decades, but it turns out that these claims were not even based on computer simulations and actually ran contrary to the peer-reviewed literature on the subject.[21]

In the UK

The failure of the late-20th-century rise in global temperatures to produce any noticeable changes in drought levels in the UK or around the world has not prevented extraordinary claims being made about what manmade global warming will do in the future.

Perhaps the most notorious of these came from the OECD, which announced in 2008 that the south of England faced a drought risk similar to that in the Sahara.[22] A few years earlier, at the end of a two-year drought in the UK, a speaker from the Met Office told a fringe meeting at the Conservative Party conference that a third of the Earth's surface could be in drought by the end of the century.[23] A contemporary newspaper report quoted Andrew Simms of the New Economics Forum as saying [emphasis added]:

> What we're talking about here are trends that will push people over the edge *in a matter of years*. Of all the studies that have come out on climate change, this is the most terrifying piece of research I've seen.

These wild claims were, inevitably, made on the basis of the output of a GCM and should therefore be considered of dubious authority.

Claims about future drought levels are sometimes made on the basis of regional climate models (RCMs) too. One example was a paper by Oxford Geographer Mark New, who published a paper that predicted, on the basis of output from the Met Office's RCM, that droughts would become more widespread and severe.[24] However, the performance of RCM simulations may be even worse than that of GCMs,[25] so there should be little expectation that their predictions will prove correct.

But in fact, even if such claims do turn out to be true, the impacts for the UK are often not as alarming as they might seem. It is frequently claimed that UK winters will be wetter, while summers will be dryer. However, in hydrological terms this is not a bad thing. Much of England and Wales gets its summer water supply from aquifers.

Replenishment of groundwater supplies by abundant winter rainfall is therefore unequivocally a good thing in terms of avoiding difficulties the following summer. As hydrologists Terry Marsh and Melinda Lewis put it:

> …the rainfall patterns currently envisaged by most climate change scenarios (wetter winters and drier summers) could help increase the resilience of much of England and Wales to drought episodes.[26]

Moreover, evidence from the paleoclimate records finds little support for the idea that wet areas become wetter and dry areas dryer as the Earth's temperature rises.[27]

5 Heatwaves

In the past

The IPCC's conclusions about heatwaves and extreme temperatures are somewhat muted.

> [T]here is medium confidence that globally the length and frequency of warm spells, including heat waves, has increased since the middle of the 20th century although it is likely that heatwave frequency has increased during this period in large parts of Europe, Asia and Australia.[28]

Once again, the methodological difficulties seem to have played a part in reducing confidence in the results, with the IPCC noting 'differences in trends depending on how heatwaves are defined'. There are also many other problems with the available literature. For example, the IPCC report only cites a handful of papers in support of its position, mentioning in particular two that use periodic temperature averages as proxies for heatwaves, but correctly cautioning against drawing strong inferences from the results.

The IPCC also cites a study by Della-Marta et al.,[29] which examined just 54 weather stations with only vague details of how these were chosen,[30] and then applied significant 'corrections' to the data, which made the earlier parts of the record colder and the later parts warmer. The authors note that much of the increase in heatwaves that they claim to have uncovered would not be seen were it not for these adjustments.

In the future

If the IPCC's projections of warmer temperatures are realised then it would appear reasonable to assume that heatwaves will be warmer too: in a world that is 1 °C warmer, we might expect a 33°C heatwave will become a 34°C heatwave. However, the IPCC suggests that global warming will bring changes beyond what would be expected from a simple shift in the temperature mean:

> Changes in the absolute value of temperature extremes are also very likely and expected to regionally exceed global temperature increases by far, with substantial changes in hot extremes projected even for moderate (<2.5°C above present day) average warming levels (Clark et al., 2010; Diffenbaugh and Ashfaq, 2010). These changes often differ from the mean temperature increase, as a result of changes in variability and shape of the temperature distribution (Hegerl et al., 2004; Meehl and Tebaldi, 2004; Clark et al., 2006).

Once again, the levels of confidence expressed are extraordinary, given that they are based on unvalidated GCMs.

