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The Challenge of Climate Change Adaptation: Learning from National Planning Efforts in Britain, China, and the USA

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Abstract

This article examines projected climate impacts and national planning efforts in three major countries: the USA, UK and China. The three countries are in varying stages of planning for climate adaptation. Planning frameworks in all three countries suffer from a lack of specificity and urgency. To address this situation, the article recommends two measures. The first is the use of scenario planning, including consideration of high-impact scenarios, to address the downside risks of climate change. Planning in the UK has begun to make use of scenario analysis, although in a less comprehensive manner, while the USA had an earlier experiment in the use of the worst-case scenario as a planning tool. The second recommendation is to identify and prioritise impacts on vulnerable populations such as the elderly, the poor and coastal communities. This recommendation has roots in the US planning proposals, but also resonates with international human rights law.

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1. Introduction

Mitigation may affect the degree of adaptation that is ultimately required, but whatever mitigation measures are adopted, a significant degree of climate change seems unavoidable.[1] As the IPCC explains, 'warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized'.[2]

Given the unavoidability of significant climate impacts, adaptation is a necessity. Business as usual (BAU) assumes that past weather patterns will remain characteristic of the future. Adaptation is the response to the almost certain failure of this assumption of stationary climate. Adaptation can be defined to include any deviation from BAU to reduce harm from predicted changes in climate or from uncertainty about future climate, including extreme events as well as average weather. Adaptation encompasses a panoply of programmes such as improvements in the infrastructure for water supply and flood protection; new plant varieties; public health measures to deal with heat waves and changing disease patterns; limiting population and construction in vulnerable areas and assisting relocation where necessary; new forms of insurance for catastrophic events; and programmes to protect forests and wetlands. The goals include making systems more robust, so that they can cope with a broader range of events, and more resilient, so they can respond quickly to events and recover readily from events beyond their capacity to control.

National governments have already begun planning for adaptation, but planning efforts are still at a relatively early stage: it is almost more accurate to say that governments are making plans to engage in adaptation planning exercises. Although much of the actual effort to adapt to climate change will take place at the regional and local levels, national governments have an important role to play as well.[3]

This article will consider adaptation planning in the USA, the UK and China. These countries were chosen because of the central importance of the USA, the European Union (with the UK as a representative member),[4] and China to

1 Indeed, some effects of climate change are already being seen. See IPCC, 'Summary for Policymakers' in Susan Solomon and others (eds), *Climate Change 2007: The Physical Science. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (CUP 2007) 1, 5.

2 IPCC (n 1) 16. Failure to reach international agreement on binding greenhouse gas limitations makes the need for adaptation all the greater. 'Facing the Consequences: Adapting to Climate Change' *The Economist* (27 November 2010) 85.

3 Daniel A Farber, 'Climate Adaptation and Federalism: Mapping the Issues' (2009) 1 San Diego J of Climate & Energy L 259.

4 For a broader survey of EU efforts, see E Carina H Keskitalo (ed), *Developing Adaptation Policy and Practice in Europe: Multi-level Governance of Climate Change* (Springer 2010).

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the world economy and to international climate change policy. Collectively, the USA, EU and China represent over two billion people.

The three countries in the study have made promising beginnings in setting guidelines for future planning. Nevertheless, these planning guidelines may result in business as usual accompanied by boilerplate and platitudes about adaptation needs, unless steps are taken to give the planning process urgency. Planning mandates need some sharp edges if they are to generate a sense of urgency and commitment.

In some respects, adaptation planning resembles environmental assessment, in that it involves forecasting and responding to future environmental changes. The US experience with impact statements under the National Environmental Policy Act (NEPA) provides two useful cautions. First, broad guidelines are not enough to force agencies to confront uncertainties. A clearer mandate is required, such as a directive to consider the worst-case scenario. Second, it is not enough to tell agencies to make decisions based on a spectrum of desirable goals. There need to be genuine constraints. For this reason, although NEPA continues to shape agency processes, the substantive policies articulated in NEPA had little effect and were ultimately held unenforceable by the Supreme Court. In contrast, because the Endangered Species Act has a clearly defined mandate to avoid jeopardising rare organisms, agencies are forced to take biodiversity seriously.

Based partly on this US experience, this article proposes that nations adopt two requirements for adaptation planning. First, adaptation plans should be required to consider multiple scenarios, including at least one based on high climate sensitivity and emission levels. The approach should be precautionary in the sense that plans should be robust in the pessimistic scenario as well as more favourable circumstances. Second, adaptation plans should guarantee protection of the most vulnerable individuals and communities, although that protection could take alternative forms. Governments should assume an obligation to ensure that individuals do not lose their lives or become homeless as a result of climate change, and that displaced individuals be treated appropriately. Adaptation must at a minimum protect core human rights.

The least developed countries will face the most difficult challenges.[5] This article focuses on the somewhat more tractable problems faced by countries of varying wealth but substantial governmental capacity and economic resources. Even these better-situated countries face serious challenges. The two adaptation pillars of precaution and human rights apply with even more force, however, in the case of less favourably situated countries.

5 'The poorest developing countries will be hit earliest and hardest by climate change, even though they have contributed little to causing the problem'. Nicholas Stern, *The Economics of Climate Change: The Stern Review* (CUP 2007) xxvi.

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Section 2 of this article contains national case studies of the USA, the UK and China. One purpose of the case studies is to demonstrate the range and potential severity of the climate impacts facing these nations. Another is to help identify best practices—in particular, the UK's use of scenario planning and the US emphasis on vulnerable populations are both promising techniques.

Section 3 makes the case for precautionary adaptation taking into account lower probability, extreme outcomes and for a human rights approach that mandates protection for vulnerable individuals and communities. These proposed practices are action forcing in the sense that uncovering dangerous risks and mandating protection of vulnerable communities help combat the force of inertia toward continuing business as usual.

2. National Case Studies

We begin with an examination of the steps that some key nations are already taking toward adaptation planning. This section first examines the need for adaptation globally, and then focuses on the situations in the USA, the UK and China. Although this section sets the stage for the recommendations in Section 3, it should also be useful because up-to-date cross-national information about adaptation is not widely known (and in the case of China is particularly difficult to locate).

2.1 Global Impacts and the Need for Adaptation

With rare exceptions, recent years rank at the top of the list of the warmest global temperatures,[6] and depending on future emissions and climate sensitivity, the world will end up 2–7°C warmer than it is today.[7] Temperature change in the Arctic will be about twice as large.[8] Even warming of 2°C would leave the earth warmer than it has been in millions of years.[9]

Clearly, we need to begin assessing and responding to the foreseeable impacts. Sea level rise is one of the most predictable.[10] Apart from the potential contribution of melting from Greenland and Antarctica,[11] the simple change

6 David Archer and Stefan Rahmstorf, *The Climate Crisis: An Introductory Guide to Climate Change* (CUP 2010) 43.
7 ibid 129.
8 ibid 133.
9 ibid 225.
10 See K Hasselman and others, 'The Challenge of Long-Term Climate Change' (2003) 302 Science 1923, 1924. Figure 2 predicts a two meter increase in sea level under a 'business as usual' scenario by 2100; but only 20 cm under an optimum regulatory strategy.
11 On the potential for catastrophic melting in these areas, see Stern (n 5) 16; IPCC (n 1) 16.

