NEW YORK UNIVERSITY

CENTER ON INTERNATIONAL COOPERATION

Globalization and Scarcity

Multilateralism for a world with limits

Alex Evans

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The world faces old and new security challenges that are more complex than our multilateral and national institutions are currently capable of managing. International cooperation is ever more necessary in meeting these challenges. The NYU Center on International Cooperation (CIC) works to enhance international responses to conflict, insecurity, and scarcity through applied research and direct engagement with multilateral institutions and the wider policy community.

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About the author

Alex Evans directs CIC's program on Resource Scarcity, Climate Change and Multilateralism. He also works on climate and scarcity issues with organizations including the United Nations, World Bank and Oxfam, and co-edits GlobalDashboard.org, the global risk and foreign policy blog, with David Steven.

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Alex's previous publications can be downloaded from Global Dashboard.

List of abbreviations

BRIC	Brazil, Russia, India and China
CAP	EU Common Agricultural Policy
CDM	Clean Development Mechanism
CEO	Chief Executive Officer
CGIAR	Consultative Group on International Agricultural Research
CNOOC	China National Offshore Oil Corporation
CO^2	Carbon dioxide
CO^2e	Carbon dioxide equivalent
CSD	UN Commission on Sustainable Development
DESA	UN Department of Economic and Social Affairs
DFID	UK Department for International Development
DPA	UN Department of Political Affairs
DPI	UN Department of Public Information
DPKO	UN Department of Peacekeeping Operations
DRC	Democratic Republic of the Congo
EIA	US Energy Information Administration
EITI	Extractive Industries Transparency Initiative
EU	European Union
FAC	Food Aid Convention
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIEWS	FAO Global Information and Early Warning System
GPAFS	Global Partnership for Agriculture and Food Security
IEA	International Energy Agency
IEF	International Energy Forum
IEP	International Energy Program
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
mb/d	Million barrels of oil per day
MDG	Millennium Development Goal
MIT	Massachusetts Institute of Technology
mtoe	Million tonnes of oil equivalent
NAFTA	North American Free Trade Agreement
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
OCHA	UN Office for the Co-ordination of Humanitarian Assistance
ODA	Official Development Assistance
OPEC	Organization of the Petroleum Exporting Countries

ppm	Parts per million (concentration level of CO^2 or greenhouse gases)
R&D	Research and development
REDD	Reducing Emissions from Deforestation and Forest Degradation
SADC	Southern African Development Community
SSM	Special Safeguard Mechanism
UNDP	UN Development Programme
UNEP	UN Environment Programme
UNFCCC	UN Framework Convention on Climate Change
UNICEF	UN Children's Fund
UNSG	UN Secretary-General
US	United States (of America)
WFP	World Food Programme
WMO	World Meteorological Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

Globalization has improved the living standards of hundreds of millions of people – but growing resource scarcity means it risks becoming a victim of its own success. Left unaddressed, scarcity of food, energy, water, land and other key 'natural assets' has the potential to trigger intensifying zero sum competition between states – in the process, increasing poverty, state fragility, economic instability, inflation, and strategic resource competition between major powers.

On **food**, projections suggest that production will need to increase by 50% by 2030 (and 100% more by 2050), to meet forecast demand. Yet there are already signs that the productivity gains of the Green Revolution are running out of steam, even as significant amounts of crops are being diverted to biofuels. The 2008 food price spike provided a taste of what may be to come, with the number of undernourished people rising by over 150 million, unrest in 61 countries and over 30 countries introducing export bans or restrictions.

On **land**, competition between different land uses is increasing fast – both globally (between land uses including food, feed, fuel, forest conservation, carbon sequestration and growing cities), and in hotspots where land degradation, desertification, fast growing populations and weak systems of land tenure create the risk of political discord or violent conflict.

On **water,** demand will rise by around 25% by 2025, but even existing consumption levels are already beyond sustainable levels. Water scarcity will intensify over the next decade as groundwater depletion continues in many regions. Declining water availability is also projected to be probably the most significant impact of climate change over the next decade, with particular impacts on regions dependent on glacial meltwater and trans-boundary freshwater resources.

On **energy,** the International Energy Agency estimates that investment of $26 trillion is needed between now and 2030 to meet projected demand – a figure that rises to $36.5 trillion once the need to reduce greenhouse gas emissions is factored in too. However, current investment totals are nowhere near this level, with investment in energy having fallen particularly fast during the global downturn – leading the IEA to warn of the risk of a renewed oil supply crunch as the global economy recovers.

Climate change, finally, will intensify all of the above challenges, reducing food and water availability, driving massive shifts across energy and agricultural systems and causing a range of other shocks and stresses. A particular challenge facing policymakers is the fact that climate change impacts are likely to be highly unpredictable, non-linear, and hallmarked by sudden shifts as key thresholds are passed.

These scarcity challenges need to be understood as an integrated whole, not as separate issues. They share common drivers, including both rising demand – driven by a global population projected to reach an estimated 9.2 billion by mid century, and the increasing affluence of a growing 'global middle class' – and further signs that the supply of key resources will struggle to keep pace. All of them present the greatest risk to poor people and countries, who have the least capacity to cope with shocks or adapt to new realities. And all of them are linked together by complex and often poorly understood feedback loops, creating the risk of unexpected change, unintended consequences from policy, and multiplier effects that complicate attempts to manage risk.

Scarcity issues could emerge as an important catalyst for collective international action to tackle global challenges – in the process helping to ensure that a globalization that is already *efficient* also becomes more *sustainable*, *equitable* and *resilient*. Few observers of the multilateral system would dispute that it is up to the task of managing scarcity, configured as it is today. But this paper argues that it is already possible to begin assessing the key implications of scarcity issues for a range of international agendas; to identify the specific cases in which international collective action of reform of existing multilateral institutions is needed; and to start mapping out the key actions that need to be taken over the short,

medium and longer term. In particular, the paper focuses in on four key policy areas as follows:

Development and Fragile States

Climate change and resource scarcity will hit poor people and countries hardest – not only for geographical reasons (e.g. that climate impacts will impact disproportionately on low latitudes), but also because of their high vulnerability. Environmental shocks are often part of the reason people become poor in the first place; poor people and countries spend high proportions of their incomes on food and fuel; the institutional and political weaknesses of fragile states can make them more susceptible to conflict risks arising from scarcity (although scarcity issues will usually be threat multipliers, rather than stand-alone conflict risk drivers).

Multilateral actors are already massively involved in issues of development, state fragility and conflict response, and this – together with the fact that poor people and countries are most vulnerable to scarcity – means that the multilateral system will have no choice but to take account of scarcity in its work in developing countries, whether in humanitarian assistance, conflict mediation, peacekeeping, long term development partnership or support in international forums.

Finance and Investment

The key areas in which investment is needed as a result of climate change and resource scarcity are (a) energy systems, where the policy challenge is to deliver both energy security and climate stabilization at the lowest possible cost; (b) agriculture, where there is a need to finance increased crop production, again in a way that addresses climate stabilization, and with far lower input levels than today's agriculture; and (c) the costs of financing improved resilience (for example, through social protection systems), especially in developing countries, in particular in light of the need to adapt to climate change.
Three roles stand out for multilateralism. Collective action is needed, first, to correct market failures, such as environmental costs that are not reflected in prices; second, to provide 'signals from the future' that can improve long-term predictability for private sector investors; and third, to protect poor people and poor countries from the effects of scarcity by financing enhanced resilience.

International Trade

The food and fuel price spike demonstrated the risk of acute trade shocks such as price spikes, and how these can lead to knock-on social, economic and political consequences. At the same time, such impacts risk leading to countries losing confidence in open international trade to ensure their security of supply on key commodities, while in the climate context the potential for unilateral use of 'carbon tariffs' risks leading to a slide towards tit-for-tat protectionism. Over the longer term, increasing energy scarcity or tight emissions controls could impede international supply chains and reduce the overall volume of international trade.

Effective multilateral cooperation can help to head off these risks by creating trust between countries that they can rely on the trade system to meet their needs – in the process, easing security of supply concerns that risk leading to self-fulfilling prophecies as countries act on zero sum competition rather than cooperating to produce open trade.

Strategic Resource Competition

Finally, increasing scarcity will create new strategic resource competition between states – at worst, involving the risk of inter-state conflict.158 of the world's 263 international river basins lack any kind of cooperative management framework, with projected glacial melting an especially important risk driver in the future. Already, both developed and emerging economies are engaged in a scramble for energy resources in numerous regions, and a similar dynamic may be emerging in the context of land and food access deals. Climate impacts, especially rising sea levels, will create new political disputes over newly available resources and sea lanes, whilst challenging existing legal infrastructure (for example, water sharing agreements). Disputes between states over immigration

may become more common if climate change leads to an increase in migration.

Multilateral cooperation is needed not only to contain worst case scenarios, such as the risk of inter-state conflicts over resources, but also the risk of a generalized shift away from international cooperation, and towards zero sum competition. Given the highly distributed nature of scarcity issues, governments and international organizations will also need to work collectively to build shared awareness of scarcity issues among non-state actors, and shared platforms that can help to construct political coalitions to push for the international action needed.

The paper's key recommendations in each of these areas are summarized in the table below.

SUMMARY OF RECOMMENDATIONS

Policy area	Implications of climate change and scarcity	Why multilateralism is needed	Key multilateral actions
Development and fragile states	• Climate change and scarcity combine with existing sources of vulnerability to impact poor people and countries hardest • Risk of increased poverty, hunger; economic impacts including reduced growth, higher inflation, worsening fiscal finances, higher interest rates, currency depreciation • New winners and losers; wider implications for political economy of developing countries • Risk of violent conflict (though with scarcity usually as a threat multiplier rather than a stand-alone cause)	• Multilateral institutions already massively involved in issues of development and state fragility • Poor people and countries will be disproportionately impacted by climate change and scarcity • Multilateral system will hence increasingly have to take account of scarcity issues across the board in its work in poor countries	**Short term** • Increase international humanitarian assistance capacity and funding • Scale up social protection systems, safety nets, etc. • Build international donor capacity for analysis of natural resource governance, political economy and conflict risk dimensions of scarcity • Scale up work on girls' education, access to reproductive health services, women's empowerment and other sectors that can help reduce unsustainable population growth.

Policy area	Implications of climate change and scarcity	Why multilateralism is needed	Key multilateral actions
Development and fragile states			**Medium term** • Work towards an integrated approach to building resilience as part of core development strategies • •Build scarcity issues into conflict response strategies **Key questions and issues** • Need for more concrete examples of low-carbon, climate-resilient growth • Need for integrated assessment of finance for development needs (see Finance and Investment below) • What happens if scarcity develops to the point where social protection systems are insufficient for protecting poor people?
Finance and investment	• Energy infrastructure investment requirements of $36.5 trillion between now and 2030 • Need for a 21st century 'Green Revolution', especially in low income countries with high potential productivity gains – potentially $420 billion between now and 2030 • Mainstreaming of climate adaptation through development strategies – potentially around $50-100 billion per year from 2015 onwards	• Role of collective action in tackling market failures (e.g. environmental costs that are externalized from current price signals) • Governments need to provide clear 'signals from the future' to improve long-term predictability for private sector investment • Protecting poor people and poor countries from the effects of climate change and resource scarcity	**Short term** • Pursue key climate adaptation and mitigation actions that can move forward without a comprehensive global deal • Accelerate investment in a 21st century 'Green Revolution' • Scale up R&D spending on both energy and agriculture **Medium term** • Move to longer term commitment periods and a more robust compliance regime in global climate policy • Agree a global climate stabilization target • Equitable and binding targets for developing countries within a global emissions budget **Key questions and issues** • Need to reassess finance for development requirements in light of scarcity

Policy area	Implications of climate change and scarcity	Why multilateralism is needed	Key multilateral actions
International trade	• Risk of acute trade shocks in food / fuel contexts • Risk of countries losing confidence in open international trade to ensure their security of supply • Potential unilateral use of carbon tariffs, risking slide into tit-for-tat protectionism • Emission controls or oil scarcity could drive reductions in international trade volumes	• Role of international institutions in creating enough trust to support the global public good of open trade (and avoiding tip into zero sum competition and protectionism) • Current international institutions poorly configured to cope with scarcity trends (e.g. emerging economies not full IEA members, WTO lacks rules on export restrictions) • Protecting poor people and poor countries from the effects of climate change and resource scarcity	**Short term** • Bring emerging economies into full IEA membership • Scaling up food stocks (either real or virtual, at multilateral or regional level) • Implement mechanisms to use intergovernmental peer pressure to reduce the risk of export bans or restrictions **Medium term** • Move forward with liberalization of developed country farm support regimes • Agree terms of use for carbon tariffs to reduce the risk of 'climate protectionism' **Key questions and issues** • What will energy scarcity mean for international trade? • Will more countries come to regard increased self-sufficiency as more resilient than reliance on open markets?
Strategic resource competition	• Risk of increased competition for trans-boundary fresh water resources • Risk of inter-state competition for energy resources • Risk of inter-state competition for land, food, biofuels, etc. • Impacts of climate change on resource competition, especially rising sea levels • Potential disputes between states over the fate of 'climate refugees' • Risk of overall increase in zero sum competition between states in international relations	• Conflict risk arising from scarcity directly relevant to UN Charter's primary objective of maintaining international peace and security • Intensifying zero sum competition risks eroding existing international cooperation • Governments and international organizations need to work collectively to build shared awareness of scarcity issues among non-state actors, and shared platforms to build coalitions for action	**Short term** • Undertake stress testing of existing multilateral architecture • Build up foresight and surprise anticipation capacities • Invest in resilience, e.g. trade measures as discussed earlier, development policies • Start developing options for shared global operating systems to manage scarcity • Commission relevant international agencies to produce a joint World Resources Outlook **Medium term** • Start building up international system bandwidth and inter-agency interoperability • Develop political narratives centered on 'fair shares', especially on food, energy and climate • **Key questions and issues** • Will policymakers be ready to take advantage of political windows of opportunity for further-reaching action as and when they open up?