6 Heat deaths

In the past

The literature on heat deaths and the related question of deaths from severe cold is reasonably substantial but fraught with difficulty. Any future warming will affect both of these ends of the mortality scale and the net effects are dependent on many factors:

- whether the expectation that global warming affects winter temperatures more than summer ones turns out to be true
- the fact that deaths in winter and summer are not necessarily caused by temperature and it is therefore hard to determine what is the effect of climate
- the ability of human beings to adapt to changes in temperature
- the effect a rash of cold deaths one winter has on the death toll from heat in the following summer.

Studies giving quantitative predictions of the effect of manmade climate change on mortality are therefore few and far between.

In trying to make sense of this, the Working Group II Summary for Policymakers stated that:

> …there has been increased heat-related mortality and decreased cold-related mortality in some regions as a result of warming (medium confidence)… [31]

… although they did not offer an opinion on the net effect. However, examination of the body of the report suggests that even a confidence level of 'medium' represents a triumph of hope over empirical evidence, with the conclusions being based more on an assumption than on any evidence.

> The IPCC Special Report on Extreme Events (SREX) concludes that it is very likely that there has been an overall decrease in the number of cold days and nights, and an overall increase in the number of warm days and nights, at the global

> scale. If there has been an increase in daily maximum temperatures, then it follows, in our view, that the number of heat-related deaths is likely to have also increased.[32]

This very much appears to be a case of the IPCC inventing conclusions rather than taking them from the peer reviewed literature.[33]

There was also some discussion of a paper that had declared that the risk of extreme summer heat in Europe had quadrupled in the decade 1999–2008, but the study concerned[34] reached this conclusion based, once again, on the output of GCMs. So when it said that it is 'likely' that the excess mortality attributed to the French heatwave of 2003 is attributable to anthropogenic global warming, a great deal of caution is warranted.

The IPCC's conclusions looks even worse when seen in the light of some of the recent literature on the subject. For example, a paper in the British Medical Journal said:

> …recent evidence [on deaths due to heat waves] is relatively reassuring. Heat related mortality is similar in hot and cold parts of western Europe and in hot and cold parts of the United States. This implies that the populations of hot regions have adjusted by physiological or other means to their hotter summers… Analysis of actual changes in heat related mortality during global warming since 1971 is even more reassuring.[35]

Another comprehensive survey examined data relating to 74 million deaths in 384 locations around the world and concluded that the burden of cold-related deaths far outweighed that from heat – by a factor of nearly 18 times – and noted that 'the contribution of extreme days [to overall mortality] was comparatively low'.[36]

In the future

The IPCC report went on to consider how increased temperatures had brought benefits at the cold end of the mortality scale and disbenefits at the warm end and gave its assessment of how these two effects compared.

> The rise in minimum temperatures may have contributed to a decline in deaths associated with cold spells; however, the influence of seasonal factors other than temperature on winter mortality suggests that the impacts on health of more frequent heat extremes greatly outweigh benefits of fewer cold days (Kinney et al., 2012; Ebi and Mills, 2013).[37]

However, examination of the two papers cited suggests that they do not actually support the IPCC's claim. Both are studies of winter mortality alone, with only brief references to heat-related mortality. Kinney et al.[38] hypothesised that reductions in winter mortality would not be significant,[39] basing their ideas on a schematic graph that purported to reproduce the findings of an earlier paper, by Curriero et al.,[40] who had examined the mortality–temperature relationship in warm southern US cites and cold