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in temperature of the oceans will contribute to thermal expansion, just as increased temperature causes the mercury in a thermometer to rise.[12] This rise in sea level will result in loss of coastal lands,[13] inundation of some estuary systems with salt water, salt-water intrusions into some drinking sources and increased exposure to flood damage.[14]

Other changes are also foreseeable. Snow cover will decrease in most areas,[15] and oceans will become increasingly acidic.[16] Even moderate climate change will trigger significant extinctions,[17] and extreme events such as fires, floods and heat waves will become more widespread.[18]

Adaptation to these impending changes poses serious challenges.[19] *The Stern Review* estimates that the cost of adapting infrastructure 'to a higher-risk future could be $15—150 billion each year (0.05—0.5% of GDP), with one-third of the costs borne by the US and one-fifth in Japan'.[20] Furthermore, '[e]xtreme events such as floods and drought cause extensive damage to many parts of society, and thus a critical issue for adaptation is the degree to which frequency, intensity, and persistence of extreme events change'.[21]

National governments are now beginning to consider how to adjust to these changes. Hopefully, mitigation efforts will limit the extent of future impacts—and it should go without saying that mitigation should be an international priority—but some degree of adaptation will be required in any event.

12 Changes in ocean temperature will also affect fish stocks; see Hans O Pörtner and Rainer Knust, 'Climate Change Affects Marine Fishes Through the Oxygen Limitation of Thermal Toleration' (2007) 315 Science 95.

13 A Barrie Pittock, *Climate Change: Turning Up the Heat* (Earthscan 2005) gives examples, including China, ibid 264, India, Pakistan, Bangladesh, ibid 268, and the USA, ibid 278.

14 See Elizabeth Kolbert, *Field Notes from a Catastrophe: Man, Nature, and Climate Change* (Bloomsbury Pub 2006) 123–24 (British governmental study indicating that what are now 100-year flood events could become routine by late in this century); see also Pittock (n 14) 118 (stating that without adaptive measures, annual financial losses as a result of flooding would increase from 1 to 24 billion in different scenarios).

15 Archer and Rahmstorf (n 6) 147.

16 ibid 148.

17 ibid 162.

18 ibid 174; Heidi Cullen, *The Weather of the Future: Heat Waves, Extreme Storms, and Other Scenes from a Climate-Changed Planet* (Harper 2010); on the flooding issues (in particular, the impact of climate change on catastrophic weather events), see Howard C Kunreuther and others, *At War with the Weather: Managing Large-Scale Risks in a New Era of Catastrophes* (MIT Press 2009) 11–12.

19 These challenges are discussed in Tim Bonyhady, Andrew Macintosh and Jan McDonald, *Adaptation to Climate Change: Law and Policy* (The Federation Press 2010); US Government Accountability Office, 'Climate Change Adaptation: Strategic Federal Planning Could Help Government Officials Make More Informed Decisions' (GAO-10-113 2009).

20 Stern (n 5) 417.

21 William E Easterling III, Brian H Hurd and Joel B Smith, 'Coping with Global Climate Change: The Role of Adaptation in the United States' (Pew Center on Global Climate Change 2004) 17.

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2.2 US Adaptation Needs and Strategies

This section will survey some of the most likely impacts of climate change in the USA, the sorts of adaptation that may be required and current adaptation planning efforts. Under the Bush Administration, climate change was nearly a taboo topic for US government officials, given the Administration's determination to avoid any serious engagement with mitigation efforts. That strategy would have been undermined by serious consideration of climate impacts, so planning for adaptation had to await the Obama Administration. Given this late start, the USA has only begun to think seriously about adaptation at the national level.

The USA will be faced with a variety of serious climate impacts. The country is large and geographically diverse, with correspondingly varied climate impacts.[22] Wetter conditions are expected in the Northeast and on the coasts, while drier conditions are expected in the inland west.[23] Temperatures are expected to rise everywhere, but more inland than in coastal or southern areas in the continental USA, with the greatest increases in Northern Alaska.[24] In the southeast, even though absolute changes will be smaller, the baseline is high, resulting in many more very hot days later in this century.[25] Cities in the Midwest will experience increasing heat waves and decreased air quality.[26]

Sea level rise may cause dramatic losses in wetlands in the United States.[27] Two-thirds of all US coastal wetlands would be lost with a one-meter rise in sea level.[28] What used to be a 100-year flood in New York City is now an 80-year flood, and may be a 20-year flood by mid-century.[29]

Meanwhile, in the arid southwestern USA, the future of the water supply is uncertain, with potentially major impacts on agriculture.[30] Scientists have examined the prospect of prolonged drought over the next 100 years.[31] Increased temperature, drought, wildfire and invasive species will change the southwestern landscape, while ironically the droughts may be punctuated by increased flooding.[32]

22 Recent information about nationwide climate impacts in the United States can be found in US Global Change Research Program, *Global Climate Change Impacts in the United States: A State of Knowledge Report* (Thomas R Karl and others eds, CUP 2009) (hereinafter US Impacts).
23 ibid 42.
24 ibid 29.
25 ibid 112.
26 ibid 117.
27 Victor S Kennedy and others, 'Coastal and Marine Ecosystems & Global Climate Change: Potential Effects on US Resources' (Pew Center on Global Climate Change 2002).
28 US Impacts (n 22) 84.
29 Cullen (n 18) 238.
30 Gina M MacDonald, 'Water, Climate Change, and Sustainability in the Southwest' (2010) 107(50) Proceedings of the National Academy of Sciences 21256.
31 Kenneth Strzepek and others, 'Characterizing Changes in Drought Risk for the United States from Climate Change' (2010) 5(4) Environmental Research Letters <http://iopscience.iop.org/1748-9326/5/4/044012> accessed 28 May 2011.
32 US Impacts (n 22) 131–2.

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Public health impacts of climate change are also a concern.[33] The number of heat-wave days in Los Angeles is expected to at least double by midcentury and to quadruple by the end of the century.[34] The most vulnerable group (aged over 65) will double as a proportion of the California population over the same time.[35] Higher ozone levels due to the increased temperatures will cause additional deaths.[36] The probability of large wildfires is also expected to increase by 12—53% by the end of the century.[37]

The US government is just beginning to seriously address adaptation issues, following most of a decade in which climate change issues of all kinds were ignored or downplayed. President Obama appointed a task force composed of key federal agencies to investigate adaptation. The Task Force's Report[38] is a solid step forward in preparing the US to deal with the challenges of climate change. There are three key recommendations relating to domestic adaptation measures at the federal level.