Part 1: Into a World of Scarcity

The world is entering an age of scarcity, with climate change, food security, competition for land and water, and energy security all moving steadily closer to the center of the international agenda. As they do so, they are creating new challenges and new concerns in foreign policy. As the Financial Times's Martin Wolf observed at the height of the food price spike

> "…the biggest point about debates on climate change and energy supply is that they bring back the question of limits. This is why climate change and energy security are such geopolitically significant issues. For if there are limits to emissions, there may also be limits to growth. But if there are indeed limits to growth, the political underpinnings of our world fall apart. Intense distributional conflicts must then re-emerge – indeed, they are already emerging – within and among countries." [1]

This paper is about what scarcity issues mean for international relations – and what they require in terms of collective action and multilateral reform.

It begins by looking briefly at the key scarcity issues: food, land, water, energy and climate change. Climate change is regarded as a scarcity issue not only because it is the key driver of change on the other three, but also because 'airspace' for human-caused greenhouse gas emissions is itself an increasingly scarce resource – with just as much potential to create zero sum disputes as any of the others. (Other natural resource issues, such as forestry and fisheries, are omitted from the paper's analysis for reasons of space – but many of the arguments made in this paper would also apply to them.)

The paper then sets out why these scarcity trends need to be regarded as an interconnected whole, noting that they share both common drivers – a rising global population, growing affluence, increasing limits to supply growth – and a web of complex feedback loops of knock-on effects from one scarcity issue to another.

Finally, the paper looks at what these issues mean for international relations more broadly, in particular the areas of development and fragile states; international trade; financing and investment; and inter-state strategic resource competition.

Across all of these areas, the paper argues that effective multilateral cooperation is essential – not only to build resilience to the likely effects of scarcity, but also to co-ordinate the collective action needed to stabilize the root causes of resource scarcity and shift the world to a more sustainable trajectory.

Scarcity Issues: An Overview

Food

The food price spike that peaked in 2008 pushed the global total of undernourished people over a billion for the first time, from a total of 854 million before the spike.[2] With oil prices spiking at the same time, 61 countries experienced political unrest, in many cases violent; more than thirty imposed food export bans or restrictions.[3]

More recently, the summer of 2010 saw unpleasant reminders of the events of two years earlier. Wheat prices saw their biggest one month jump in over three decades following a severe drought in Russia, and rose still further following Russia's decision to ban exports of the crop; in Mozambique, a 30% rise in bread prices triggered riots that left seven dead and 288 wounded.[4]

Concerns about a repeat of 2008 appear overdone – the International Grains Council points out that the world is in fact on course for the third highest wheat crop on record in 2010 – but the volatile summer had the effect of refocusing political and media attention on the issue of food prices, and on the long term challenge of feeding a world of nine billion.[5] So what drove the food price spike – and should policymakers expect a repeat?

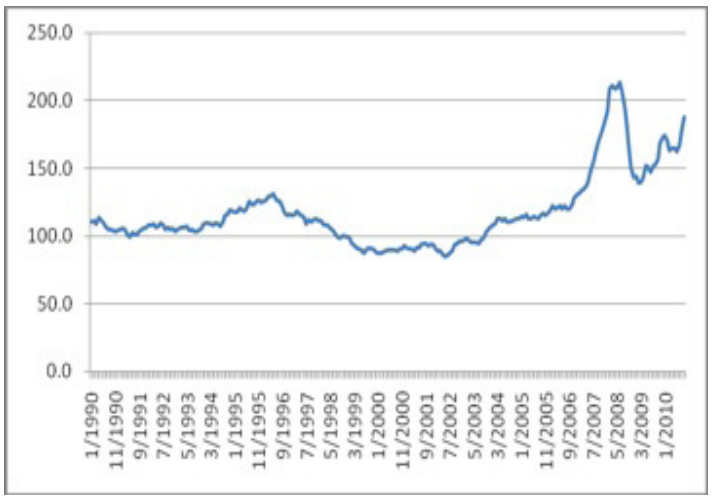
As many commentators and analysts have observed since the food price spike, the period of 2006 to 2008 was in many ways a 'perfect storm'.[6]

As Figure 1 below shows, the Food and Agriculture Organization's benchmark Food Price Index rose by 9% during 2006, by 24% during 2007 and by 51% during the twelve months to July 2008.[7]

Among the key drivers of the food price spike were historically low stock levels(food reserves declined from over 110 days' worth just before 2000, to just over 60 days' worth by 2004); poor weather in important producer countries; and high oil prices (which pushed up costs for transportation and for inputs like fertilizer).[8]

As prices approached their peak, a range of positive feedback loops driven by the perceptions of consumers, investors and governments had the effect of amplifying the crisis. As already noted, over 30 governments implemented food export bans or restrictions in attempts to calm domestic political pressures over food prices – pushing food prices higher at the same time as reducing incentives for producers to increase output. At the same time, many import dependent countries tried to rebuild their stock levels, pushing prices higher still. [9]

Figure 1: FAO Food Price Index, 1990-2010 (source: Food and Agriculture Organization)[10]



But a range of underlying structural drivers was also involved, and it is here that the reasons for fears about longer term global food security become apparent. Demand for crops is rising sharply, not only because of an expanding global population, but also as a result of the changing diet patterns of a growing middle class and a large increase in biofuels production in the US and the EU, driven by government subsidies and regulatory mandates. Looking to the future, the World Bank suggests that demand for food could grow by 50% by 2030, even before biofuels are taken into account.[11]

Yet the yield increases driven by the 20th century Green Revolution appear to be running out of steam, with average productivity growth rates falling from 2.0% between 1970 and 1990 to 1.1% between 1990 and 2007, and further falls projected in the future.[12] The US Department of Agriculture's Economic Research Service observed in 2008 global demand for grain outstripped supply for seven of the eight years between 2000 and 2008.[13] In future, the supply side also appears likely to be increasingly constrained by the other scarcity issues discussed in this section, namely:

- *Lower water availability*–likely to be the most important scarcity issue affecting food production in the short term;

- *Competition for land*–given that the amount of arable land available globally has fallen from 0.39 hectares per capita in 1960 to 0.21 hectares in 2007; [14]

- *Rising oil prices*–which will make inputs and transportation more expensive while increasing the attractiveness of biofuels; and

- *Climate change*–which is projected to have a negative impact on crop yields in most developing countries more or less immediately (and in all countries over the longer term), will expose tens of millions more people to the risk of hunger, and which will greatly complicate the challenge on each of the three scarcity issues previously mentioned.[15]

Land

Before the 20th century, additional demand for food was met almost entirely through increasing acreage – the amount of land under cultivation – rather than through enhancing the crop yield from each hectare in production.

During the 20th century, this dynamic reversed, with increasing crop yields the key driver that allowed food production to keep pace with a rising global population. In the 21st century, however, many analysts suggest that meeting food needs will once more require more land to be brought into food production.[16]

The problem, however, is that growing global demand for food is by no means the only source of increasing demand for land. Land is also needed for:

- feed for the world's livestock industry, which is converted into meat (demand for which is projected to grow by 85% by 2030, according to the World Bank) and dairy products, both of which are proportionally much more resource-intensive than direct consumption of crops;[17]

- crops to use as biofuels, which accounted for almost half the increase in the consumption of major food crops in 2006-07, according to the International Monetary Fund (primarily as a result of corn-based ethanol production in the United States);[18]

- forestry to produce fiber, such as paper (demand for which is projected to grow by 2.1% a year to 2020) and timber (demand for which is projected to rise by 1% a year); [19]

- cities (FAO has estimated the global urban expansion rate to be 20,000km2 per year, with 80% of this taking place on agricultural land (cities account for a small proportion of total global land use, but tend to grow on some of the best agricultural land); [20]

- afforestation projects used to sequester CO2 from the atmosphere;[21] and finally

- protection of existing forests, either for biodiversity objectives or to avoid greenhouse gas emissions (potentially a particularly important source of demand for land, given that overall expansions in grassland, agricultural crops and urban areas have come at the expense of equivalent overall reductions in forest area). [22]

At the same time, the amount of arable land available per person has fallen steadily over recent decades, even taking into account the amount of land converted from forest cover. As noted above, the amount of arable land available globally fell from 0.39 hectares per person in 1960 to 0.21 hectares per capita in 2007 – despite the extent to which large-scale deforestation had brought more cropland into production over the same period. [23]

In addition to competition for land between sectors at the global level, there is also the possibility of intensifying 'land scarcity' in particular regional hotspots where rapidly growing population levels combine with land degradation and weak land tenure regimes to create resource stress and potentially the risk of violent conflict. These risks are discussed further in the next chapter of the paper, as are growing concerns about the impact of international deals for leasing arable land.

Admittedly, reductions in the amount of land available for arable crops can be offset by improved yields on the land that is available – which is what has happened over the last fifty years. Even as arable land per capita almost halved from 1960 to 2007, global food production was able to keep pace with the world's growing population, thanks to the 'Green Revolution' of new seed varieties, increased use of fertilizer, and expanded irrigation. [24]

As already noted, however, the productivity growth driven by these techniques has fallen significantly since 1970, and scarcity trends (particularly of water, discussed below) will necessitate a far more resource-efficient approach in future.

Water

In water, too, the long term outlook is one of rapidly increasing demand coupled with hard questions about whether supply will be able to keep pace. As population and average per capita water use have grown, so the amount of fresh water withdrawn globally each year has grown too – from 579 cubic kilometers in 1900 to 3,973 km3 in 2000. Demand is projected to rise further to 5,235 km3 in 2025.[25]

Much of the increase in demand over this period came from agriculture, which today accounts for 70% of human water use, with the majority used by irrigation – one of the central planks of the success of the 20th century Green Revolution in raising crop yields.[26] From 1961 to 1999, the amount of land under irrigation worldwide grew at an astonishing rate, most of all in West Asia (where the increase was 256%); at present, 40% of the world's food supply comes from land that is irrigated.

However, most irrigation is highly inefficient. While surface water irrigation efficiency is between 50-60% in Israel, Japan and Taiwan, for example, it is only 25-40% in India, Mexico, Pakistan, the Philippines and Thailand. Technologies exist that could dramatically improve efficiency levels, but uptake levels remain low, often due to a lack of water pricing: less than 1% of the irrigated area in both China and India uses drip irrigation, for example (compared to 90% in Cyprus).[28] Subsidized electricity compounds the problem, encouraging profligate pumping of groundwater.[29] Meanwhile, demand is growing rapidly from sources other than agriculture, above all industrialization and the world's growing cities.

Consequently, unsustainable rates of water extraction from both rivers and groundwater are already a major problem all over the world. 1.2 billion people live in basins where human use has exceeded sustainable limits; by 2025, this figure will rise to 1.8 billion, with up to two thirds of the world's population living in water-stressed conditions, mostly in non-OECD countries.[30] Others will suffer from the problem of too much water rather than too little, often because of poor drainage or flooding, with the result that land becomes waterlogged, salts build up in the soil, and fertility decreases – a problem that affects 10-15% of irrigated land.[31]

Climate change will make matters worse.[32] A range of areas are likely to see significantly reduced overall water runoff over the 21st century, including particularly the Mediterranean, Middle East, Southern Africa and the western USA / northern Mexico.[33] Many more areas will experience large seasonal changes, particularly in regions where summer river flows depend on snowmelt and / or glacial melting.[34] More than a sixth of the world's population lives in river basins fed by glaciers or snowmelt – including the Indus, Ganges, Mekong, Yangtze and Yellow, all of which rely on the Himalayas.[35]

Climate change will also affect water security through rising sea levels – which will reduce freshwater availability in coastal regions as estuaries and groundwater become salinized – and through changes in the variability and intensity of precipitation, which will increase the risk of both droughts and floods. [36]

While water scarcity issues are often local rather than international, two important exceptions exist. One is the case of trans-boundary watercourses. At present, 263 rivers either cross or delineate national borders (the number changes when, for example, new states are created). As the next chapter discusses, however, 158 of these lack any kind of cooperative management framework, and even where such frameworks do exist, they are increasingly coming under stress (as for example in the cases of the Nile and Indus).

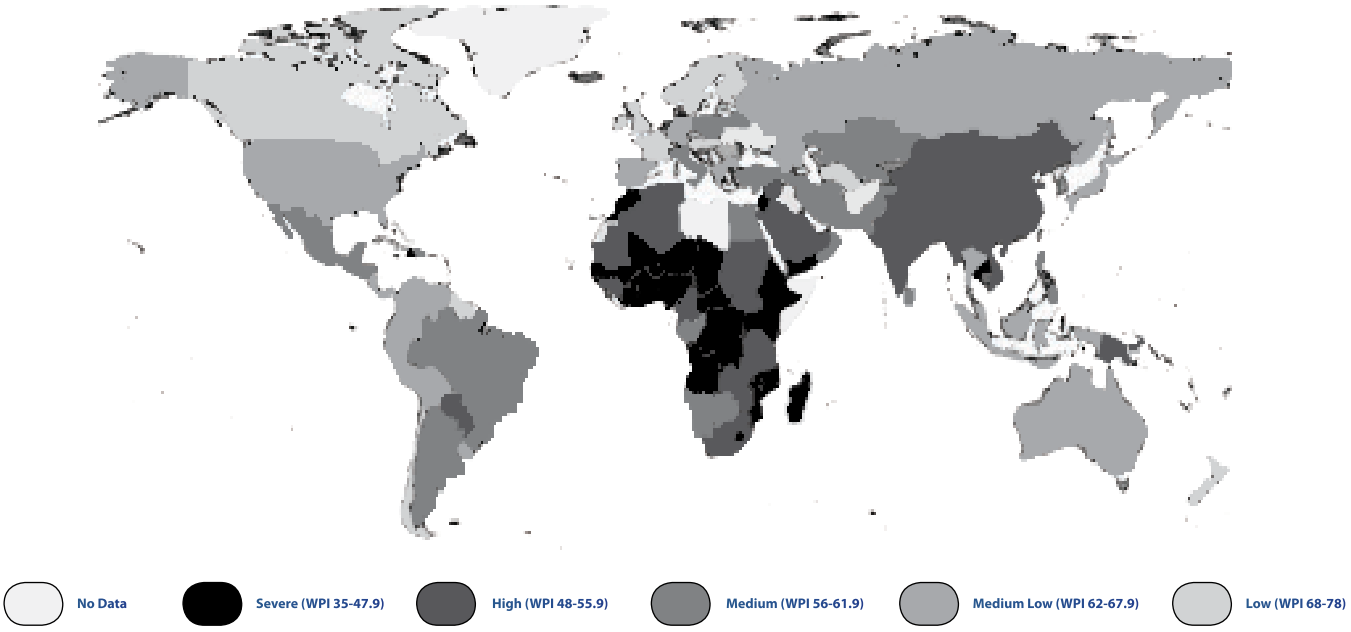
The second, less obvious way in which water security becomes an international issue is through 'virtual' or 'embedded' water – the water used to grow a crop that is then exported, thus in effect exporting the water too. One kilogram of wheat effectively contains 1,300 liters of virtual water, for example, while 15,500 liters of water are needed to product 1kg of beef, and the 500g of cotton needed to produce a medium size T-shirt requires 4,100 liters of water. As water resources become more scarce, it has been suggested that governments seeking land purchases in third countries (discussed later) are actually primarily interested in the water resources that come with that land. The CEO of the food company Nestle, for example, has argued that:

> "… with the land comes the right to withdraw the water linked to it, in most countries essentially a freebie that increasingly could be the most valuable part of the deal. Estimated on the basis of one crop per year, land purchased represents 55 to 65 cubic kilometers of embedded freshwater, an amount

equal to roughly 1½ times the water held by the Hoover Dam. And, because this water has no price, the investors can take it over virtually free."[40]

As with food, however, oil faces hard questions about whether supply growth will be able to keep pace with increasing demand. Throughout the last decade, as demand for oil was exploding, supply was struggling to keep pace, remaining stubbornly at around 85 million barrels a day.[44] As a result, oil prices followed a similar trajectory to food over the decade just ended, rising from around $20 per barrel in 1990 to $147 per barrel in July 2008, before falling sharply as the global economy slowed.[45]

Figure 2: Water Poverty Index, 2005 (source: Oxford Centre for Water Research)



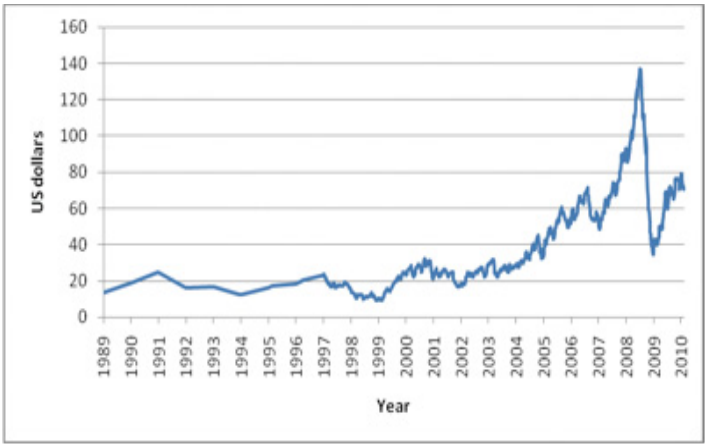
Energy security

Energy is another area in which demand is increasing rapidly. The International Energy Agency forecasts that world primary energy demand will increase by 1.5% a year between 2007 and 2030, an overall increase of 40%.[41] The IEA identifies developing Asian economies as the main drivers of this demand growth, with by far the biggest increase in demand accounted for by coal, followed by natural gas. [42]

However, with coal projected to remain readily available for years to come and natural gas markets experiencing a supply glut due to booming production in North America as a result of new drilling techniques, it is oil that is the main focus of energy security concerns. By 2030, oil remains the single largest fuel in the primary energy mix on IEA projections; demand for oil rises by 1% a year over this period, from 85 million barrels a day in 2007 to 105 mb/d with 97% of the increase accounted for by the transport sector.[43]

One reason why oil prices rose so much during this period was the long time-lag involved in developing new supplies; another was low stock levels before the price spike.[46] From 2007, price volatility was further increased by the weakening of the US dollar, which set off a 'flight to commodities' as investors turned to oil and other resources as a store of value.[47] Supply side tightness also made the oil market especially vulnerable to local shocks, such as supply disruptions in Nigeria and Venezuela.[48]

Figure 3: World spot prices for oil, 1989-2010 (source: US Energy Information Administration)[49]



In the background, however, was the story of the decline of 'easy oil' – a trend which is likely to prove ever more significant in years to come. As Michael Klare has written, "each new barrel added to global reserves … will prove harder and more costly to extract than the one before; it will be buried deeper underground, farther offshore, in more hazardous environments, or in more conflict-prone, hostile regions of the planet." [50]

While crude oil prices collapsed from July 2008 onwards, reaching a low of around $35 in January 2009, they had by June 2009 already rallied to around $70 per barrel as tentative signs of economic recovery started to appear in some parts of the world – leading some analysts to wonder "why oil prices aren't $20 per barrel, as they were only eight years ago, during the last recession."[51] At the time of writing, in fall 2010, oil prices stand at just over $80.[52]

Looking to the future, concerns for security of oil supplies center on two key issues. The first is the risk that the crash in oil prices in the second half of 2008, coupled with ongoing tight financial sector lending, has led to an ongoing shortfall in investment in oil exploration and production. The International Energy Agency has warned on several occasions during the global downturn that these shortfalls risk setting the stage for a new oil supply crunch as soon as the global economy recovers, and noted in the 2009 World Energy Outlook that global upstream oil and gas investment budgets had been cut by 19% from 2008 to 2009. [53]

The second security of supply concern on oil centers on whether the world is approaching the 'peak' of global oil production – when the rate of world oil production reaches its highest level, and starts to decline.[54] While such arguments were, until recently, viewed as somewhat fringe by mainstream energy analysts, they have become significantly more mainstream over the last two years. The chief executive of Total, Europe's third largest energy group, has argued that the world will never be able to produce more than 89 million barrels of oil per day, for example.

While arguments about how much oil remains in the ground continue to be divisive and contested, there is broader agreement that the supply side for oil looks set to become tighter in future. In reality, the peak of global oil production could result not because of geological factors, but rather because of 'above ground' factors, such as a marked deterioration in regional security in the Middle East or an OECD ban on deepwater drilling. As the UK government's former Chief Scientific Adviser, Professor Sir David King, has argued:

> "While there is certainly vast amounts of fossil fuel resources left in the ground, the volume of oil that can be commercially exploited at prices the global economy has become accustomed to is limited and will soon decline. The result is that oil may soon shift from a demand-led market to a supply constrained market." [55]

Climate change

This leads, finally, into the broader challenges posed by climate change.

Since pre-industrial times, global average temperatures have increased by 0.7º Celsius. Emissions already in the atmosphere mean that the world is committed to a further increase of 0.6º Celsius.[56] Even if the 2009 Copenhagen climate summit had agreed stringent action, this might have proved insufficient to avoid global average warming of 2º Celsius or more; as it is, the summit's weak outcome leaves the world on track for average warming of around 3º degrees. [57]

Climate change will have far-reaching implications and knock-on effects for all of the scarcity issues already discussed in this chapter.

While today's energy systems are driving climate change, the need to tackle climate change must drive tomorrow's energy systems. The scale of change required is breathtaking. As noted above, global emissions cuts of 50-85% are needed by 2050.[58] The IEA is unable to model a scenario in which such demanding cuts are achieved without replacement of existing capital stock before the end of its usual lifetime. In the energy context, 'adaptation' to climate change will be as much about adapting to the *solutions* that are needed as adapting to direct climate impacts.[59]

Table 1: Climate change policy – requirements versus current situation

Where we need to be	Where we are
According to the Intergovernmental Panel on Climate Change (IPCC)[60], limiting average temperature increase to 2° Celsius would involve: • Stabilizing greenhouse gas levels in the air at between 350 and 400 parts per million of carbon dioxide (or 445-490 ppm of carbon dioxide equivalent, with other greenhouse gases included). • Global emissions peaking by 2015 at the latest. • Global emissions then declining by 50-85% below 2000 levels by 2050.	•Current atmospheric levels of CO2 already just over 389ppm, and rising by around 2ppm per year.[61] • Weak outcome at Copenhagen appears to leave global average warming on track for 3° Celsius.[62] • 2009 WEO Reference Scenario projects continuing growth in emissions – from 28.8 Gigatonnes (Gt) of CO2 a year in 2007 to 40.2 Gt of CO2 by 2030, an increase of 40%.[63] • A recent MIT study gave a median projection of atmospheric CO2 concentrations reaching 866ppm by 2095 on the basis of current emissions, with median surface warming of 5.1° Celsius.[64]

On food, while the 2007 IPCC Assessment Report projected that "on the whole" global food production would increase with warming between 1-3° Celsius, it also argued that it would decrease beyond this. In low and tropical latitudes – where most developing countries are – it found that "even moderate temperature increases (1-2° Celsius) are likely to have negative yield impacts for major cereals".[65]

These estimates also took no account of the effect on food production of extreme weather events, such as hurricanes and floods. The 2010 floods in Pakistan and drought in Russia (each of which was attributed by the government to climate change) provided two vivid examples of the effects that such events can have on agriculture. Overall, the IPCC estimates that climate change will expose tens to hundreds of millions more people to the risk of hunger.[66]

At the same time, agriculture's own contribution to climate change will need to be reduced drastically. Agriculture accounts for up to 32% of global greenhouse gas emissions, if deforestation is included.[67] Over time, it will have to become a net sink for emissions rather than a net *source* of them – a shift that agriculture has barely begun to anticipate, but which will massively intensify the challenge faced by farmers as they attempt to meet rising demand.

On water, as just noted, climate change will cause major problems through changes in precipitation, glacial melting, droughts and other shifts.

Finally, climate change will introduce a range of other risks in addition outside of those in the water, food and energy sectors. Among the most important will be the danger faced by densely populated coastal 'megadeltas' in Asia and Africa, such as the Nile, Ganges–Brahmaputra and Mekong, where tens of millions of people will be at increased risk of acute flood and storm damage, chronic coastal flooding and loss of coastal wetlands.[68] Other impacts will include extensive implications for health and infectious disease.

For policymakers, it can be hard to make sense of what is happening. New science findings continue to emerge

rapidly. The IPCC's 2007 Fourth Assessment Report is already out of date in some key respects.[69] While climate models are improving all the time, their findings remain subject to considerable uncertainty, especially at more specific levels of geographical focus. And while estimates of future climate impacts may seem to imply steady, gradual changes that can be adapted to over time, past changes in the earth's climate have been the opposite: unpredictable, highly non-linear, and hallmarked by sudden shifts as thresholds are passed. Policymakers must hence also consider the risk of abrupt climate change resulting from positive feedback effects, such as:

- rapid die-back of tropical forests or melting of Arctic tundra (both of which would release large amounts of methane into the atmosphere); [70]
- rapid melting of polar ice sheets or glaciers (which would result in higher sea levels);[71] or
- reduction in the capacity of atmospheric sinks such as the world's oceans to absorb carbon dioxide (which would magnify the impact of current emissions).[72]

While these kinds of risk are largely omitted from IPCC assessments because of the high degree of uncertainty associated with them, they remain a real consideration for policymakers wanting to take a risk management approach based on feasible worst case scenarios.[73] Current best-guess estimates suggest that global average warming of around 2° Celsius may be a key threshold for some of these effects – but such assessments are tentative guesses at best, and may prove to be over-optimistic.[74] In effect, then, policymakers responding to scarcity issues must make a bet on the basis of incomplete information and their own attitudes to risk.

Why See Scarcity Issues as a Set?

So why think of energy, food and water security as an integrated whole under the collective 'scarcity' heading – rather than regarding them simply as separate issues?

Common drivers

First and most obviously, because of the extent to which scarcity issues all share common drivers. On one side of the equation, **demand** for food, land, water, energy and 'atmospheric space' for anthropogenic emissions is rising – for two reasons. First, the 'global middle class' is growing in size and affluence. Especially important for scarcity issues are

- *energy use* (larger homes, increased mobility, energy used to manufacture and move consumer goods – and hence greater demand for both oil and, increasingly, biofuels); and
- *diet* (higher consumption of meat, dairy products and processed food than the global average, which are in turn far more resource intensive in terms of energy, grain, water use and greenhouse gas emissions).

People in developed countries have consumed a disproportionate share of these resources for decades. But what has changed in the last 10 years is the sheer pace of growth in China and other emerging economies. By mid-2007, the four 'BRIC' economies – Brazil, Russia, India and China – together accounted for 15% of the world economy.[75] This trend is set to accelerate: even before the global downturn, in which emerging economies have often fared better than OECD economies, Goldman Sachs suggested that the four BRICs could outweigh the combined GDP of the G7 economies by 2035.[76]

This dizzying growth has, in turn, brought the issue of global resource consumption to a head. Perhaps the most vivid illustration of the implications of current growth rates for natural resources is seen by simply following the logic of exponential growth rates to its logical conclusion. With annual GDP growth of 9%, China's economy doubles in size roughly every 7-8 years – with all of the resource use implications that this entails.

The second reason for rising global demand is a growing world population. Contrary to many popular perceptions, the rate of global population growth has actually slowed

substantially in recent decades, having peaked in 1963.[77] While many discussions of resource scarcity still focus anxiously on the idea of a Malthusian 'population explosion', in fact global population levels are on course to stabilize, at around 10 billion people.[78] With strong commitment to the policies such as girls' education, women's empowerment and access to reproductive health services, stabilization could happen much sooner, and at much lower levels.[79]

Table 2: World's 20 Most Populous Countries, 2007 and 2050 (source: UN DESA)[81]

2007		2050	
Country	**Population (m)**	**Country**	**Population (m)**
China	1,329	India	1,658
India	1,169	China	1,409
USA	306	USA	402
Indonesia	232	Indonesia	297
Brazil	192	Pakistan	292
Pakistan	164	Nigeria	289
Bangladesh	159	Bangladesh	254
Nigeria	148	Brazil	254
Russia	142	DRC	187
Japan	128	Ethiopia	183
Mexico	107	Philippines	140
Philippines	88	Mexico	132
Vietnam	87	Egypt	121
Ethiopia	83	Venezuela	120
Germany	83	Russia	108
Egypt	75	Japan	103
Turkey	75	Iran	100
Iran	71	Turkey	99
Thailand	64	Uganda	92
DRC	63	Kenya	85

However, most future population growth will be heavily concentrated in the world's lowest income regions, where population is projected to rise from 5.4 billion now to 7.9 billion in 2050 under the UN's median scenario, and especially in cities.[80]

As the table above illustrates, the list of countries in which population growth is likely to be fastest includes numerous states that are as fragile as they are regionally significant – including Pakistan, Nigeria, Bangladesh, the Democratic Republic of the Congo, Ethiopia, Iran and Kenya.