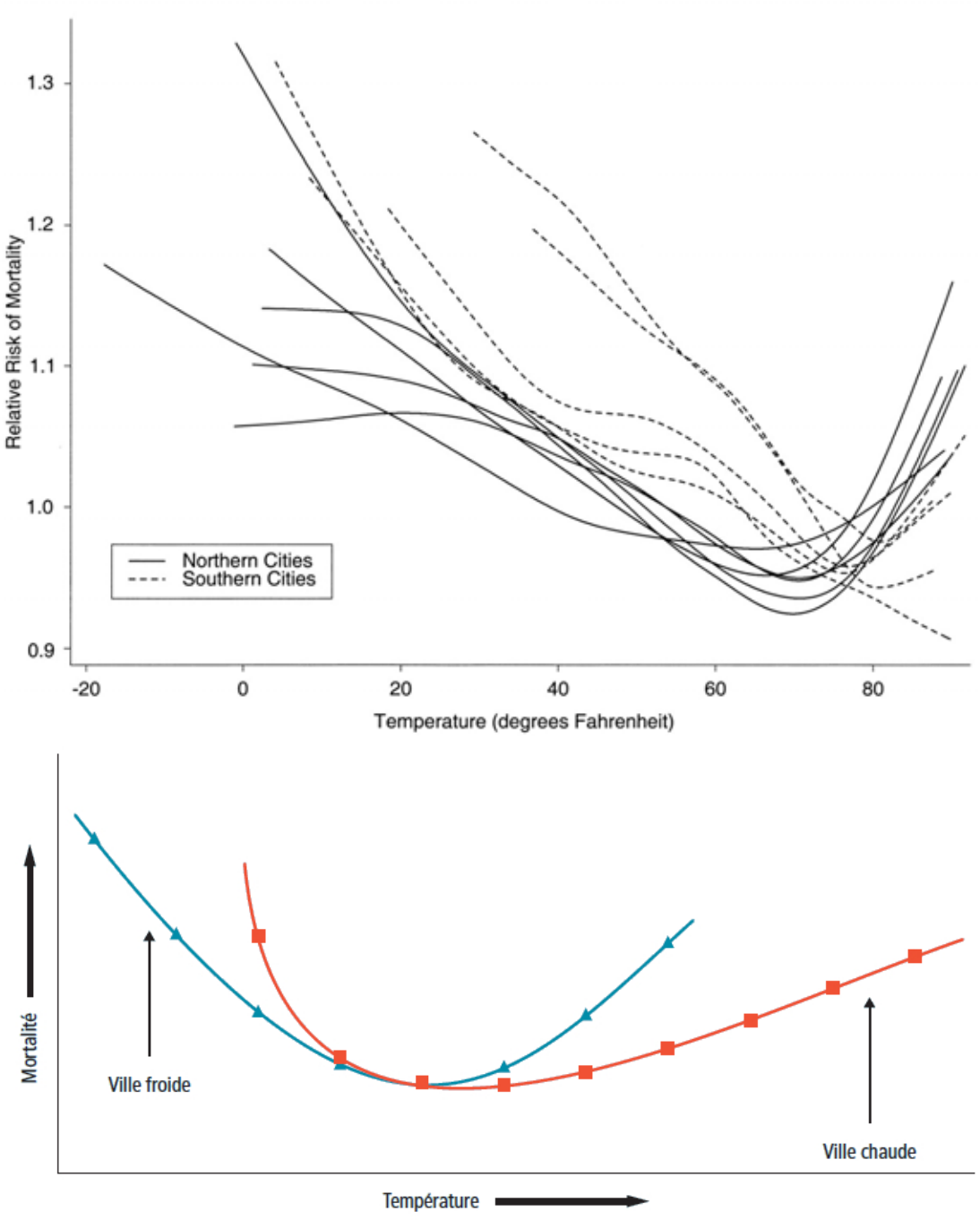

Figure 3: Mortality in warm and cool climates

Top: according to Curriero et al.; Bottom: Kinney et al. remodelling of Curriero's figure.

northern ones. However, comparison of the data reported by the Curriero group and that in the Kinney paper is illuminating. Fig. 3a shows Curriero's data: note particularly the dotted lines, representing warm southern cities. To the right of the minimum, some of these are going in different directions and it is therefore hard to draw clear conclusions. Fig. 3b shows how the data for these cities were reworked by the Kinney group. The extension of the curve for warm southern cities far beyond its minimum seems not to be based on Curriero's original data. This therefore looks more like an exercise in public relations than science.

Moreover, since the Curriero graph only extended to 80°F (26.6°C), for Kinney et al. to have made claims about the relative incidence of heat- and cold-related deaths from their graph – whether correctly represented in the schematic or not – can only be considered to be rather misleading.

The other paper cited by the IPCC, by Ebi and Mills, is similarly alarming. It found only a limited temperature dependence of cardiovascular disease, the main reason for high winter mortality, and concluded that warmer temperatures would have little effect on winter mortality rates.