First, according to the Report, adaptation needs to become a standard part of agency planning.[39] The plans should focus on ecosystems rather than either individual species or governmental jurisdictions.[40] An important recommendation is that adaptation plans should prioritise the most vulnerable people, places and infrastructure:[41]

> Adaptation plans should prioritize helping people, places, and infrastructure that are most vulnerable to climate impacts. They should also be designed and implemented with meaningful involvement from all parts of society. Issues of inequality and environmental justice associated with climate change impacts and adaptation should be addressed.[42]

Second, the government needs to ensure that scientific information about the impacts of climate change is easily accessible.[43] Without solid scientific information, public and private sector decision-makers cannot plan intelligently.

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33 See Louise Bedworth, 'Climate Change and California's Public Health Institutions' (Public Policy Institute of California 2008).
34 ibid 2.
35 ibid 3.
36 ibid 7.
37 ibid 10.
38 The White House Council on Environmental Quality, 'Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy' (2010) <http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf> accessed 24 May 2011.
39 ibid 10, 25–26.
40 ibid 22.
41 ibid 11.
42 ibid 21.
43 ibid 30–33.

This effort would build on the US Geologic Survey and its National Climate Assessment.[44]

Third, the government needs to address climate impacts that cut across agency jurisdictions and missions.[45] Unfortunately, this is the case for many of the main impacts, such as those that threaten water resources,[46] public health,[47] oceans and coasts[48] and communities.[49] Some important arenas for agency action are to improve water-use efficiency,[50] strengthen public health systems,[51] integrate climate risks into insurance[52] and develop an open-source risk assessment model.[53]

The Task Force's Report is not an adaptation plan. Instead, it is essentially a plan of how to *begin* adaptation planning. Nevertheless, this is an important first step to responding to the impacts of climate change; to the extent those impacts cannot be avoided by reducing emissions.

2.3 Adaptation in the UK

The UK began to address climate adaptation earlier than the USA or China and is correspondingly more advanced in its planning. Since the European Union has been a leader internationally in addressing the problem of climate change in terms of mitigation, it is not surprising that an EU country such as UK is also in the forefront of addressing adaptation issues.

A key distinction between the UK and the other two countries is that climate adaptation is mandated by statute, with primary responsibility given to a single government agency and specific implementation requirements for local authorities.[54] Flooding has long been a key public concern, and some notable television programmes increased public awareness of climate impacts.[55] A 2005 Climate Change Programme report helpfully assembled available information about climate impacts in England.[56] The discussion of coastal flooding

44 ibid 23, 49.
45 ibid 34.
46 ibid 35–36.
47 ibid 37–38.
48 ibid 42–43.
49 ibid 39–40.
50 ibid 36.
51 ibid 38.
52 ibid 41.
53 ibid 21.
54 ibid 103–110.
55 E Carina H Keskitalo, 'Climate Change Adaptation in the United Kingdom: England and Southeast England' in Keskitalo (n 4) 97–147, 102.
56 Chris West and Megan Gawith (eds) *Measuring Progress: preparing for climate change through the UK Climate Impacts Programme. UK Climate Impacts Programme Technical Report*. (UKCIP 2005).

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illustrates the report's approach:

> With rising sea levels and increased storminess, coastal areas may be affected by severe flooding. Under the High scenario sea defences designed to withstand a 1 in 100 year event would only withstand events with a 2—8 year return period in East Anglia by the 2050s. Work in Scotland suggests that frequencies for the 1 in 100 year events would increase to 1 in 10 or 20 years by the 2050s under the same scenario . . . . Coastal erosion could also increase substantially, with annual damages expected to increase by 3—9 times, costing up to £126 million per year by the 2080s.[57]

Note that the report distinguishes between different scenarios (here referring to a particular 'High' scenario). The use of scenarios is an aspect of UK planning that we will consider again.

In 2008, the British government issued a framework for climate adaptation in England.[58] The report focuses on a series of impacts including hotter, drier summers and more extreme weather events such as heat waves and heavy rain.[59] The report establishes some basic principles, suggesting that adaptation should follow the principles of sustainable development, be proportional to the level of risk, and involve collaboration and transparency.[60] Importantly, the report calls for the use of scenarios, one with a 50% probability and a more extreme one with a 10% probability.[61] Inclusion of the more extreme scenario seems to embody an implicit use of the precautionary principle.

The report also stresses the important role of local and regional authorities.[62] Like the US Task Force report, the British report calls for adaptation metrics[63] and for mainstreaming adaptation within agency and programme planning.[64]

In September 2010, the Adaptation Subcommittee of the Committee on Climate Change issued an assessment of current readiness to deal with climate change.[65] Part 2 of the Climate Change Act 2008 established the Committee on Climate Change and charged it, among other duties, with making recommendations regarding adaptation. The report concluded:

> The UK has started to build capacity for adaptation, with evidence of growing awareness of the risks and appropriate responses, particularly

57 ibid 33.
58 DEFRA, 'Adapting to Climate Change in England: A Framework for Action' (DEFRA 2008).
59 ibid 13.
60 ibid 27.
61 ibid 29.
62 ibid 36.
63 ibid 39.
64 ibid 42–45.
65 Sebastion Catovsky and others, 'How Well Prepared is the UK for Climate Change?' (Committee on Climate Change Adaptation 2010).

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> in public sector organisations. This compares favourably with progress in other countries, with some examples of good practice in adaptation decision-making. However, from the evidence reviewed, we conclude that capacity building is not yet systematically translating into tangible action on the ground . . . .[66]

Thus, despite the relatively advanced state of planning in UK compared with the USA and China, a great deal remains to be done.

2.4 Adaptation in China

Officials within the Chinese government have begun to give formal attention to the need for adaptation. This effort is at a relatively early stage but provides grounds for hope about China's long-term adaptation effort.

Like the USA, China is large and geographically diverse; as such, the impacts of climate change vary across the country. For example, the Chinese government reports worsening of heat waves and droughts in northern China, flooding in southern China, and heavy snow in the west.[67]

The Chinese government notes that 'discernible adverse impacts on . . . agriculture and livestock industry' have already emerged.[68] The effects include:

> increased instability in agricultural production, severe damages to crops and livestock caused by drought and hot extremes and heat waves in some parts of the country, aggravated spring freeze injury to early-budding crops due to climate warming, decline in the yield and quality of grasslands, and augmented losses caused by meteorological disasters.

China projects a likely drop in the:

> yield of the three major crops — wheat, rice and corn; changes in the agricultural production layout and structure; accelerated decomposition of organic carbon in the soil; enlarged scope of crop diseases and insect outbreaks; accelerated potential desertification trend of grasslands; increasing frequency of natural fire; decreasing livestock productivity and reproductive ability; and growing risk of livestock disease outbreak.[69]

In the water sector, Chinese officials note that the overall water supply in northern China has decreased significantly, while water supply in southern

66 ibid 6.
67 Information Office of the State Council of the People's Republic of China, 'China's Policies and Actions for Addressing Climate Change' (2008) <http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File419.pdf> accessed 24 May 2011.
68 ibid 7.
69 ibid 7–8.