On the other hand, there is the challenge of limitations to supply growth of energy, food and water, as discussed in the last section. Admittedly, innovation and technology can make a huge contribution towards both increasing supply and reducing demand. But important obstacles stand in the way. One is the extent to which public R&D budgets have declined in recent decades: the budget for the Consultative Group on International Agricultural Research (CGIAR) has fallen by 50% over the last 15 years, for instance, while the IEA estimates that public R&D on energy is half its level of 25 years ago.[82]

Many other technologies face barriers in attaining commercial roll-out, for example because of the often long timescales on which capital investment costs are recouped. Another key barrier to the uptake of clean or high-efficiency technologies is that environmental costs are frequently 'externalized', i.e. not properly reflected through price mechanisms. This is particularly true of water, which is often not priced at all, but it also applies to energy prices (which tend not to reflect the environmental costs of fossil fuel combustion), food production (where food prices rarely include costs that are borne elsewhere, such as pollution from fertilizer use) and 'environmental services' (such as the vital role played by the world's forests in regulating the climate – for which the owners of forest land rarely receive recompense).

Common linkages

The second reason for seeing energy, food and water scarcity as a single set of issues is the dense, and increasingly complex, mesh of feedback loops between them.

These feedback loops are often most apparent at country level. In Haiti, for example, complex feedback loops of cause and effect link deforestation, soil loss and erosion,

degradation of agricultural land, changed precipitation patterns and increased risk of flooding with human variables such as increased hunger and food insecurity, the risk of instability and violent conflict, and state fragility (see Figure 4 below).

Figure 4: Satellite image of border of Haiti and Dominican Republic, showing deforestation (2002)

At regional and global level, the complexity of these linkages and feedback loops increases still further, thus raising the risk of unexpected outcomes, disruptive change and unintended consequences.

The linkage between energy and food provides a particularly good example of why such feedback loops matter for policy. Over the last century (and particularly over the last decade), energy and food, have in effect been converging into a single food-energy economy. Today, energy can be converted into food, food into energy, and prices for both are becoming linked in a process termed by Goldman Sachs as "bushel-to-barrel convergence."[83]

While modern agriculture has achieved massive increases in crop yields, it has done so partly by becoming more energy intensive. Mechanization began to replace human labor in agriculture early in the 20th century. Since then, dependence on fossil fuels has further increased, whether in nitrogenous fertilizers (made in energy-intensive processes in which fossil fuels are also the raw material), on-farm energy use (including heating livestock sheds and greenhouses, as well as tractors and combine harvesters), and the energy used to pump groundwater for irrigation. Today's longer supply chains are also energy-intensive in their dependence on fossil fuels and refrigeration systems. Agriculture's energy dependence is hence one of the major reasons why higher oil prices tend to mean higher food prices.[84]

The other half of the food-energy link has to do with the growing importance of biofuels in the international energy economy. Although less than 2% of global demand for liquid fuels is met by biofuels, they accounted for 75% of the increase in non-OPEC oil supplies in 2008.[85] And while biofuels' contribution to total liquid fuel needs may be small, they have nonetheless caused major ripples in the food context. As the IMF noted in its *World Economic Outlook 2008*

> "Although biofuels still account for 1.5% of the global liquid fuels supply, they accounted for almost half the increase in the consumption of major food crops in 2006-07, mostly because of corn-based ethanol produced in the United States."[86]

As biofuels show, the linkages between different scarcity issues introduces the risk of unintended consequences from policy measures taken to tackle one scarcity issue, without taking other dimensions of scarcity into account. A measure taken to improve US energy security can have the side-effect of creating substantial food security problems in multiple other locations around the world.

The convergence of the world's energy and food economies provides just one example of how scarcity issues are increasingly overlapping with one another. There are many others. Water security is often energy-intensive, for example, whether in the energy used to power groundwater pumps or in the high energy use rates often associated with desalination technologies; equally, many countries rely on water to produce electricity, through hydroelectric power generation. Water and food are connected through the fact that agriculture accounts for 70% of human water use; land is connected to water since land rights usually come with rights to extract the water

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Table 3: Selected linkages between scarcity issues

Cause...effect	Energy	Food / land use	Water	Climate change
Energy		Agriculture is a major consumer of energy, both directly (cultivation, harvest, processing, refrigeration, distribution) and indirectly (fertilizer, pesticides, other inputs)	Water is a highly energy intensive industry (energy = 40% of cost of water in developing countries) Groundwater depletion leads to higher energy use for extracting / desalinizing water	Climate change demands retreat from fossil fuels, investment in new energy systems Extreme weather can severely impact oil production (e.g. hurricanes in Gulf of Mexico)
Food / land use	Higher energy prices lead to higher food prices as input and transport costs increase Biofuels create arbitrage relationship between food and fuel, pulling food costs upwards in line with energy Biofuel cultivation leads to increase in demand for cultivable land Deforestation for firewood		Lower water availability has negative effect on crop yields, can make some crops unsuitable for areas Changes in water management (dams, irrigation, etc.) can affect viability and productivity of land downstream	Short term yield variance due to rising temperatures Reduced yields through extreme weather events Reduced yields through changes in precipitation and water availability Desertification, land and soil degradation will increase with climate change
Water	Higher energy costs lead to higher water costs because of energy used in extracting / pumping / processing it Water essential for hydroelectric power generation (c. 16% of global total power generation)	Increased water use for irrigation can affect water resources (e.g. shrinking of Aral Sea) Land use change affects water management (e.g. wetland drainage reduces flood resilience)		Climate-driven changes in precipitation; increased droughts Changes in water availability e.g. through glacial melting
Climate change	Emissions drive climate change Some air pollution dampens climate change by reducing radiative forcing Energy security concerns may lead to more coal use	CO2 emissions from agriculture energy use (cultivation, processing, refrigeration, distribution) Methane emissions from livestock, rice cultivation; deforestation leads to methane emissions as trees decompose	See energy intensity points above	

continued from page 19

beneath it; and so on. (Table 3 provides a fuller overview of some of the most important linkages between different aspects of scarcity.)

Nor are the direct feedback loops between scarcity issues the only ways in which they are linked. As the section on development and fragile states discusses, all aspects of scarcity have in common the extent to which poor people and fragile or low income states are especially vulnerable to them. All have the potential to drive increased violent conflict, albeit almost always as threat multipliers rather than as stand-alone causes. And because of the numerous international dimensions of scarcity issues, together with the resource dependence of the global economy, all pose profound questions for globalization itself.

Part 2: Scarcity and Multilateralism

Development and Fragile States

What do climate change and scarcity mean for development and fragile states?

In the real world, the impacts of resource scarcity or climate change will almost always blur with those of other risk drivers – which makes it hard to attribute any particular shock, stress or other impact solely to climate change or resource scarcity.

Take for example recent figures on the global total of undernourished people. In 2007, according to the UN High-level Task Force on the Global Food Crisis, 854 million people were undernourished.[87] By late 2009, the Food and Agriculture Organization put the figure at 1.05 billion.[88] While one part of the reason for the rise was the final year of the food and fuel price spike, another part was due to the subsequent effects of the global downturn, which further eroded the purchasing power of many poor people.[89] (The figure has subsequently fallen to an estimated 925 million undernourished people.)[90] Likewise, the peacebuilding agency International Alert stresses that the most significant impacts of climate change may be "consequences of consequences" – indirect effects felt in the broader social, political or economic arena.[90]

The problem of attribution of effects to scarcity is compounded by the fact that vulnerability – whether of individuals, communities, ecosystems, states, or economies – is as important a hazard in determining the impact that shocks and stresses driven by scarcity have on the ground.

Poor people are especially vulnerable to scarcity, as to other risks, in particular when these risks are experienced as sudden-onset events that can lead to poverty traps. Droughts, for instance, often force poor families to sell livestock or other assets. Other kinds of shock can force families to take children out of school. When such shocks come in cycles, they are often what cause people to become poor or stay poor. Environmental risks are an especially common cause of such shocks; climate change will worsen the problem.[92] Poor people are also most at risk from food or fuel price spikes because they spend a high proportion of income on these commodities: in the case of food, often between 50-80%.

The same applies at the country level for import-dependent low income countries. An International Energy Agency study published in late 2007 found that in 13 non-oil producing African countries – including South Africa, Ghana, Ethiopia and Senegal – increases in the cost of oil over the previous three years came to more than the sum of aid and debt relief they received over the same period.[93] The food spike affected poor countries hardest too: during 2008, low-income food-deficit countries saw their import bills rise by as much as 40%.[94]

State fragility is another source of vulnerability for many countries. A 2007 report from International Alert found that 46 countries would experience a "high risk of violent conflict" as climate change interacted with economic, social and political problems, while in a further 56 countries "the institutions of government will have great difficulty taking the strain of climate change on top of all their other current challenges."[95]

So climate change and resource scarcity are better understood as 'threat multipliers' than as stand-alone sources of risk to poor people and fragile states.[96] With this caveat stated, however, a range of potential impacts can be identified.

First, climate change and scarcity risk leading to a rise in **poverty**. As noted, the number of undernourished people rose sharply during the food and fuel price spike. In rural areas, where three quarters of poor people live, rising energy costs also saw small farmers hit by steep increases in costs for fertilizer and pumping water.[97] In the future, the number of people at risk of hunger because of climate change is expected to increase by 10-20% more than would be expected without climate change, with the number of malnourished children rising 21% over the same period.[98]

Second, scarcity issues will have far-reaching implications for the **political economy of developing nations**. As a recent World Bank study observed, "renewable natural resources define systems of power and access" in a range of ways, including ownership, consumption, distribution and governance.[99] In countries with patronage-based political systems, the effect of such resources becoming scarcer may change the political economy balance by reducing the size of the patronage 'cake', or creating new winners and losers – potentially contributing to unrest or violent conflict in the process (see below). Land and water governance regimes are especially important in this context.

Conversely, growing resource scarcity may also create new forms of the '**resource curse**' – the problem in which point-sourced commodities such oil, diamonds, precious metals, minerals and certain plantation crops such as coffee and cocoa have the effect of "warping the political economy of a country" by encouraging rent-seeking competition, facilitating corruption and catalyzing conflict over control of revenues.[100] In the Niger Delta, for example, perceived inequalities in benefit-sharing from oil production have contributed to an insurgency that has, at times, shut down one fifth of the country's oil production.[101] If oil prices are set for long-term inflation, then the risk of such insurgencies – and their capacity to leverage impact – may increase.

It is also possible that new kinds of commodity may become subject to the resource curse in future as a result of resource scarcity – for example as a result of unequally shared benefits from third country land or food access deals (so-called '**land grabs**' – which as noted earlier, can also be water grabs).

One potential indicator of this risk was the 2009 controversy in Madagascar over a deal which saw the South Korean company Daewoo lease one half of the country's arable land for 100 years – for which the government would receive no payment.[102] When news of the deal broke in the *Financial Times*, discontent simmered over, and was widely perceived to have contributed to the coup d'état that took place in March 2009. The new President's first act was to cancel the deal.[103] More recently, a major World Bank report on such deals argued that a priority was for governments to "improve land governance to ensure that the pressures from higher land values do not lead to dispossession of existing rights."[104]

Another risk is that scarcity shocks can lead to **violent unrest**. During the food and fuel price spike that peaked in 2008, for example, 61 countries experienced unrest as a result of price inflation. In 38 countries, these protests turned violent, with fragile states proving particularly susceptible to this problem.[105] More recently, as noted earlier in the paper, Mozambique experienced serious unrest in summer 2010 when it tried to reduce subsidies on bread, leaving seven people dead and over 200 injured.[106]

At worst, scarcity may contribute to the outbreak or sustenance of violent conflict. Some quantitative studies have found strong causal relationships between rainfall variation or temperature increase and violent conflict, although the methodological approach taken by these studies has been challenged, and such quantitative approaches also rest on an implicit assumption that the past will be a guide to the future – which may be incorrect, given the potential for abrupt, non-linear changes in the future, as discussed in the section on climate change earlier in the paper.[107] Alternatively, cases can be identified in which scarcity has played a role, for instance competition for land in the run-up to the 1994 Rwandan genocide or the disputed elections in Kenya in 2008, or the role of both water and land as conflict threat multipliers in Ethiopia and Darfur.[108]

In many cases, the risk of violent conflict that arises from resource scarcity has less to do with disputes over the control of natural resources themselves, than with the livelihoods that they enable. One widely discussed example of this is the example of piracy off the coast of Somalia, where it has been argued that depletion of fisheries due to over-exploitation by fleets from other countries has led to fishing communities taking up piracy as an alternative livelihoods strategy.[109]

Why is multilateral cooperation needed?

The multilateral system's involvement in issues of development, state fragility and emergency response is already vast. In the development context, for example, OECD DAC countries spent just under a quarter of their total development aid through multilateral institutions between 2004 and 2006.[110] In the conflict context, nearly 80,000 peacekeepers are deployed to conflict-affected states through the UN, costing $8 billion a year.[111] The UN humanitarian system will spend the same amount again this year through the Consolidated Appeals Process.[112]

At the same time, as just noted, poor people and poor countries will be disproportionately impacted by scarcity – a theme that comes up again in each of the other three policy areas discussed in this part of the paper. Climate change will hit hardest on low latitudes, where most developing countries are located. Poor people and poor countries have the greatest vulnerability to environmental shocks and stresses, just as for kinds of shocks and stresses. They spend more of their resources on food and fuel, and are more exposed to commodity price inflation. They have less capacity to organize to secure fair shares, whether in local, national or international settings.

So given that the multilateral system is already heavily involved in supporting poor people and poor countries, and that these actors have such a direct stake in effective management of climate change and scarcity, it follows that the multilateral system will increasingly need to take account of scarcity in all its work in poor countries – whether humanitarian relief, conflict prevention and response, long term development, or indeed provision of global public goods. What does this involve in practice?