> We find that although there is a physiological basis for increased cardiovascular and respiratory disease mortality during winter months, the limited evidence suggests cardiovascular disease mortality is only weakly associated with temperature…Therefore, assuming no changes in acclimatization and the degree to which temperature-related deaths are prevented, climate change may alter the balance of deaths between winters and summers, but is unlikely to dramatically reduce overall winter mortality rates.

The assumption that no acclimatization takes place would seem to make the paper irrelevant to questions of climate change over many decades rather than a few years.

Ebi and Mills went on to suggest in passing that mortality rates were steeper at hot temperatures than low ones, citing Kinney et al in support of their position. As a glance at the Kinney graph shows, this is incorrect for heat-adapted cities, which have much gentler mortality slopes at warmer temperatures than cold-adapted ones. And as noted above, Kinney was a study of cold-related deaths, so the point is hardly solid.

The Summary for Policymakers for Working Group II summarised the effect of climate change on future mortality patterns. For heat-related deaths it said:

> Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions…Examples include greater likelihood of injury, disease, and death due to more intense heat waves and fires (very high confidence);

But for cold deaths it said:

> Positive effects are expected to include modest reductions in cold-related mortality and morbidity in some areas due to fewer cold extremes (low confidence)

It is striking that the findings of the Curriero et al paper, which underlie the IPCC's position, have led to completely different confidence levels regarding the relative

impacts on hot and cold-related deaths. For the area of cold-related deaths, which was the subject of the paper, it concluded, with a low level of confidence, that the effect would be modest. For the area of heat-related deaths, which was not the subject of the paper, it expressed very high confidence that there would be an appreciable effect.

Perhaps the wisest thing said about the effect of global warming on deaths from heat and cold came from a paper that was not cited by the IPCC.

> …net future climate-related mortality rates are very low relative to the baseline death rate, indicating that climate change will have little impact in defining future mortality patterns.[41]

7 Drought, climate change and conflict

The mainstream media often feature stories linking manmade climate change, and particularly drought, with armed conflict. Such stories remain somewhat unconvincing in the wake of the long-term decline in conflict-related deaths.

As the Stockholm Peace Research Institute notes, the alleged links are the source of intense academic controversy, with the field divided into two camps, which PRI describes as 'ecologists' and 'conflict researchers'.[42] The ecologists claim that the link between climate change and conflict is firmly established. They point particularly to a meta-analysis by Hsiang et al., that claimed to have demonstrated such a link, although it also conceded that climate was not a primary driver of conflict.[43]

Conflict researchers on the other hand find it hard to understand how such bold claims can be made on the basis of such thin evidence, perhaps not realising that this is normal in climate-related fields. The Hsiang et al. paper has therefore been strongly criticised, with its data choice and statistical methodology in particular coming under fire.[44] In fact the whole idea of climate change conflict has been described by one expert as a 'myth':

> History shows that 'warm' periods are more peaceful than 'cold' ones. In the modern era, the evolution of the climate is not an essential factor to explain collective violence. Nothing indicates that 'water wars' or floods of 'climate refugees' are on the horizon. And to claim that climate change may have an impact on security is to state the obvious but it does not make it meaningful for defense planning.[45]

The dichotomy of ecologists and conflict researchers can be seen everywhere in the field. Recently, climatologist Colin Kelley has linked the Syrian conflict to global warming,[46] his findings based on '[c]entury-long observed trends in precipitation, temperature, and sea-level pressure, supported by climate model results'.

However, Francesca de Châtel, an expert in water conflict in the Middle East who was for many years based in Damascus, has noted that droughts are common in Syria,

and that many are severe but do not cause conflict. Moreover, the same drought that is alleged to have caused the Syrian uprising also affected many other countries in the region, apparently without ill-effects.[47] Noting that the Syrian crisis predated the drought, she finds the cause of the conflict to lie more with government policy measures and policy failures. She suggests that attempts to link it to climate change are unhelpful:

> The role of climate change is not only irrelevant, even emphasizing it is damaging.[48]

And even some climatologists have taken a stand against the claims made by Kelley. In a newspaper article, prominent climatologist Mike Hulme and international relations expert Jan Selby described the attempts to link the Syrian crisis to climate change as 'misguided'.[49] They also point out that earlier attempts to link conflicts to climate change have fallen apart in the face of rigorous analysis of the data:

> In fact we have been here before. In 2007, it was Darfur that was being portrayed as a 'climate war', after Ban Ki-moon's contention: 'The Darfur conflict began as an ecological crisis arising at least in part from climate change'. This thesis has since been roundly dismissed by a host of academic studies that have shown, among other things, that the war could not have been caused by drought because rainfall levels in Darfur increased prior to the start of the war.