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China has slightly increased. Chinese officials report increased flooding and droughts.[70] Looking forward, they predict reductions in:

> the area of glaciers and glacier ice reserves, thus having significant impacts on rivers and run-offs with sources in glacier melt water. Climate warming could reinforce the drought trend in northern China, and intensify water scarcity and imbalance between water supply and demand.[71]

Chinese authorities report an 'accelerating trend of sea level rise' over the past three decades, which has caused 'seawater intrusion, soil salinization and coastal erosion', has damaged the ecological systems of coastal wetlands, mangroves and coral reefs, and has 'diminished the service functions and bio-diversity of ecological system in coastal areas'.[72] Continuing sea level rise will 'undermine the capacity of public drainage facilities in coastal cities, and impair the functions of harbours'.[73]

Overall, Chinese government reports are far from sanguine about the potential impacts of climate change. The government's prediction is that 'climate change will also produce far-reaching impacts on society, economy and other fields, and cause huge losses to the national economy'. Finally, China predicts increased 'threats to the safety of life and property, and to the normal order and stability of social life'.[74]

As in the USA and the UK, adaptation efforts in China are in their infancy, according to research and informal conversations with experts working on climate change in China. We know that at least some government attention has been given to the problem, but not whether there is a real resolve to follow up.

This article does not attempt to present an exhaustive look at adaptation in China. Indeed, information on the subject is difficult to come by. Few studies exist assessing the efficacy of China's adaptation efforts. Some information does exist, however. Research into English-language literature, as well as informal discussion with multiple experts, revealed some independent analysis, by sector. Also, in 2007, the year China's first climate plan was released, independent experts produced a National Assessment Report on impacts and adaptation.[75] Release of a revised assessment was planned to take place before the

70 ibid 9.
71 ibid.
72 ibid 9–10.
73 ibid 10.
74 ibid.
75 Lin Erda and others, *Synopsis of China National Assessment Report (II): Climate Change Impacts and Adaptation* (English translation 2007), <http://www.law.berkeley.edu/centers/envirolaw/capandtrade/Lin%20Erda%202-5-07.pdf> accessed 24 May 2011.

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end of 2010 and to contain some information about adaptation,[76] but as of March 2011 the report had not yet appeared.

China has at least announced a commitment, at the national policy level, to adaptation. China was the 'first major developing economy to issue an action plan'.[77] In 2007, China released the *China National Climate Change Programme*.[78] The following year, the government released a white paper, *China's Policies and Actions for Addressing Climate Change (Policies and Actions)*[79]; and in 2009, China followed up with a *Progress Report* on those policies and actions.[80] Notably, they devote sections to the 'present and imminent task'[81] of adaptation,[82] as contrasted with the 'long and arduous challenge' of mitigation.[83]

An analysis by the World Resources Institute calls the plan 'impressive,' and generally 'large in scope and scale'.[84] Broadly speaking, the plan stresses the 'need for adaptation of human and natural systems without hindering economic development. There is also a great focus on national level policy/legislative approaches to enhance China's overall adaptive capacity'.[85] However, the plan 'lacks specific targets and action-steps for realizing' goals.[86] This is, as we have seen, an endemic issue with national planning efforts, as illustrated by the US effort to date.

In addition to addressing adaptation in specific reports on climate change, the Chinese Communist Party recently discussed adaptation in the context of broader national governance plans. To understand the significance, some

76 Qian Wang, 'Climate Change Resulting in Wild Weather in China' (*China Daily* 9 September 2010) <http://www.chinadaily.com.cn/china/2010-09/09/content_11276617.htm> accessed 24 May 2011.

77 Taryn Fransen and others, 'National Climate Change Strategies: Comparative Analysis of Developing Countries' (World Resource Institute 2009) 1, <http://pdf.wri.org/working_papers/developing_country_actions_table.pdf> accessed 24 May 2011; the framework for adaptation efforts in China is briefly addressed in Jolene Lin, 'Supporting Adaptation in Developing Countries at the National and Global Levels' in Benjamin J. Richardson and others (eds), *Climate Law and Developing Countries: Legal and Political Challenges for the World Economy* (Edward Elgar 2009) 127–50, 138–9.

78 National Development and Reform Commission, People's Republic of China, 'China's National Climate Change Programme' (2007) <http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File188.pdf> accessed 24 May 2011.

79 Information Office (n 67).

80 National Development and Reform Commission, People's Republic of China, 'China's Policies and Actions for Addressing Climate Change: The Progress Report' (2009) <http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/File571.pdf> accessed 24 May 2011.

81 Information Office (n 67) 12.

82 This article relies upon the English translations provided by the Chinese government of its plans and reports.

83 Information Office (n 67) 12.

84 Fransen and others (n 77).

85 ibid.

86 ibid 1.

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background on Chinese governance may be necessary. Twice a decade, the Chinese government issues a five-year plan for the nation's priorities.[87] In October 2010, the Communist Party issued an 'Opinion' on the country's forthcoming 5-year plan (essentially a 'set of structures and parameters' for the drafters of the plan to follow).[88] Notably, the Opinion is the 'most comprehensive public statement the Chinese Communist Party has made on climate change', according to Deborah Seligsohn at the World Resources Institute.[89] While the majority of the section on climate change is devoted to mitigation, the Opinion explicitly references the need for adaptation.[90]

In China's *Policies and Actions*, the Chinese government notes that climate change 'threats are particularly pressing in the fields of agriculture and animal husbandry, forestry, natural ecological systems and water resources and in coastal and ecological fragile zones'; therefore China outlines broad plans for adaptation in these arenas, as well as 'Impacts on Society, Economy and Other Fields'.[91]

In another promising development, China[92] partnered in June 2009 with the UK and Switzerland to launch 'Adapting to Climate Change in China (ACCC)', a three-year, $6.75 million dollar pilot project to assess how 'climate change will impact China and how China can better plan to adapt to its effects'.[93] The project focuses on three provinces, Guangdong, Inner Mongolia

87 Andrew Batson, 'China Seeks a New Self Through an Old Method' *Wall Street Journal* (New York, 13 October 2010) <http://online.wsj.com/article/SB10001424052748703927504575541030493518168.html> accessed 24 May 2011.

88 Deborah Seligsohn, 'China's Party Plenum Recommends Actions in the 12th Five Year Plan' (*ChinaFAQs: The Network for Climate and Energy Information* 29 October 2010) <http://www.chinafaqs.org/blog-posts/chinas-party-plenum-recommends-climate-actions-12th-five-year-plan> accessed 24 May 2011; see also 授权发布:中共中央关于制定国民经济和社会发展第十二个五年规划的建议 (www.news.cn, 27 October 2010) <http://news.xinhuanet.com/politics/2010-10/27/c.12708501.htm> accessed 24 May 2011.