What are the key tasks for multilateral cooperation?

Once again, it bears repeating that scarcity issues will rarely, if ever, be experienced in isolation from other risk drivers. This means that policy responses must be equally integrated. The list of actions below is not just an agenda for action on scarcity, therefore, but in some ways an agenda for *development itself* in a world increasingly characterized by risk – of which scarcity is just one aspect.

Key Multilateral Tasks for Managing Scarcity: Protecting Poor People and Fragile States

Short term (e.g. actions that could be agreed at summit meetings in 2011 or 2012)

- Increase international humanitarian assistance capacity and funding
- Scale up social protection systems, safety nets, etc.
- Build international donor capacity for analysis of natural resource governance, political economy and conflict risk dimensions of scarcity
- Scale up work on girls' education, access to reproductive health services, women's empowerment and other sectors that can help reduce unsustainable population growth

Medium term (actions requiring greater political heavy lifting, likely to take 3-5 years)

- Move towards a more integrated approach to building across development programs
- Build scarcity issues into conflict response strategies

Key questions and issues

- Need for more concrete examples of low carbon, climate-resilient growth
- Need for integrated assessment of finance for development needs (see next section)
- What happens if scarcity develops to the point at which social protection systems are insufficient for protecting poor people?

Short term tasks

To start with, the multilateral system will need to **scale up humanitarian assistance capacity** to cope with scarcity. Today, a rough rule of thumb sometimes used by UN humanitarian practitioners is that global emergency relief systems can reach up to 100 million people to at one time. The food / fuel spike saw these capacities severely tested. Even before the spike, the World Food Programme was helping 73 million people in 78 countries; the food crisis then increased the number of undernourished people by well over 100 million, to over a billion in total.[113]

As scarcity increases, then, humanitarian relief may need to assist many more than 100 million. Exact estimates are

impossible, but a potential doubling of capacities over the next 10-15 years is probably a reasonable starting point. At the same time, the humanitarian system will need to be ready to deal with different kinds of challenge. In the past, emergency relief has generally come after violent conflict or a natural disaster. Scarcity issues will change this context significantly. The food price spike provided a taste of the future: as World Food Programme executive director Josette Sheeran observed at the time, "there is food on the shelves but people are priced out of the market … there is vulnerability in urban areas that we have not seen before."[114]

To cope with these changing circumstances, emergency relief is likely to need:

- *Additional financial resources*. WFP nearly ran out of funds during the peak of the food price spike, when it had to raise $755 million of additional funding just to continue feeding people already dependent on it. In 2009, the agency needed approximately $6 billion – a 20 % increase on 2008 (itself a record year). The importance of funds being available in advance is also likely to increase.

- *Improved co-ordination*. Humanitarian agencies will have to work with a wider range of governments and international agencies as scarcity evolves. Humanitarian co-ordination structures must also cope with spikes in their own running costs, and potentially also with wider economic volatility (for example in exchange rates, costs for insurance and the potential effects of export bans).

- *Re-conceptualizing*. As humanitarian agencies find themselves helping victims of scarcity-driven slow onset stresses, the line between humanitarian relief and social protection (see below) will become increasingly blurred – driving new complexities in funding and co-ordination, but potentially also creating new opportunities for improved delivery.

The UN humanitarian system should start planning now for the how caseloads may grow and evolve. The UN Office for Co-ordination of Humanitarian Assistance (OCHA) is best placed to undertake this analytical work, and should be mandated by the UN Secretary-General to carry out a full review of how needs will change in the light of scarcity issues.

Second, there is a need to **scale up social protection systems and safety nets** as a way of building resilience. Social protection is usually defined as public actions carried out by the state or privately that can enable people to deal more effectively with risk, vulnerability to crises or change, and that help to tackle chronic or extreme poverty.[115] The proportion of people who currently enjoy access to social protection is very low – around 20% of people globally.[116]

Social protection policies are often classified into two categories: *social insurance,* where social security is financed by contributions and based on the insurance principle of pooling risk; and social assistance, where public actions transfer resources to needy people.[117] In practice, it can take a huge range of forms, including cash and in-kind transfers, employment guarantee schemes, mother and child health & nutrition or school feeding programs, weather-indexed crop insurance, micro-finance or social pensions.[118]

Such policies have a valuable role to play in managing scarcity. Food and energy security is not just about the total amount of food or oil that is *produced* globally, but crucially also who is able to *access* these goods. (As the economist Amartya Sen once observed, "Starvation is the characteristic of some people not having enough to eat. It is not the characteristic of there not being enough to eat.")[119]

The food / fuel price spike sharply reduced the access of poor people to food and fuel, and led to unrest in many countries – at least 46 of which imposed either price controls (which distorted markets and removed incentives for increased supply) or economy-wide subsidies (leading to inflationary impacts and serious budget shortfalls). As the UN food task force argued at the time, social protection systems targeted at the poorest and most vulnerable people could have offered a far more affordable and

targeted way, with fewer unintended side effects.[120] At the same time, as Nicholas Stern has argued, social protection systems are also increasingly seen as potentially forming a core element of climate adaptation strategies.[121]

Scaling up social protection will require financial resources and harmonization across aid donors, but it will also require them to take a politically sophisticated approach. The key barriers to social protection systems are often political, not technical: elites may oppose them out of fears that they will encourage dependency, for example (the evidence actually suggests the opposite).[122]

A third task is **building international donor capacity for analysis of natural resource governance, political economy and conflict risk dimensions of scarcity**. As already noted, the impact of scarcity issues in fragile states needs to be seen in a broad political, economic and social context. Getting involved in such politicized areas presents challenges for aid donors. Many find it easier to concentrate on 'safe' areas – for example seeing development assistance as primarily about disbursing money rather than exercising influence, or concentrating on relatively technical areas of governance such as public financial management systems.

But as scarcity increases, donors will find themselves forced to engage with tough debates about resource rights, given that in many countries the default outcome will be for the poor to end up the losers, because of their lack of political clout. The first step towards this engagement is for donors to have as full an understanding as possible of the country context, together with a clear-sighted recognition of the fact that donors themselves are always political actors, never neutral bystanders.

The capacity for this kind of analysis is becoming an increasingly central plank of progressive donors' engagement in poor countries – the UK Department for International Development (DFID), for example, now uses 'drivers of change' analysis as a basis for developing Country Assistance Programs in all countries where it operates. The next step is for donors to bring scarcity issues to the heart of these analyses, mapping the outlook on resource scarcity against indicators of human vulnerability, economic impact, conflict risk and so on, with particular attention to the governance regimes that countries apply to resources such as land and water. (The Center on International Cooperation is in the process of producing pilot studies for what such integrated country assessments would look like in practice.)

Finally, there is a pressing need for donor agencies to do more to **address unsustainable population growth** in key low income countries. Population is one of the most sensitive issues in development, involving as it does highly personal questions about sexual behavior and women's empowerment. Discussion of population growth can also raise acute fears, whether because of the draconian approach that some countries have taken to the issue (for example, China's one child policy), or because of accounts of environmental degradation that lay the blame with poor people for 'reproducing too much' rather than with OECD countries or the world's middle class for 'consuming too much'.

Yet as discussed earlier in the paper, the fact remains that some of the world's poorest and most fragile states face some of the least sustainable rates of population growth. If unaddressed, these rates of growth will greatly intensify the problem of managing scarcity; slower population growth, on the other hand, can buy more time to adapt, particularly in the face of the coming impacts of climate change.[123]

Moreover, the evidence shows that far from requiring draconian approaches, the process of development itself tends to reduce fertility rates. In particular, policies to improve girls' education, women's empowerment and access to reproductive health services have a particularly important role to play on this agenda, and should be regarded as priority areas for support by international donors.

Medium term tasks

In the medium term, the key task for the multilateral system is to **move towards a more integrated approach to building resilience across development programs.** A wide range of work on this front is already underway: recent years have seen greatly increased attention paid to climate adaptation, peacebuilding, disaster risk reduction, statebuilding and social protection, for example, all of which are fundamentally concerned with managing risks to poor people and development. Such measures can have a transformative effect: the most recent science findings on the effects of climate change on hunger, for instance, show that while hunger may increase by 10-20% because of climate change, effective adaptation could reduce the number to 5%.[124]

But much remains to be done to *mainstream* these resilience-focused areas of work through national development strategies. For fragile states, in particular, a paradox will be the fact that successful resilience-building will depend on the resource that by definition they lack: institutional capacity.

Much also remains to be done to explore the synergies between the different elements of the 'resilient development agenda'. International Alert, for example, has argued that "peacebuilding and adaptation are effectively the same kind of activity, involving the same kinds of methods of dialogue and social engagement, requiring from governments the same values of inclusivity and transparency."[125] DFID recently undertook a major program of work to explore the links – and potential tensions – between statebuilding and peacebuilding.[126]

The other key medium term task centers on **building scarcity issues into conflict response strategies** – such as mediation, peacekeeping or post-conflict reconstruction. International actors need to invest in improving the capacity of conflict specialists – whether mediators, peacekeepers or peace-builders – to understand the role of scarcity in conflicts, and build this in to their approaches, both to avoid doing harm or creating unintended consequences, and to seek to reduce these drivers' potential to cause further conflict in the future.[127] These issues are returned to in more detail later in the paper.

Key questions and issues

On the analytical front, multilateral actors need to work to **develop a clearer and more tangible idea of what the vision of 'low-carbon, climate-resilient growth' actually means**. It is already clear that climate change and scarcity issues will radically alter the context for development in the future. Agriculture will need to become more sustainable, and less reliant on inputs like water or fertilizer. Developing country governments will need to find ways of improving their citizens' access to energy without locking them in to increasingly expensive and decreasingly sustainable infrastructures. Communities, countries and regions will need to become more resilient to an increasingly turbulent world, with scarcity and climate change foremost among the drivers of change.

Developed countries must take the lead in tackling the root causes of many of these challenges, at least in areas such as reducing emissions, where there is a moral and a political imperative for them to do most to tackle the problem they did most to create. Yet there is also the potential for developing countries to pursue growth paths that learn from developed countries' mistakes, and position themselves to gain from the opportunities of the future.

There are few examples of countries demonstrating what it means to tackle these challenges successfully on the ground (not least since developed countries have so far conspicuously failed to 'take a lead' on climate change). Accordingly, the potential exists for international actors to support developing countries in ambitious pilot projects that show what could be achieved. Costa Rica is an example of what can be done: the country already generates 80% of its electricity from renewable sources, and is racing countries including Norway, Iceland and New Zealand to become the first wholly carbon neutral country in the world.[128] The World Bank-administered Climate Investment Funds are also focusing increasingly on country-level approaches, for instance the Pilot Program on Climate Resilience (PPCR).[129]

At the same time, multilateral actors will also need to **reassess overall finance for development needs in light of scarcity.** Existing estimates of aid requirements in poor countries (and indeed the long-standing target for OECD countries to allocate 0.7% of gross national income to aid) will clearly be affected by the substantial price tags attached to objectives such as scaling up access to energy at the same time as reducing greenhouse gas emissions, increasing investment in agriculture, adapting to climate change and dramatically improving access to social protection systems. This issue is covered in more detail in the next section.

Finally, a question for the longer term is **what happens if scarcity issues develop to the point at which social protection systems prove insufficient for protecting poor people?** As discussed above, social protection systems and safety nets have a key role to play in protecting poor people from price spikes and other shocks and stresses. But it is also possible to imagine conditions in which even universal social protection coverage might still leave many poor people unable to cover their basic needs.

Imagine, for example, a future recurrence of the conditions that led to the food price spike of 2008, but with some or all of the following additional elements, all of which are feasible or even predictable in the next two decades: global population of a billion higher than today; global average warming of 2° Celsius, with reduced crop yields in high as well as low latitudes; volatile swings in precipitation patterns, including an outright failure of the South Asian monsoon; and global oil production down to 75 million barrels, with significant unmet demand and dramatic knock-on consequences for fertilizer costs, the economics of biofuels.

In this situation, poor people with access to basic social protection could nonetheless still find themselves priced out of the market for key foodstuffs. The issue would be less one of absolute poverty than of lower relative purchasing power in conditions of scarcity – in other words, a problem of inequality coupled with a context of limits. While social protection provision might be better than nothing in such circumstances, it would be no substitute for a collective will on the part of policymakers and publics to face up to the much deeper issues of fairness involved – an issue returned to later in the paper.

Finance and Investment

What do climate change and scarcity mean for investment and finance?

Scarcity and climate change will require massive investment in energy systems, agriculture and improved resilience, especially in developing countries.

Start with **energy systems**, the most expensive of the three areas. As the first part of the paper noted, from a scarcity perspective the key energy security concern centers on oil supplies – both because of the risk of a short term supply crunch as a result of under-investment, and because of longer term worries about when global oil production will peak.

But the need to respond to climate change means that the policy challenge is not simply to create a framework for increasing the amount of investment going towards upstream oil production. For one thing, meeting the projected 1% a year demand increase for oil is hard to reconcile with limiting temperature increase to 2° Celsius. For another, meeting this demand forecast would require more and more liquid fuel to come from unconventional sources, such as oil sands – which are themselves far more energy-intensive to produce, with emissions 21-47% higher than those from conventionally produced petroleum fuels – or deepwater drilling.[130]

Instead, the key policy requirement is to fulfill energy security needs *while at the same time reconciling them with the need to stabilize the climate*. Rather than simply increasing oil supplies, policymakers must embrace a whole range of alternatives, ranging from more efficient vehicles, and improved public transport through to electric or hydrogen powered cars.

As the latter two examples show, it is not enough just to look at the investment required in the transportation

sector: a much more holistic approach is needed. Today, admittedly, energy demand from transport is largely separable from energy demand from power generation, households and industry. Transport relies largely on oil products (and will account for most future demand for oil); power generation, industry and the household sector, on the other hand, rely mainly on coal, natural gas, nuclear, renewables and hydro.[131]

But in future, this boundary will become increasingly blurred. Electric cars will reduce demand for oil while increasing demand for electricity – and increasing the importance of whether that electricity is generated from coal, gas, nuclear or renewables. The same point would apply if a significant number of cars were fuelled by hydrogen (also derived from electricity, via the process of electrolysis). Similarly, if energy security concerns led more countries to produce liquid fuels from coal (as Germany had to during World War 2), this would increase demand and hence prices for a fuel currently used primarily for power generation, not vehicles.