However, recognising that both sides at least agree that climate is not a primary cause of conflict, it must surely make more sense to focus on those causes that both sides agree are important. As Andrew Solow of the Woods Hole Oceanographic Institute has put it:

> If we want to reduce the level of violence in other places, then it would be more efficient ... to bring people out of abject poverty, to provide them with the technology that loosens the connection between climate and survival, to reduce corruption, and so forth, rather than on preventing climate change. I sometimes have the feeling that some people only care about human suffering if it can be traced to climate change.[50]

But perhaps the last word should go to science writer John Horgan, who, in reviewing the state of the field, observed that environmentalists should take care when warning of climate-fuelled conflict, since the result is likely to be higher military spending rather than lower carbon dioxide emissions.[51]

8 Conclusions

The tendency of climate scientists to make apocalyptic claims based on the output of computer simulations is thoroughly to be regretted, as indeed are the tendencies of environmentalists to use these wild statements to promote their own fundraising efforts and of politicans to act upon them. It is not a new observation that GCMs – which

are only vast untested hypotheses – are no basis for public policy. However, in the area of droughts and heatwaves we have some clear and stark evidence of just how damaging politicians' failure to recognise this fact has been. Nearly ten years after Tim Flannery told Australians that the great cities of Australia were about to run permanently dry, the desalination plants that were built in response stand as monuments to the shamelessness of the environmental movement and the cringeing politicians who bowed to their demands. And ten years after Andrew Simms informed us that drought was about to push people 'over the edge', there is still little sign that such an apocalypse will come to pass soon, or even in the distant future. The absence of any meaningful global trends in either drought or heatwaves in the recent past seems to indict the very integrity of those who make such claims.

Drought makes for powerful images, with dusty landscapes and parched earth a staple of the fundraising efforts of both environmentalists, the public relations efforts of academics and the posturing of politicians. But as the rains wash the drought away and cool days replace hot ones, and as the desalination plants are quietly mothballed, life goes on much as it always has, with farmers and the general public quietly adapting to whatever the weather throws at them. The antics of greens and politicians have cost them dear though, and will cost them dear again, until the unvalidated computer simulation ceases to be a tool of public policy.

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GWPF BRIEFINGS

1	Andrew Turnbull	The Really Inconvenient Truth or 'It Ain't Necessarily So'
2	Philipp Mueller	The Greening of the Sahel
3	William Happer	The Truth about Greenhouse Gases
4	Gordon Hughes	The Impact of Wind Power on Household Energy Bills
5	Matt Ridley	The Perils of Confirmation Bias
6	Philipp Mueller	The Abundance of Fossil Fuels
7	Indur Goklany	Is Global Warming the Number One Threat to Humanity?
8	Andrew Montford	The Climate Model and the Public Purse
9	Philipp Mueller	UK Energy Security: Myth and Reality
10	Andrew Montford	Precipitation, Deluge and Flood
11	Susan Crockford	On the Beach
12	Madhav Khandekar	Floods and Droughts in the Indian Monsoon
13	Indur Goklany	Unhealthy Exaggeration
14	Susan Crockford	Twenty Reasons not to Worry about Polar Bears
15	Various	The Small Print
16	Susan Crockford	The Arctic Fallacy
17	Indur Goklany	The Many Benefits of Carbon Dioxide
18	Judith Curry	The Climate Debate in the USA
19	Indur Goklany	The Papal Academies' Broken Moral Compass
20	Donoughue and Forster	The Papal Encyclical: a Critical Christian Response
21	Andrew Montford	Parched Earth Policy: Drought, Heatwave and Conflict

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