89 Seligsohn (n 88).

90 See ibid. The Party recently issued an opinion to the drafters of the Five-Year Plan. In Section 6, Item 22, the Opinion notes that: 'As parts of efforts for climate adaptation, China will emphasize capacity building to address extreme weather events', according to the informal translation by the World Resources Institute. ibid. (The original text is 加强适应气候变化特别是应对极端气候事件能力建设 <http://news.xinhuanet.com/politics/2010-10/27/c.12708501.6.htm> accessed 24 May 2011). The draft of the Five-Year Plan places considerable emphasis on climate change mitigation and discusses the need for adaptation measures such as preparation for extreme weather events. See Deborah Seligsohn and Angel Hsu, 'How Does China's 12th Five-Year Plan Address Energy and the Environment?' (*ChinaFAQs: The Network for Climate and Energy Information* 7 March 2011) <http://www.chinafaqs.org/blog-posts/how-does-chinas-12th-five-year-plan-address-energy-and-environment> accessed 24 May 2011.

91 Information Office (n 67) 1.

92 The main Chinese partner is the National Development and Reform Commission, see Ellen Kelly 'Introduction to ACCC' (Powerpoint presentation, ACCC Meeting 3 March 2010, *ACCC Project Workshop Documents*) <http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=23050> accessed 24 May 2011.

93 ibid slide 2.

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and Ningxia. It seeks to improve the climate change science; conduct comprehensive risk assessments in selected sectors; integrate climate risks into planning and management within the three project provinces, and inform national policymakers.[94] In August 2010, the project launched a bilingual website, 'Adapting to Climate Change in China', with information about the pilot project and adaptation more generally.[95]

In terms of future Chinese adaptation efforts, agriculture is an obvious priority given the need to feed a billion people. Some representative adaptation response measures include improving 'agricultural infrastructure', promoting the 'use of high-yield, stress-resilient crops' and promoting 'large-scale, water-saving irrigation'.[96] According to a 2010 independent study on China's mitigation and adaptation measures in the agricultural sector, the majority of China's adaptation responses are still in the planning phases. China has, however, made 'tangible progress'.[97] The government is also exploring the insurance industry and how to 'provide insurance for household losses, which will be in greater demand in a world that suffers from more severe weather events'.[98]

With respect to water issues, representative response measures include unifying 'water management planning and allocation'; 'speeding up water infrastructure development' including the South to North Water Diversion Project; and sloping and shoring 'protection through engineering and biological measures'.[99] The 2009 *Progress Report* lists accomplishments including flood control projects on all of the major rivers, investments in water and soil conservation projects, and the completion of the east and beginning of the middle line of the South–North Water Diversion Project.[100]

Adaptation measures under discussion include establishing an 'emergency response mechanism for marine disasters', and 'advanc[ing] and strengthen[ing] R&D of technologies for marine ecological system protection and restoration'.[101] According to the 2009 Progress Report, China now has a 'Working Plan for Investigating and Assessing the Impacts of Sea Level Rise', has built eight 'national-level special marine reserves', has 'established 18 areas in the coastal zones for marine ecology monitoring covering a total

94 ibid slide 3.
95 See *Adapting to Climate Change in China* <http://www.ccadaptation.org.cn/en/index.aspx> accessed 24 May 2011.
96 Fransen and others (n 77) 2.
97 Jinxia Wang, Jikun Huang and Scott Rozelle, *Climate Change and China's Agricultural Sector: An Overview of Impacts, Adaptation and Mitigation* (International Centre for Trade and Sustainable Development and International Food & Agricultural Trade Policy Council 2010) 12.
98 ibid.
99 Fransen and others (n 77) 2.
100 National Development and Reform Commission, People's Republic of China, 'China's Policies and Actions for Addressing Climate Change: The Progress Report' (n 80) 32–33.
101 Information Office (n 67) 34.

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area of 52,000 square kilometres',[102] and 'enhanced emergency management of marine hazards'.[103]

While it is unclear whether there is yet a strong commitment to adaptation at high levels in the government, the groundwork is being laid for future planning efforts and reports do make some actionable recommendations. Given the climate impacts that will face China, beginning a genuine planning process soon would obviously be prudent.

3. Strategies for Sharpening the Focus for Adaptation

The planning efforts discussed in Section 2 are useful beginnings to the process of adaptation. The risk, however, is that actual planning and implementation on the ground will be half hearted. National adaptation guidelines in all three countries suffer from vagueness and a lack of urgency. If planning focuses on averages—the average citizen and the most probable estimate of future impacts—then assessments of planning needs will be mild and action will be modest. Instead, to provide focus and impetus to planning, we need to keep a clear eye on the worse than average: vulnerable portions of the population and scenarios where we are unlucky about climate developments. This section suggests two ways of putting teeth into adaptation planning: requiring the use of specified pessimistic scenarios as part of the planning process and mandating protection for the rights of vulnerable populations.

3.1 Scenario Planning

Unfortunately, climate change is accompanied by great uncertainties.[104] We can be fairly sure of the lower end of the potential temperature increase but not of the higher end; we are even less sure about the scale of impacts on humanity from greater temperature increases. Current models allow for a 'wide range of possible temperature increases . . . including a 5% probability that temperature increases will equal or exceed 6°C and a 2% probability of increases equal to or greater than 8°C within the next 100 to 200 years'.[105]

102 National Development and Reform Commission, People's Republic of China, 'China's Policies and Actions for Addressing Climate Change: The Progress Report' (n 80) 33–34.

103 ibid 34–35.

104 For a good overview of these uncertainties and potential strategies for managing them, see Robert Willows and Richenda Connell (eds) *Climate Adaptation: Risk, Uncertainty and Decision-Making* (UKCIP 2003).

105 Daniel H Cole, 'The *Stern Review* and Its Critics: Implications for the Theory and Practice of Benefit-Cost Analysis' (2008) 48 Nat Resources J 53, 75. Feedback effects, such as methane releases triggered by temperature increases, threaten to accelerate temperature changes. Katey Walter Anthony, 'Methane: A Menace Surfaces' (2009) 301(6) Scientific American 68, 73.

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Basically, the 'further we push our Earth outside of its mode of operation of the past millennia, the further we steer it into uncharted waters'.[106] Projecting regional or local impacts, which is necessary for adaptation planning, is even more difficult. As the IPCC explains:

> Most sources of uncertainty at regional scales are similar to those at the global scale, but there are both changes in emphasis and new issues . . . Spatial inhomogeneity of both land use and land cover change and aerosol forcing adds to regional uncertainty. When analysing studies involving models to add local detail, the full cascade of uncertainty through the chain of models has to be considered . . . [M]odels agree more readily on the sign and magnitude of temperature changes than of precipitation changes.[107]

When it is impossible to give confident odds on the outcomes, scenario planning may be the most fruitful approach.[108] Scenario planning can identify unacceptable courses of action and then assist in choosing among appealing remaining alternatives. Robustness rather than optimality is the goal.[109]

The UK Climate Impact Programme advocates scenarios as a 'key tool for climate change risk assessment'.[110] Scenarios are designed to deal with uncertainty by making speculation 'more disciplined, more anchored to scientific knowledge where it is available and more transparent'.[111] Scenario analysis avoids the pitfall of projecting a single probable future when vastly different outcomes are possible, broadens the decision maker's knowledge by requiring more holistic projections, and most importantly 'forces decision-makers to use

106 Archer and Rahmstorf (n 6) 152.

107 Jens Hesselbjerg Christensen and others, 'Regional Climate Projections' in Susan Solomon and others (eds), *Climate Change 2007: The Physical Science. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (CUP 2007) 847, 921.