The consequence of these market transformations is that policymakers concerned to reduce the risks of oil price volatility will increasingly need to look at the price tags for energy systems as a whole – whether or not they are also concerned to mitigate climate change.

The sums involved are astronomical. Simply to meet projected energy demand in the 2009 World Energy Outlook's Reference Scenario, the IEA estimates that cumulative investment of $26 trillion (in 2008 dollars) would be needed between now and 2030.[132] However, the Reference Scenario takes no account of the cost of reducing emissions (and would hence put the world on track for a temperature increase of up to 6º Celsius). To meet projected energy demand and limit average warming to 2º Celsius, the cost rises to some $36.5 trillion over the next two decades. [133]

Much of this investment will be needed in developing countries, where most of the growth in demand for energy will take place. Non-OECD countries account for all of the projected growth in demand for oil between now and 2030, and for all of the projected increase in emissions over the same period.[134]

At the same time, there is also much to be done to scale up access to energy in developing countries. 1.4 billion people currently lack access to electricity, 85% of them in rural areas.[135] In Sub-Saharan Africa, where the challenge is greatest, the electrification rate is just 31%, with 80% of people relying on traditional biomass energy (wood, dung and so on). The IEA estimates in its 2010 World Energy Outlook that achieving universal access to modern energy systems by 2030 would require additional investment of $756 billion ($36 billion per year) – less than 3% of the total required over this period in the IEA's 'New Policies' scenario.

However, actual levels of total current investment in energy are far less than is needed. Part of the reason is the tough financing environment that has followed the credit crunch. In the context of oil specifically, a key factor is the decline in prices since 2008: current levels of around $80 per barrel are also only just above the level at which oil production from sources such as tar sands in Canada or deep water wells off the coast of Angola become economic, for example.[136] But a third part of the reason for current inadequate investment levels – and arguably the one that policymakers can do most to rectify – is the lack of 'signals from the future' for investors about the extent of future emissions controls.

Capital stock lifetimes for power stations, refineries and other kinds of energy infrastructure are typically several decades long. Accordingly, energy sector investors need clear indications of how much future demand for (say) oil or coal-fired electricity will be curtailed by future climate policy. Unfortunately, the Copenhagen climate summit fell well short of giving investors this long-term predictability.[137] Accordingly, it becomes rational for investors to reduce their exposure to political uncertainty, for example by concentrating investment in technologies with rapid payback times – such as gas-fired power stations – rather than those with longer payback times, like nuclear, wind power or many forms of energy efficiency.

Admittedly, political concerns on energy security and peak oil will drive changes in energy systems even *without* a comprehensive international climate regime. Unfortunately, though, there is nothing to say that energy security must necessarily be low-carbon. To take one example, the technology has long existed to derive liquid fuels from coal – which could reduce countries' reliance on foreign oil, but at a severe cost in climate change terms. Similarly, while electric power can be used to run vehicles, the electricity can (as noted above) be generated as easily from coal-fired power stations as from nuclear or renewable energy.

In all, then, the policy requirement is for governments to jump-start the emergence of a low-carbon economy, which would simultaneously address energy security and climate change concerns. Achieving this requires a much more favorable investment climate, however; the paper returns shortly to the question of what this would require from the multilateral system.

Agriculture is the second key area in which investment is needed. As noted earlier, the productivity gains driven by the agricultural 'Green Revolution' during the 20th century have shown signs of running out of steam in recent years – just as demand is rising rapidly in line with rising affluence and a growing global population.

A 21st century 'Green Revolution' will need to replicate the improvements in crop yields made by its 20th century predecessor. But it will also need to achieve three more objectives. First, it must be far more resource-efficient. Agriculture, more than any other sector, is where the battle on water security will be won or lost: as noted earlier, it accounts for 70% of human water use. Agriculture's reliance on fossil fuels and high greenhouse gas emissions will also need to be reduced dramatically.

Second, a 21st century Green Revolution must be resilient to the shocks and stresses that can be expected in years to come, especially changing weather patterns. Third and finally, it must reduce poverty: three quarters of the world's poor live in rural areas, and the countries in which the greatest potential for productivity improvements exists are those that missed out on the 20th century Green Revolution, particularly in Africa and Asia.

One of the most important areas for investment is improving producers' access to markets – a broad category of tasks that includes upgrading transport and distribution infrastructure (everything from rural roads to ports) as well as mechanisms to allow small farmers to aggregate their output in order to sell to large purchasers like supermarkets or global food companies. A second priority is investing in access to knowledge, particularly through scaling up rural extension services that can diffuse science and technology innovations out to producers in the countryside. Other key areas for investment are access to credit, access to risk management and access to assets (including land and water).[138]

As with energy, agricultural objectives are challenged by a historical problem of under-investment. The proportion of official development assistance going to agriculture fell from 17% of the total in 1980 to 3% in 2006; the amount of public investment in agricultural research and development has roughly halved over the last 15 years; and despite the fact that some of the greatest potential gains in agricultural productivity are to be found in Africa, in 2008 only 4.5% of public sector spending there went on agriculture, despite an African Union target to spend 10% of public expenditure on agriculture by 2008.[139] At the same time, while private sector investment in developing country agriculture has increased markedly, there have been concerns over whether such investments benefit the host country, and particularly poor people (an issue discussed in the *International Trade* section of the paper).

In future, the Food and Agriculture Organization suggests that roughly $30 billion a year is needed to improve agricultural productivity in low income countries, while UN Secretary-General Ban Ki-moon has put the same figure at $15-20 billion. These estimates would put the total between now and 2030 in the range of $420 billion, using the upper end of the UNSG's estimated range – an order of magnitude lower than the amounts that the IEA estimate are needed in the energy sector, but a massive sum nonetheless.

The third key area where finance and investment is needed in order to manage scarcity issues is **adapting to climate change**. As just discussed, much of the investment needed in order to cope with climate change will be targeted at the agricultural sector as part of a broader push to produce more food in a more sustainable and more resilient way. But adaptation will also be a much broader endeavor, involving tackling vulnerability across the board in developing countries (and indeed developed ones) and seeking to improve resilience.

In financing terms, there is a lively – and as yet unresolved – debate about the price tag attached to climate adaptation in developing countries. The World Bank has estimated that $9-41 billion a year will be needed between 2010 and 2015; the Stern Review, $4-37 billion; the UN Development Programme, $86-109 billion; the UNFCCC Secretariat, $27-66 billion.[140] More recently, a major study undertaken by the Grantham Institute for Climate Change and the International Institute for Environment and Development argued that all of these estimates are substantially lower than is warranted, and that the true cost of climate adaptation is likely to be between two and three times higher than the figure suggested by the UNFCCC Secretariat.[141]

Why is multilateral cooperation needed?

What will be the role of governments on mobilizing the investment needed – and when will they need to act collectively? In essence, there are three answers. First, they have a role in tackling market failures, most obviously the lack of consistent pricing on carbon or water. Taking policy action to rectify these externalities through price signals in turn has an impact on the investments at which finance is directed.

Second, governments can facilitate efficient private sector investment through improving long term investor certainty – through sending 'signals from the future' that can become self-fulfilling prophecies. If governments can convince private firms and citizens that a rapid transition to a low carbon world is now inevitable, then these actors have a powerful incentive to ensure they are positioned to take advantage of the change. Low carbon investment, in turn, makes policy action more palatable, creating a virtuous circle. This in turn requires a longer term and more credible approach to climate policy, for example basing global climate targets on longer term commitment periods or enhancing the robustness of compliance mechanisms.

Finally, governments have a role in protecting poor people from the effects of climate change and scarcity, given their disproportionate vulnerability. Given that private sector investors will tend not to have incentives to invest in helping poor people become more resilient, it is for governments to fill the gap, whether through direct public financing or regulatory frameworks that seek to direct private sector flows towards the same end.

All three of these areas are trans-boundary in nature. No country can achieve total internalization of climate and environmental costs on a unilateral basis: it would incur a cost to competitiveness that would prove impossible in both economic and political terms. On the adaptation side, meanwhile, the fact that poor countries lack the resources to cope with climate change and its wider effects on scarcity makes for a compelling case for multilateral support to the most vulnerable countries.

Short term tasks

The single most important multilateral task on financing and investment is to move forward with a comprehensive global deal on post-2012 commitments. However, following the weak outcome of Copenhagen, it appears as though this deal may be out of reach for the next two years or so (as a result of which it is discussed in the section on medium term tasks below). So what can policymakers start on immediately?

To begin with, they can **pursue a range of climate adaptation and mitigation actions that can move forward without a comprehensive global deal**. On the financing side, developed countries committed under the Copenhagen Accord to provide resources "approaching $30 billion for the period 2010-2012" to support developing countries' climate efforts on both adaptation and mitigation.

What are the key tasks for multilateral cooperation?

Key Multilateral Tasks for Managing Scarcity: Finance and Investment

Short term (e.g. actions that could be agreed at summit meetings in 2011 or 2012)

- Pursue key climate adaptation and mitigation actions that can move forward without a comprehensive global deal
- Accelerate investment in a 21st century 'Green Revolution'
- Scale up research & development spending on both energy and agriculture

Medium term (actions requiring greater political heavy lifting, likely to take 3-5 years)

- Move to longer term commitment periods and a more robust compliance regime in global climate policy
- Agree a global climate stabilization target
- Equitable and binding targets for developing countries within a global emissions budget

Key questions and issues

- Need for re-assessment of finance for development needs in light of scarcity
- Need for new financing sources (e.g. emissions trading)

As at the beginning of October 2010, developed countries' 'fast start' funding pledges came to $27.9 billion – a significant step towards the total pledged.[142] However, important caveats apply. It is not yet clear how the money will be split between mitigation and adaptation; not all pledges are 'new and additional', as they are supposed to be; it is not clear that donor countries will meet a commitment to target spending at the most vulnerable countries.[143]

In sectoral terms, a range of mitigation actions can also be pursued without a comprehensive global deal. One of the best examples of these is reducing emissions from deforestation and forest degradation (REDD) – an area that poses quite different challenges from other kinds of emissions reduction. There are also arguably good reasons for actively seeking to deal with REDD separately from negotiations over national emissions targets. Rather than incentivizing REDD projects by crediting them with emissions trading permits, a better approach may be to finance avoided deforestation separately, through developed countries providing direct financial incentives for developing nations to conserve their forests.[144]

Another example of an area of climate mitigation investment that countries could move ahead with now is action to reduce emissions of 'black carbon' (soot), which accelerates global warming by reducing the amount of sunlight reflected back into space, but which is not a greenhouse gas and is not covered under the Kyoto Protocol.[145]

On agriculture, secondly, policymakers need to **accelerate investment in the 21st century Green Revolution described above**. This investment will need to come from a plurality of sources. Part of the picture will be scaling up the proportion of development aid spent on agriculture and rural livelihoods.

The G8 L'Aquila Summit in 2009 made a good start in scaling up development assistance to agriculture, pledging $20 billion over three years.[146] However, not all the money pledged is for agriculture; a substantial proportion will be for humanitarian assistance and access to food. Both of these areas are essential, but mean that the G8's pledge is further from meeting the estimated $20 billion a year that might be needed in agriculture. There are also concerns that a number of key donor countries may not live up to their L'Aquila pledges – including the United States, which despite strong leadership from the Obama Administration on food, faces challenges in getting its spending pledges through Congress.

Philanthropic donors have also become major players in agriculture (the Alliance for a Green Revolution in Africa, for example, was set up by the Rockefeller and Gates Foundations rather than by bilateral or multilateral donors), and are likely to see their significance continue to grow. Last year saw the Gates Foundation alone allocate $316 million to agricultural development spending, with the proportion likely to increase in future.[147]

At the same time, investment from the private sector and from countries seeking to ensure security of supply for food – such as China and South Korea – is emerging as a major source of funds for agriculture in low income countries. This has the potential to finance significant productivity improvements, but much greater transparency is needed – not only on where funds are going, but also about the terms of such deals, given the concern about whether such agreements represent a fair deal for the country ceding its land or agricultural production. This issue is discussed in more detail in the section on *International Trade* below.

Finally, a range of longer-term analytical tasks will need to be undertaken on finance and investment. Of these, the most important is likely to be **scaling up research and development spending on both energy and agriculture**.

Investment in public R&D in both areas has fallen sharply in recent years. As noted earlier, the budget of the Consultative Group on International Agricultural Research (CGIAR, the key co-coordinating body for public investment in agricultural R&D) has fallen by around 50% over the past 15 years.[148] Public sector investment in energy R&D, meanwhile, is at just two thirds of its 1980 level in real terms, while the International Energy Agency warns that there is "growing evidence that the private sector is, in current economic circumstances, slashing spending on energy R&D."[149]

The dangers of this under-investment are pressing. R&D decisions must be taken today in order for key technologies to be deployed by 2020. As an indicative assessment, then, developed country policymakers should commit to double public R&D spending on low carbon technologies and sustainable agricultural innovation by 2015, and quadruple it by 2020 – at the same time as working with China, India, Brazil and other emerging economies to plan road maps for technical deployment.[150]

Medium term tasks

As this section has already argued, a key reason for investment shortfalls, particularly in the energy sector, is investors' lack of long-term certainty about what the long term global energy future will look like – in terms of both prices and technologies – and hence where they should target their money. Governments can therefore play a critical role in sending 'signals from the future' that shape investors' expectations about what the future is likely to look like, influence where they allocate finance on the basis of those expectations, and hence catalyze self-fulfilling prophecies of a low-carbon economy.[151]

While governments could, in theory, take a range of actions to increase investment levels in the oil sector (such as agreeing a price floor for oil, as has been suggested by George Soros and others), such approaches would do nothing to address climate change. If, on the other hand, policymakers manage to give investors greater confidence about the long term predictability and credibility of global climate policy, then investors can operate within a more integrated policy framework, that marries both energy security and climate mitigation objectives.