108 Scenario planning rests on a realisation that plans need to take into account multiple possible futures. The flip side of this is the realisation that our plans may not work out as we hope. This observation seems too obvious to be worth mentioning, but often the possibility of failure is entirely overlooked in government planning. Dave Owen, 'Probabilities, Planning Failures, and Environmental Law' (2009) 84 Tulane L Rev 265. According to the *Economist*,

> It is tempting to imagine that adaptation decisions might wait for models that can provide greater certainty about what might happen where. This is a forlorn hope . . . Decisions about adaptation will be made in conditions of pervasive uncertainty. So the trick will be to find ways of adapting to many possible future climates, not to tailor expectations to one future in particular.

'Facing the Consequences' (n 2) 86.

109 Robert Verchick, *Facing Catastrophe: Environmental Action for a Post-Katrina World* (Harvard UP 2010) 239–49.

110 Willows and Connell (n 104) 79.

111 E A Parson, 'Useful Global-Change Scenarios: Current Issues and Challenges' (2008) 3(4) Environmental Research Letters 5 <http://iopscience.iop.org/1748-9326/3/4/045016> accessed 24 May 2011.

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their imaginations'.[112] In addition, '[t]he very process of constructing scenarios stimulates creativity among planners, helping them to break out of established assumptions and patterns of thinking'.[113]

It may be particularly important to require consideration of extreme outcomes rather than just the most likely scenario. At one time, the White House directed agencies to deal with catastrophic uncertainty by discussing the 'worst-case' scenario in environmental impact statements.[114] This rule mandated 'reasonable projections of the worst possible consequences of a proposed action'.[115] An environmental impact statement does not dictate the substance of regulatory decisions but is at least supposed to force the agency to take a 'hard look' at the relevant factors.[116] The worst-case requirement was criticised as being excessively pessimistic and too intrusive on agency discretion.[117]

In response to these criticisms, the White House issued a new regulation dealing with uncertainty, replacing the worst-case scenario requirement with a requirement that uncertainties be explicitly discussed.[118] The revised regulation applies when an agency completing an environmental impact statement (EIS) has 'incomplete information' that is relevant to 'reasonably foreseeable significant adverse impacts' (including credible low-probability catastrophic impacts).[119] In such cases, the agency must discuss uncertainties and give its evaluation based on the best available information (even though incomplete).[120] The Supreme Court upheld this regulation in *Robertson v Methow Valley Citizens Council* and held that the governing statute does not require a worst-case analysis.[121]

The BP Deepwater Horizon oil blowout has brought a renewed argument for reinstating the worst-case requirement.[122] In the absence of such a requirement, it is all too easy for agencies to pick the scenario that best suits their

112 Verchick (n 109) 242–43.

113 ibid 243. For this reason, it is particularly important to consider 'wild-card scenarios' in which the planner's assumptions are violated; see James A Dewar, 'The Importance of "Wild Card" Scenarios' RAND discussion paper <http://www.au.af.mil/au/awc/awcgate/cia/nic2020/dewar.nov6.pdf> accessed 24 May 2011.

114 40 CFR § 1502.22(b) (1991).

115 Vicki O'Meara Masterman, 'Worst Case Analysis: The Final Chapter?' (1989) 19 Envt L Rep 10026, 10027.

116 See *Robertson v Methow Valley Citizens Council*, 490 US 332 (1989). For an overview, see Edward A Fitzgerald, 'The Rise and Fall of Worst Case Analysis' (1992) 18 U Dayton L Rev 1.

117 See Notes, 'Federal Agency Treatment of Uncertainty in Environmental Impact Statements Under the EPA's Amended NEAP Regulation § 1502.22: Worst Case Analysis or Risk Threshold?' (1987-1988) 86 Mich L Rev. 777, 807–09

118 40 CFR § 1502.22(b).

119 ibid.

120 ibid.

121 *Robertson v Methow Valley Citizens Council*, 490 US 332 (1989).

122 Oliver A Houck, 'Worst Case and the Deepwater Horizon Blowout: There Ought to be a Law' (2010) 40 Envt L Rep 11033; William H Rodgers Jr and Anna T Moritz, 'The Worst Case and the Worst Example: An Agenda for Any Young Lawyer Who Wants to Save the World from Climate Chaos' (2009) 17 Southeastern Environmental LJ 295.

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plans, ignoring other risks as speculative and dismissing entirely any risks that they cannot quantify.[123]

One difficulty with requiring consideration of the worst-case scenario is that it is difficult if not impossible to identify a single scenario that stands out as the 'worst' among all credible scenarios. It is important, however, that planning not be limited to relatively benign scenarios or to the most likely outcome. Thus, it would be useful to identify benchmark scenarios that are considered credible, but substantially more extreme than the most likely outcome. Scenario users are entitled to know the uncertainties associated with particular scenarios, to the extent those are understood.[124]

Scenario planning is beginning to find use in the adaptation area. The UK is making a useful start in this direction in reporting rainfall scenarios that represent mid-range and 10% probabilities.[125] The scenario for the natural gas grid used high-level emissions as the base scenario; this was the worst case among the scenarios considered, featuring an 8°C increase in summer temperatures and much higher rainfall and severe weather.[126] In the USA, some local authorities are also beginning to use scenario planning.[127] Other countries would do well to issue scenarios reflecting plausible extreme outcomes, which could be heuristically identified as having a 5 or 10% probability. Planners should be required to take into account such possible extreme events and, if they find it infeasible to respond to such scenarios, make risks clear at the time of their decisions. The important point, however, is not the choice of the extreme scenario but the willingness to consider multiple designs and their vulnerabilities.[128]

3.2 Protecting the Most Vulnerable

Vulnerable individuals, communities and species can provide harbingers of what is to come for all of us. Vulnerability means either a higher degree of

123 Daniel A Farber, 'Confronting Uncertainty under NEPA' (2009) 8(3) Issues in L Scholarship <http://www.bepress.com/ils/vol8/iss3/art3> accessed 24 May 2011.

124 Parson (n 111).

125 See text accompanying (n 61).

126 National Grid Gas plc 'Climate Change Adaptation Report: National Grid Gas - Gas Transmission and Distribution' (September 2010) <http://archive.defra.gov.uk/environment/climate/documents/interim2/national-grid-cca-gas-report-100927.pdf> accessed 26 May 2011.

127 The San Francisco Bay Conservation and Development Commission is using scenario planning to address sea level rise. See http://www.bcdc.ca.gov/planning/climate.change/climate_change.shtml accessed 24 May 2011 (staff recommendations can be found under 'Proposed Climate Change Bay Plan Amendment'). The New York Sea Level Rise Task Force is taking a similar approach. See <http://www.dec.ny.gov/energy/45202.html> accessed 24 May 2011.

128 This kind of scenario planning resembles Toyota's set-based concurrent planning which encourages the consideration of large numbers of designs before a decision is made. See Durward K Sobek, Allen C Ward and Jeffrey K Liker, 'Toyota's Principles of Set-Based Concurrent Engineering' (1999) 40 Sloan Management Rev 67.

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exposure to climate impacts (such as flood risk to people living in coastal areas), higher levels of damage from a given level of exposure (such as the greater physical vulnerability of the elderly to high temperatures) or a lower ability to adapt without assistance (such as the difficulty of financing infrastructure improvements in poor communities). By attending to impacts on these vulnerable entities, we can not only provide adaptation measures to those most in need but anticipate broader needs that may be soon to come. In addition, as Chinese adaptation planning notes, the effect of climate change on social stability deserves careful consideration, and one major cause of instability may be mass relocations by vulnerable populations if they are unable to manage in their current locations.[129]

According to the IPCC, '[i]n the absence of an improvement to protection, coastal flooding could grow tenfold or more by the 2080s, to affect more than 100 million people/yr, due to sea-level rise alone'.[130] In addition:

> Those densely-populated and low-lying areas where adaptive capacity is relatively low, and which already face other challenges such as tropical storms or local coastal subsidence, are especially at risk. The numbers affected will be largest in the mega-deltas of Asia and Africa while small islands are especially vulnerable.[131]

More developed countries have more adoption options, but there, too, coastal communities will clearly be among the first to be threatened by climate change. For instance, the Louisiana coast is already 'disappearing before our very eyes' despite its importance for buffering storms, nurturing Gulf of Mexico fisheries and maintaining water quality.[132] The coast is also home for fishing communities with unique history and cultures, many of them dating back 200 years.[133] Cajun identity is so distinct that each town often has its own cuisine, musical style and dialect.[134] Rising sea levels increase the stress on these unique communities. Combined with the erosion of the coastal buffer, rising sea levels also threaten New Orleans because of potential increases in storm surges, with scientists predicting 'a vast swath of the coastal

129 Alex de Sherbinin, Koko Warner and Charles Ehrhart, 'Casualties of Climate Change' (2011) 304(1) Scientific American 64. For further discussion, see Kurt W. Campbell and others, 'The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change' (Center for Strategic International Studies 2007).

130 Robert J Nicholls and others, 'Coastal Systems and Low-Lying Areas' in M L Parry and others (eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (CUP 2007) 315, 339.

131 IPCC, 'Summary for Policymakers' in Parry and others (n 130) 1, 12.

132 Verchick (n 109) 16–19.

133 Herbert R Padgett, 'Physical and Cultural Associations on the Louisiana Coast' (1969) 59 Annals of the Association of American Geographers 481.

134 ibid.

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lands around New Orleans will be underwater by the dawn of the next century'.[135]

Climate change will disproportionately affect vulnerable individuals[136] and 'poorer regions and countries, that is, those who have generally contributed the least to human-induced climate change'.[137] For example, climate change will make what are now extremely rare heat waves more common in the future.[138] By the end of the century, the number of heat wave days in Los Angeles could double, while the number in Chicago could quadruple.[139] The number of heat wave deaths could rise proportionately.[140] We have already seen the extent of the threat with the death of approximately 35,000 people in the 2003 European heat wave.[141] Elderly people are more vulnerable to heat stress; they are especially at risk when they are socially isolated.[142]

In China, 'poor farming communities will be hit harder by droughts and floods than urban populations' and 'women and men will be affected in different ways according to their roles in the household and at work'.[143] This differential impact on women seems to be a widespread problem in developing countries.[144]

135 Suzanne Goldenberg, 'Rising Sea Level to Submerge Louisiana Coastline by 2100, Study Warns' *The Guardian* (London, 29 June 2009) <http://www.guardian.co.uk/environment/2009/jun/29/rising-sea-level-new-orleans> accessed 24 May 2011.

136 Stephen Humphreys, *Climate Change and Human Rights: A Rough Guide* (International Council on Human Rights Policy 2008) 3. According to Eakin and Pratt:

> Studies on adaptive capacity, in many cases, challenge existing social and economic orders by illustrating that adaptation by the most vulnerable social classes may require redistribution of resources and improved access to finance, land, technology, water, and other assets, as well as enhanced access to decision making and governance.

See Hallie C Eakin and Anthony Pratt, 'Are Adaptation Studies Effective, and What Can Enhance Their Practical Impact?' (2011) 2 Wiley Interdisciplinary Reviews: Climate Change 141. London's adaptation planning explicitly recognises risks to vulnerable groups, see Greater London Authority, *The Draft Climate Change Adaptation Strategy for London: Public Consultation Draft* (Greater London Authority 2010).

137 The Office of the UN High Commissioner for Human Rights also discusses the 'human rights implications of response measures'. See UN Office of the High Commissionerr for Human Rights, 'Report of the Office of the United Nations High Commissioner for Human Rights on the Relationship between Climate Change and Human Rights' UN Doc A/HRC/10/61 (2009).

138 US Impacts (n 22) 90.

139 ibid 91.

140 ibid.

141 Ulisses Confalonieri and others, 'Human Health' in Parry and others (n 130) 391, 397. This is a relatively low estimate.

142 US Impacts (n 22) 90.

143 Kelly (n 92) slide 4.

144 Kate Raworth and others, 'Climate Wrongs and Human Rights: Putting People at the Heart of Climate-Change Policy' (Oxfam International 2008) Briefing Paper 117, 7 <http://www.oxfam.org/sites/www.oxfam.org/files/bp117-climate-wrongs-and-human-rights-0809.pdf> accessed 24 May 2011.

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It is not surprising that relatively disempowered groups would be the most vulnerable to climate change, as well as other risks. As in other contexts, we must be ready to address 'the failure of law to provide vulnerable people with the protections and benefits they need to lead safe and productive lives', an issue that has already been recognised in the contexts of environmental harms and natural disasters.[145]

Many humanitarian agencies and international institutions have focused on adaptation measures as a solution to the human rights impacts of climate change.[146] However, adaptation response measures themselves may create unintended consequences.[147] For example, an adaptation policy aimed at saving water by using wastewater in agriculture could also increase the risk of disease or contamination[148] or could impact food security by altering crop irrigation patterns.[149] In another scenario, an adaptation policy to relocate a coastal community affected by sea-level rise may also 'exacerbate existing cultural, economic and political stresses on dislocated individuals'.[150] Relocated individuals may lose livelihoods; their arrival in new communities may create violent tensions over already scarce resources.[151]

At present, no mechanism exists to assist states in evaluating and preventing the unintended consequences of adaptation policies themselves.[152] In response, some have called for the UNFCC to develop a 'new structure and process' for international agencies, institutions and NGOs to assist states to '(1) clarify human rights principles applicable to the development of climate change policies; (2) facilitate information sharing; (3) provide technical

> Women produce up to 80 per cent of food grown in sub-Saharan Africa, and 60 per cent in Asia. Yet only five per cent of agricultural services are directed to women farmers, and they own just two per cent of the land and receive one per cent of agricultural credit worldwide. In addition, women and girls spend many more hours fetching fuel and water during floods or droughts in poor countries. Women are also the main [caretakers] for sick children and family members, and will usually be the first in the family to eat less when food is scarce. As a result, climate impacts put women's rights to food, life, security, and health particularly at risk.