To begin tackling this objective, governments should **move to longer term commitment periods and a more robust compliance regime in global climate policy**. Under the Kyoto Protocol, emission targets are agreed in five year commitment periods – far shorter spans of time than the multi-decade lifetimes of energy investments such as power stations, oil and gas pipelines or even just household insulation. By moving to longer commitment periods, governments would reduce the gap between policy and investment time horizons, thus reducing the risk premium faced by investors.

At the same time, policymakers also need to make global climate policy much more credible in order to maximize their capacity to unlock private sector investment. At present, the Kyoto Protocol's compliance and enforcement regime is weak, with countries that fail to meet their targets only receiving a 30% fine in the subsequent commitment period, and countries that are non-parties having a strong incentive to free ride.[152] One possible way of improving the credibility of Kyoto's compliance system would be for countries to agree a multilateral approach to using 'carbon tariffs' – an issue discussed in the next section on *International Trade*.

Ultimately, a genuinely comprehensive global climate framework – one that achieves the stated objective of the 1992 UN Climate Convention, "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" – will need to quantify that stabilization level by **determining a ceiling for atmospheric greenhouse gas concentrations.** This has never been done, as the task of setting such a target currently falls down a crack between the IPCC (who argue that the level of a global ceiling is a *political* decision about risk, not a scientific call) and policymakers (who are reluctant to touch the issue because it inevitably opens up the hugely politicized question of developing country targets).

However, policymakers could start to break the deadlock by setting up an independent body to advise on the level of a global stabilization target, that would complement the IPCC's role on the problem of climate change by advising on the form of the solution.[153] This could then provide the basis for defining the size of a safe global emissions budget – which would then need to be shared out between the world's countries.

For now, this objective seems politically unattainable, given that tackling it would entail grasping hold of the difficult issue of **binding targets for developing countries.** However, the risk of the current situation, with developing countries refusing to countenance quantified targets before 2020 at the earliest, is that they may find that most or all of the available carbon budget to 2050 has by that point been used up.[154]

Most developing countries have nonetheless persuaded themselves that it is in their interests to delay discussion on targets – leading to the ludicrous position where very low emitters in the G77 are defending the right of China to avoid setting a clear trajectory for when its emissions will peak. To break the deadlock, developed country leaders could signal to developing countries that they will create the option for them to take on quantified emission quotas on a voluntary basis – with access to carbon markets for those currently below their target. This policy would establish the following principles:

- First, that binding targets can be profitable for developing countries if set according to fair and transparent criteria. Assuming equitable allocations (see below), global emissions trading could be a massive new source of finance for development, that could ultimately dwarf aid flows.

- Second, that quotas can be set above current emissions levels, so that carbon markets 'compensate' low emitters while providing them with powerful incentives to adopt a low carbon development trajectory.

- Third, that these principles can all fit within the overall framework of a gradual, managed process of convergence of rich and poor world emission rights, within a safe global emissions budget.[155]

Building consensus around these principles will be a slow process that requires real political leadership from both sides. So far, there has been no sign that the UNFCCC negotiating process is able to cope with such politicized issues – although the UN High-Level Panel on Global Sustainability, chaired by Presidents Zuma of South Africa and Halonen of Finland, may be able to unlock the politics of these big picture dimensions of climate change.[156]

Key questions and issues

One of the most important overarching analytical issues facing the multilateral system on the finance and investment aspects of scarcity and climate change is the need for a comprehensive **reassessment of finance for development needs in the light of scarcity**.

As already described, a disproportionate amount of the investment needed – in energy systems and climate mitigation, in agriculture, and in building resilience to climate change and other scarcity impacts – is needed in developing countries. This raises the question of how these investment needs relate to existing finance for development needs – and in particular, to the long-standing target that OECD countries should give 0.7% of Gross National Income to development assistance.

Many commentators argue that climate finance to developing countries – for both mitigation and adaptation – should be additional to development assistance. At the same time, investment needs arising from scarcity are not wholly separable from existing development strategies; rather, they are about achieving current development objectives differently, taking account of the increasing importance of scarcity on the way. This is perhaps clearest in the case of climate adaptation, where there is a clear tension between calls for adaptation to be 'mainstreamed' through all other areas of development activity and the prospect of adaptation finance being dealt with separately from aid flows.

The first question, then, is how much is needed overall? One attempt that has been made to add up the total costs of managing scarcity is set out by Jeffrey Sachs.[157] is assessment of the total financing needs arising from scarcity and related issues in developing countries is as follows:

Table 4: Financial Needs for Managing Scarcity (after Jeffrey Sachs)[158]

Global Goal	Financing Need	Illustrative Annual Outlays for Global Cooperation
Climate change mitigation	Adoption of sustainable energy systems, with support for the poorest countries	1.0 % of GNP (donor countries) 0.5 % of GNP (low-income countries)
Climate change adaptation	Assistance to support the poorest countries with adaptation	0.2 % of GNP (donor countries)
Biodiversity conservation	Financing of protected areas	0.1 % of GNP (donor countries)
Combating desertification	Financial assistance for water management in low-income dry lands	0.1 % of GNP (donor countries)
Stabilizing global population	Assistance for universal access to reproductive health services	0.1 % of GNP (donor countries)
Science for sustainable development	Global public financing of research and development of new technologies for sustainable development	0.2 % of GNP (donor countries)
Millennium Development Goals	Assistance to help the poorest countries to escape from the poverty trap	0.7 % of GNP (donor countries)
Total	**Budgetary outlays for global sustainable development**	**2.4 % of GNP (donor countries)**

The figures set out in this table are rough estimates, as Sachs himself underlines, and the table is also missing the agricultural investment needs described above. Even so, it is a useful indicator of the kind of assessment that is required.

A process geared towards producing a more accurate determination of the financing needs associated with different scarcity issues – and the overlaps between them – should be an early priority for policymakers. The UN High-Level Panel on Global Sustainability provides an excellent opportunity to take forward this agenda.

At the same time, a review of 'finance for scarcity and development' should try to move towards resolution of the outstanding, highly politicized questions of control and accountability that currently bedevil discussions over climate finance. An integrated review, covering both 'how much' and 'how', should therefore be set up – involving both developing countries and the key donor forums (including the OECD Development Assistance Committee, the UN Development Group, the UNFCCC Secretariat and the World Bank). The High-level Advisory Group on Climate Finance set up at Copenhagen, chaired by Prime Ministers Meles Zenawi of Ethiopia and Jens Stoltenberg of Norway, presents an opportunity to pick up the climate-specific dimensions of the agenda, and again, the UN High-Level

Panel on Global Sustainability is well placed to examine the broader scarcity agenda.

International Trade

What do climate change and scarcity mean for international trade?

As the global economy has become more efficient and interconnected, it has also become less resilient. Redundancies, buffers and margins of error have become eroded. And as different parts of the global economy become more tightly coupled, so it becomes easier for perturbations to ripple through the system with surprising speed.

This makes the global trade system more vulnerable to **acute shocks** – and as the food and fuel spike that peaked in 2008 showed, scarcity trends can certainly provide the trigger for such shocks.

In the oil context during 2007 and 2008, for example, tightness on the supply side combined with historically low stock levels meant that actual or feared supply interruptions – such as strikes in Venezuela, militant attacks in Nigeria or regional security concerns in the Middle East – exerted a higher than normal influence over prices in volatile trading conditions, pushing prices up sharply.

In the food context, a tight supply / demand balance was made much worse by government actions. More than 30 food producing countries reduced or suspended food exports in response to domestic political pressures – forcing prices still higher on world markets, while reducing incentives for farmers to increase production. At the same time, many import-dependent countries imposed price controls, applied economy-wide subsidies or sought urgently to build up their depleted food stocks – again, pushing prices up still higher.[159]

Given the risks discussed earlier of even tighter supply / demand balances in future, the risk of acute trade shocks may increase too – particularly when policies designed to firefight crises can so easily create positive feedback loops that worsen the problem. As the last section discussed, poor countries and people are especially vulnerable to these kinds of shock.

Over the longer term, a range of further risks stands out. The broadest of these is the possibility that scarcity could lead to **countries losing confidence in the capacity of an open international trading system to meet their needs** – and hence move towards a more mercantilist 'resource nationalism'. Already, a range of signals suggests the risk of a slide in this direction, including intensifying inter-state competition for energy, land, food and 'virtual water'.

Another risk is the possible **unilateral use of 'carbon tariffs'** (applying tariffs to imports in proportion to the amount of carbon emitted in manufacturing them). President Sarkozy of France has, since 2007, proposed such tariffs as a way of penalizing countries that refuse to take on emissions targets, a position seen by many as aimed at the United States and possibly China (Prime Minister Berlusconi of Italy has more recently added his voice to these calls).[160] More recently, the US Waxman-Markey climate bill (which has passed the House of Representatives, but currently remains stalled in the Senate) set out detailed provisions for imposing "border measures designed to avoid or minimize carbon leakage" on countries that do not reduce their emissions at least as fast as the US.[161]

As the World Bank has pointed out, however, unilateral use of carbon tariffs could lead to a "proliferation of trade measures dealing with other areas where the competitive playing field is viewed as uneven", and place a disproportionate burden on low income countries.[162]

A third risk is that **oil scarcity or future emission controls could lead to a contraction in international trade.** Over the period of 2004 to 2008, transoceanic shipping costs trebled – an increase in costs that, if compared to trade tariffs, is equivalent to offsetting all of the trade liberalization undertaken over the past three decades.[163] Trade in agricultural goods is especially vulnerable to such increases in the costs of shipping: a 2009 OECD working paper, for example, noted that :

> "Maritime transport costs represent a high proportion of the imported value of agricultural products – 10% on average, which is a similar level of magnitude as agricultural tariffs. This study shows that a doubling in the cost of shipping is associated with a 42% drop in trade on average in agricultural goods overall. The tendency to source imports from countries with low transport costs is therefore strong. Trade in some products is particularly affected by changes in maritime transport costs, in particular cereals and oilseeds, which are shipped in bulk."[164]

In future, increased maritime transport costs could be driven either by scarcer oil, or by tougher emission controls. The aviation and maritime sectors – the arteries of international trade – account for a rapidly rising share of global emissions (albeit starting from a low base).[165] While both sectors were excluded from the Kyoto Protocol, future global climate controls are likely to focus increasingly on them.

In theory, rising energy costs and / or increasing controls on maritime emissions could stimulate investment in cleaner technology. Options for replacements for bunker fuels do exist, including biofuels or liquefied natural gas (LNG). In practice, though, these substitutes are somewhat further from the market than clean alternatives in, say, power generation (where renewables and nuclear are already commercially deployed) or road transport (where fuel efficiency technologies have improved substantially in recent years, and electric or hydrogen vehicles hold out the prospect of further improvements). A UK government study concluded:

> "it will be extremely challenging, and expensive, to reduce emissions of CO2 from international shipping and aviation … There are a number of options available in each sector, but currently most of these are not economically viable."[166]

But unless these options do become economically viable, increasing energy costs could effectively start to erode international trade, simply because, as the former chief economist of CIBC, an investment bank, puts it, "distance costs money".[167] Already, media reporting suggests that some global manufacturing companies are starting to move from global to regional supply chains as a result of rising energy costs.[168] Such moves could have further knock-on consequences for international trade in food, especially for low income countries dependent on imported grain.

Why is multilateral cooperation needed?

International trade is the example *par excellence* of the kind of win that can arise from non-zero sum cooperation: the existence of winners need not imply that someone else must lose.[169] But trade can also 'tip' into zero sum competition between states – through tariffs, quotas, export restrictions and other forms of protectionism. Where international institutions can play a decisive role is in creating enough *trust* between countries to increase the chances of the former, and minimize the risk of the latter. This makes it all the more significant, then, that the world's states have successfully constructed a rules-based international trading system, backed up since 1995 by the World Trade Organization – at its heart, a mechanism for enforcing the continued existence of a global public good.

Scarcity issues present two threats to this state. Acute trade shocks can lead countries to ignore shared interests in favor of short term kneejerk policy responses that worsen the problem. Over the longer term, scarcity can undermine countries' confidence in whether they can rely on liberalized trade to meet their food and energy needs – creating a risk of tipping from a non-zero sum to a zero sum state in international trade.

While international institutions exist that *could* manage these risks, they are currently configured in ways that impedes their ability to do so. One example is the International Energy Agency, created in 1974 as a mechanism for managing emergency oil reserves to reduce the risk of price spikes becoming wider economic crises or of strategic competition for oil between importing countries. Today, however, its membership remains limited to the OECD countries that founded it. The emerging economies that will account for all future growth in demand for oil remain outside formal membership.

Similarly, while the WTO has powerful enforcement capacities, the rules that it polices are largely silent about the kind of trade risks that arise from scarcity. The WTO was essentially created as a way of resolving arguments between countries about market access – the sorts of dispute that arise in a buyer's market, of the kind that prevailed in agriculture until the beginning of the 21st century. Faced with the disputes of a *seller's* market, however – concerned not with market access, but with security of supply – the WTO was left largely on the sidelines, impotent to intervene as the world trade system was convulsed by export restrictions and frantic bidding wars.

The risk of unilateral carbon tariffs shows a similar underlying dynamic. In the end, the reason some countries may opt for unilateral use of such tariffs is the absence of a multilateral framework for managing climate change. If it existed, there would be no need for individual countries to act on concerns that tackling climate change without comparable action from others would render them uncompetitive. Again, the risk of zero sum outcomes arises because of a failure to agree on collective policy frameworks that create sufficient trust to enable non-zero sum outcomes.

What are the key tasks for multilateral cooperation?

Policymakers can take a number of actions to increase the trade system's resilience to the effects of climate change and scarcity – by no means all of which are dependent on resurrecting the current ailing Doha trade negotiations (although this will ultimately be necessary in order to make progress on some fronts).

It is important to be clear, though, that while collective action on trade can make some progress, it does not represent a complete solution to the risks of zero sum competition implied by scarcity issues – a challenge returned to in the section below on strategic resource competition.

Key Multilateral Tasks for Managing Scarcity: Building a Resilient Trade System

Short term (e.g. actions that could be agreed at summit meetings in 2011 or 2012)

- Bring emerging economies into full IEA membership
- Scaling up food stocks (either real or virtual, at multilateral or regional level)
- Implement mechanisms to use intergovernmental peer pressure to reduce the risk of export bans or restrictions

Medium term (actions requiring greater political heavy lifting, likely to take 3-5 years)

- Move forward with liberalization of developed country farm support regimes
- Agree terms of use for carbon tariffs to reduce the risk of 'climate protectionism'

Key questions and issues

- What will energy scarcity mean for international trade?
- Will more countries come to regard increased self-sufficiency as more resilient than reliance on open markets?