145 Verchick (n 109) 128.

146 Zoe Loftus-Farren and Cáitrín McKiernan, 'Protecting People and the Planet: A Proposal to Address the Human Rights Impacts of Climate Change Policy' (International Human Rights Law Clinic, Miller Institute for Global Challenges and the Law, and Center for Law & Global Justice 2009) 4 <http://www.law.berkeley.edu/files/IHRLC/Protecting.People.and.the.Planet.pdf> accessed 26 May 2011.

147 The Office of the High Commissioner for Human Rights also discusses the 'human rights implications of response measures'. See Office of the High Commissioner for Human Rights (n 137).

148 Loftus-Farren and McKiernan (n 146) 6.

149 ibid.

150 ibid 5.

151 ibid 5.

152 ibid 7. For a brief description of the impacts of climate change on the right to life and security, the right to health, the right to food, the right to subsistence, and the right to health, see Kate Raworth and others (n 144) 6, Table 2.

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assistance; and (4) operate in these capacities at the international, regional and state levels'.[153]

Merely announcing a variety of worthy goals may be less effective than actually mandating some protection of the most vulnerable entitles. The example of NEPA is again illuminating. NEPA announces a federal policy to 'foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfil the social, economic and other requirements of present and future generations of Americans'.[154] The federal government is then directed 'to use all practical means, consistent with other essential considerations of national policy, to improve and coordinate' federal actions.[155] The goal is to assure (*inter alia*) 'the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences', while also assuring 'for all Americans safe, healthful, productive and aesthetically and culturally pleasing surroundings'.[156] While these are admirable goals, the statute clearly does not provide very concrete direction.

The Supreme Court has found these NEPA policies to be merely advisory. *Strycker's Bay Neighborhood Council, Inc v Karlen*,[157] involved construction of a housing project in a middle-income area. The lower court held that the agency's choice of site was unjustifiable because 'environmental factors, such as crowding low-income housing into a concentrated area, should be given determinative weight'.[158] The Supreme Court summarily reversed the Second Circuit decision, holding that NEPA required nothing more than consideration of environmental consequences by the agency. In a later case, the Court again emphasised that '[o]ther statutes may impose substantive environmental obligations on federal agencies, but NEPA merely prohibits uninformed—rather than unwise—agency action'.[159]

In contrast, biodiversity receives particularly strong protection under US law. The Endangered Species Act (ESA)[160] stems from the formative period of US environmental law in the 1970s. Section 4 requires the government to determine whether any species is endangered and to designate critical habitat, based on the best scientific data available.[161] Section 7, entitled 'Interagency Cooperation', requires consultation to ensure that agency actions do not jeopardise any endangered species—the 'consultation' has turned out to be less

153 Loftus-Farren and McKiernan (n 146) 7.
154 42 USC 4331(a).
155 42 USC 4331(b) (1), (3).
156 ibid.
157 444 US 223 (1980).
158 ibid.
159 *Robertson v Methow Valley Citizens Council*, 490 US 332, 351 (1989).
160 16 USCA § 1531 *et seq.*
161 16 USCA § 1533.

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important than the 'do not jeopardize'.[162] Section 9 goes on to forbid 'taking' any endangered species.[163]

Section 7, which prohibits the government from jeopardising any endangered species, has received strong support from the courts. For example, in *National Wildlife Federation v Coleman*,[164] the court enjoined construction of an interstate highway that would cross a critical habitat of the Mississippi Sandhill Crane. The court was also concerned about the effect of the highway in encouraging development in the area, placing the crane at further risk. The court emphasised that § 7 'imposes on federal agencies the mandatory duty to insure that their actions will not either (i) jeopardize the existence of an endangered species, or (ii) destroy or modify critical habitat of an endangered species'.[165] Thus, a strict mandate under the ESA has proved far more efficacious than a multi-factored set of goals under NEPA.

Similarly, a requirement that agencies consider a host of adaptation-relevant factors will empower the best agencies but do little to produce genuine planning by the laggards. It is all too tempting to ignore risks that fall on marginal individuals or communities. The USA has taken a useful step to address this problem with the admonition that agency adaptation plans should prioritise the most vulnerable people, places and infrastructure.[166] But a simple admonition may have little effect if it conflicts with other agency priorities.

Nations can combat the insidious tendency to downplay the needs of vulnerable individuals and communities with a requirement that planners identify marginal or disempowered groups or communities and ensure that their actions do not jeopardise the lives, homes or livelihoods of those people if possible—and where not possible, that every step is taken to respect the rights of the affected individuals. Depending on local legal conditions, enforcement of this duty could take place in various ways: through the courts, legislative oversight, bureaucratic review, or even through international human rights law. Human rights law, whether or not it provides the best legal mechanism for protecting the most vulnerable, will be at least a valuable source of inspiration:

> A human rights focus can redirect attention to people who are otherwise likely to be ignored or unheard. Where communities are already living in precarious circumstances (shanty towns, polluted or otherwise fragile environments), posing human rights questions may help to locate some of the hazards posed by climate change – from desertification, water

162 16 USCA § 1536.
163 16 USCA § 1538.
164 529 F.2d 359 (5th Cir 1976).
165 ibid 371.
166 See text accompanying n 41 to 42.

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> salination, sea level rise, and so on – as well as those who are most at risk from them.[167]

Domestic adaptation planning could clearly profit from incorporating these principles.

In short, two pillars of adaptation planning should be a precautionary adaptation principle and protection of human rights of vulnerable populations. Given differences in political and legal culture, these pillars may also be expressed in various ways.

Domestic legal systems will differ in the mechanisms that they use to implement these proposals, but serious enforcement should be assured. The precautionary principle has not, as such, been adopted by the USA, and so in the US setting it may be more constructive to stress 'robustness' rather than precaution. The Chinese generally resist the concept of international human rights, so they may be more receptive to a different vocabulary—one that explains protection of the most vulnerable populations in terms of an early warning system for society as a whole and a method of reducing potential social unrest. This article focuses on the basic principles, leaving for later the questions of how to best give these principles concrete legal form domestically or internationally.

4. Conclusion

We have seen that the USA, China and the UK have all begun the process of planning for climate adaptation. Given the ubiquity and seriousness of climate impacts, the efforts to date are only a prelude to what is likely to become a pervasive governmental effort. Adaptation will require vigilance to protect against the foreseeable impacts of climate change and action at all levels of government.

To ensure that planning efforts remain focused and on task, this article proposes two action-forcing requirements: first, that planning include at least one pessimistic scenario based on high climate impact projections (embodying a precautionary approach); and second, that planners be required to avoid jeopardising the lives or homes of especially vulnerable societal subgroups (embodying human rights concerns). In the end, as with all governmental actions, leadership is the most critical ingredient, but providing some risk-averse guardrails for planners can help to avoid at least the most egregious mistakes.

167 Humphreys (n 136) 28.

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