Short term tasks

As noted in the first part of the paper, the International Energy Agency is already warning of the risk of a renewed oil price spike in the short term. The dangers this would pose – for the still-fragile global economic recovery, for food prices, for poor countries and fragile states – make this a top priority for policymakers to tackle. The most immediate way of doing so would be to **expand the International Energy Agency's membership to include emerging economies**, who will account for virtually all growth in oil demand in the next two decades.

As noted, the IEA is, at its core, a mechanism for co-coordinating emergency oil reserves. Under the Agreement on an International Energy Program – the IEA's enabling treaty, usually referred to as the 'IEP Agreement' – IEA member governments must hold stocks equivalent to 90 days of net oil imports. In an emergency situation, they must release oil from these stocks or take other action such as restraining demand, switching to other fuels, increasing

domestic production or sharing oil with other members[170] The IEA has used this mechanism to bring additional oil to market only twice: once in 1991, in response to the Gulf War, and again in 2005 following the disruption to Gulf of Mexico production caused by Hurricane Katrina.[171]

But while the IEA has started to build a more engaged relationship with emerging economies – including through inviting China, India and Russia to attend the Agency's 2009 Ministerial meeting as full participants – the IEP Agreement does not include emerging economies as signatories.[172] The risk of renewed oil price volatility suggests it would be mutually advantageous to both OECD and non-OECD countries for key emerging economies to become full IEA members and so work towards the construction of a buffer mechanism on oil that more accurately reflects where future demand will be coming from.

On food, a key gap during 2008 was the absence of **international strategic grain reserves** that could have provided buffer capacity when acute fears were at their height. Instead, different countries have a patchwork of domestic reserves. In some circumstances, nationally held reserves can work: the Chinese government, for example, holds higher grain stocks than many countries, and argues that this helped it to avoid some of the turbulence experienced by other importers during the price spike.[173] But in many other countries, national grain reserves have become politicized, used as a tool by interest groups or fallen prey to corruption.

The most obvious approach to the problem might be to create a physical, public, globally managed grain reserve – a kind of IEA for food. As the International Food Policy Research Institute points out, though, there are potential disadvantages to such an approach, in particular high storage costs and slow transactions. IFPRI has instead proposed a decentralized regional emergency reserve of grain for humanitarian donors, and a virtual reserve and intervention mechanism based on coordinated commitments by participating countries (in which participating countries would undertake to supply funds for intervention in world grain markets).[174]

One potential drawback of this approach is that it would still leave import-dependent developing countries reliant on the goodwill of exporters – with no guarantee that the system would work during a serious crisis.

Another alternative again could be to set up a system of regional food stocks, which would have the advantage of being sited closer to areas of need. However, regional stocks would also rely on exporters who, in the end, have an interest in maintaining their trading partners' reliance on their produce.[175]

A third key area for action is the need for measures to **reduce the risk of sudden food export restrictions.** As already noted, the food price spike was worsened by more than 30 key food producing countries imposing restrictions on their exports; yet the WTO was left on the sidelines since it lacks rules to prevent such panic measures.

One option to manage this problem would be to agree new WTO rules to prevent the use of export bans. Whilst the 1947 General Agreement on Tariffs and Trade (GATT), the precursor to the WTO, does prohibit export bans and restrictions other than "duties, taxes or other charges", it makes a specific exception for "export prohibitions or restrictions temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party."[176]

To be sure, there is nothing to say that WTO rules could not be amended to remove this exception. Some analysts argue that the North American Free Trade Agreement (NAFTA) sets out a more restrictive approach to export restrictions than do the equivalent WTO rules, for example.[177] In practice, though, such a move looks politically unlikely, given the current state of multilateral trade negotiations. Even if such a rule were agreed, moreover, governments facing political emergencies over food prices might choose to take their chances with the WTO's dispute resolution body and implement such measures anyway.

A more viable alternative, however, might be to implement a mechanism to 'name and shame' countries using

export bans, thus attempting to use peer pressure as a countervailing force against sudden export restrictions. Senior UN officials observe privately that the risk of public embarrassment proved to be a helpful deterrent to export restrictions in some cases during the 2008 food price spike.[178] Policymakers could usefully explore whether such peer pressure could be systematized to prevent future recurrences of the problems of 2008 – for instance, through automatic referral of export restrictions to a discussion in the G20.

Medium term tasks

While the measures described above could all potentially be taken forward in the absence of progress more broadly on the Doha trade round, **liberalization of developed country farm support regimes** does remain a key priority for developing countries' food security – all the more so, in conditions of scarcity. As the US-based Center for Strategic & International Studies notes, the current global agricultural trade system "structurally favors production among wealthy countries and disadvantages producers in poor developing countries"; redressing that balance needs to become a strategic priority in the years ahead.[179]

The problem applies not only to developed country trade barriers that discriminate against imports from developing countries, but also to dumping of developed country exports on developing markets – including through food aid (the key reason why it is so crucial for the US to continue to move away from food aid and towards providing cash instead to humanitarian agencies such as the World Food Programme).

The second key area for progress in the medium term is the need for **agreed terms of use for carbon tariffs. As already described, carbon tariffs** present a significant risk of protectionism if used unilaterally. If used *multilaterally*, however, they have the potential to be not only benign, but a valuable component of a comprehensive global climate regime.

Part of the reason is that carbon tariffs could help to tackle 'carbon leakage' between countries. Caps on emissions in OECD countries can encourage production to move to emerging markets, raising concerns over both competiveness and environmental integrity. On the other hand, much of this carbon is still consumed in the developed world: the economist Dieter Helm estimates that, although emissions *produced* in the UK have fallen by over 12% since the Kyoto benchmark year of 1990, the UK's *consumption* of carbon actually increased by 19% between 1990 and 2003.[180]

Other research suggests that only around half of China's rapid emissions growth is due to increased domestic consumption, with the rest linked to exports. In effect, selective constraints on emissions are distorting the development patterns of both rich and poor countries, providing an incentive for both sides to situate energy intensive industries outside 'tight cap' locations.

Absent binding emission targets for all countries, carbon tariffs offer a backstop against countries that fail to make an adequate contribution to achieving a deal. While unilateral use of tariffs could trigger a slide towards tit-for-tat protectionism, a multilateral approach agreed by a quorum of major emitters and other countries could avoid these risks.

More fundamentally, it may be the only effective approach to ensuring compliance with a global climate agreement – including by countries that have refused to accede to it. For this reason, governments should start to explore how carbon tariffs can be applied in a way consistent with wider global climate policy – while at the same time reassuring each other than they will not use the measure on a unilateral basis.

Key questions and issues

Overall, further investigation is needed on **what increasing climate controls or energy scarcity are likely to mean for international trade over the longer term**. As discussed, one possible implication is a move towards a less globalized, more regional world as costs of shipping goods by ship or air increase – but this remains highly speculative, and there is a significant dearth of hard data.

If international trade *does* become increasingly constricted because of rising energy prices, then this would have extremely far-reaching implications – whether for consumers facing higher food prices as they find themselves with reduced access to international grain markets, or for exporters of bulk commodities (including food) who may find themselves having to reconsider their growth strategies. In particular, countries that currently rely on open markets to meet their commodity needs could begin to perceive increased levels of self-sufficiency as a more resilient alternative – a shift that could have far reaching implications for globalization and international relations.

Above all, it bears repeating that while action to build resilience in the trade arena will be critical, it will not prove a total solution. If scarcity increases markedly, the issue will grow from one of managing perturbations in the trade system to the larger and more risky ground of strategic resource competition – the subject of the next section.

Strategic Resource Competition

What do climate change and scarcity mean for strategic resource competition?

The final area of policy on which climate change and scarcity will impact is strategic resource competition – with, at worst, the risk of inter-state conflict. Each of the key scarcity issues considered in this paper (water, land, energy and climate change) comes with its own risks of competition, summarized below.

Firstly, there is the potential for **inter-state competition for energy.** The 'scramble for energy' between great powers in areas including West Africa, Central Asia and the South China Sea has been widely noted, prompting the US to use its 2006 National Security Strategy to set out an explicit warning to China not to try to "lock up" energy supplies.[181]

At the same time, the US's own actions have, at times, led to similar worries in other countries, perhaps the clearest example being the 2005 decision by Congress to block, on national security grounds, an attempt by the Chinese company CNOOC to acquire Unocal, a US oil company with production rights over extensive reserves.[182] Another dimension of the issue is the growing importance of OPEC oil producers and state-owned oil companies. The bulk of future increase in world oil output is expected to come from OPEC producers, rising from 44% in 2007 to 51% in 2030.[183]

The US National Intelligence Council's 2008 report on global trends to 2025 observed that "even actions short of war will have important geopolitical implications as states undertake strategies to hedge against the possibility that existing energy supplies will not meet rising demand", noting trends including Chinese and Indian purchases of equity stakes in energy fields, energy-deficient states employing "transfers of arms and sensitive technologies and the promise of a political and military alliance as inducements to establish strategic relationships with energy-producing states", and increased naval competition "in a zone extending from the Persian Gulf to East and Southeast Asia". As Michael Klare summarizes:

> "…the leaders of most countries involved in the great energy race have come to view the struggle over hydrocarbon assets as a "zero sum" contest … a zero-sum mentality leads to a loss of flexibility in crisis situations, while the lens of nationalism turns the pursuit of energy assets into a sacred obligation of senior government officials." [185]

More recently, a similar dynamic has been seen in the context of **inter-state competition for land and food**, as import-dependent countries seek to agree overseas security of supply deals for food or land. While there is often a lack of transparency about such deals, among the examples reported in the media are Chinese attempts to secure 1.24 million hectares of land in the Philippines (in a deal subsequently blocked), 700,000 hectares in Laos, 2 million hectares for biofuel production in Zambia and 2.8 million hectares for the same purpose in the Democratic Republic of the Congo.[186] Other key food importers, including the United Arab Emirates and South Korea, have also sought to improve their good security with similar deals. More acute forms of competition for food include the export restrictions discussed in the previous section.

At the same time, countries that are not dependent on imported grain can also contribute to this emerging competition for land and food through their own land use policies: as already noted, the IMF, World Bank and Goldman Sachs all argued in 2008 that the single most significant driver of the food price spike was the diversion of US agricultural land to biofuel production.[187]

On water, the key risk comes from **trans-boundary fresh water resources**. Today, there are 263 rivers that either span or delineate international borders.[188] It is important to note that so far, trans-boundary water resources have tended to trigger cooperation rather than conflicts between the countries that share them: research by Oregon State University, for example, finds that "cooperative interactions between riparian states over the past fifty years have outnumbered conflictive interactions by more than two-to-one."[189]

However, the same research also finds that 158 of the world's 263 international river basins "lack any type of cooperative management framework."[190] Moreover, with the prospect of climate change to consider, there is no guarantee that the future will look like the past. A particular concern here is the fact that many water-sharing agreements are based on a set volume of water rather than a percentage of what is available.[191]

The risk of glacial retreat, most notably in the Himalayas, has also triggered concern about future water-driven conflict risks – as well as controversy, given the recent furor over erroneous IPCC projections that 80% of Himalayan glaciers would have disappeared by 2035. Existing glaciers provide dry season water resources to 1.3 billion people living in river basins including the Mekong, Irrawaddy, Indus, Ganges, Brahmaputra, Yangtze and Yellow River.[192] As temperatures rise, some estimates (still valid, despite the recent IPCC controversy) suggest the risk of future dry season flow reductions of as much as 60-70% on the Ganges.[193] These kinds of forecast have led to increased concern about the potential risk of capture of water resources by particular countries (for instance in India, where there are fears about the potential for China to dam and divert the Brahmaputra river).[194]

Another dimension of inter-state strategic resource competition centers on the **impacts of climate change, and particularly the effects of rising sea levels**. Current international law on maritime borders awards countries territorial rights extending 200 miles offshore from their coastlines, for example – but is silent on what happens if those coastlines recede because of climate change.[195] This grey legal area introduces the potential for future conflicts over issues including:

- Border disputes, including in the South China Sea and the Gulf of Mexico;
- Ownership of undersea energy resources (notably in the Arctic);
- Newly navigable waterways (such as the North-West Passage and Northern Sea Route);
- The sovereignty rights, resource claims, and populations of low-lying island states that disappear under rising sea levels;
- The fate of 'climate refugees', which some estimates suggest could number 200 million by 2050 (although the number is disputed, and UNHCR also questions the very idea of 'environmental refugees').[196]

Why is multilateral cooperation needed?

Of all of the areas of action considered in this paper, it is in the context of strategic resource competition that the case for multilateralism is clearest. While the extent of globalization today may be unprecedented, conflict over resources is one of the oldest stories in the book – and it is, after all, preventing violent conflict between states that forms the principal raison d'être of the UN system.

Even in scenarios that do not slide as far as war, the zero sum competition that scarcity issues might prompt could still lead to a steady erosion of multilateral effectiveness. The food and fuel price spike demonstrated how the political and economic impacts of scarcity can effectively force states to ignore their long term shared interests

and focus instead on their individual, narrow, short term interests – even when they understand that this will lead to counterproductive consequences.

However, the scope for collective action between governments is constrained by the views of their publics. Climate change and scarcity are the antithesis of issues like nuclear non-proliferation, which can viably be addressed by a few dozen diplomats. Questions about the sustainability of consumption, trade and investment patterns depend on the decisions and behaviors of hundreds of millions of companies, and billions of individual people – and the political space that they cede to their governments for agreeing collective approaches.

At present, the political space available is insufficient to enable a genuinely comprehensive approach to managing scarcity. Polling data show that public confidence in the scientific consensus on climate change – arguably the bedrock of any attempt to develop policy on scarcity – is falling.[197] Nor is there much sign that developed country publics are yet willing to consider the idea of 'fair shares' to finite global resources.

Governments therefore face a larger challenge than just identifying what needs to be done to manage scarcity, agreeing it, and implementing it (including international institutional reform where necessary). More broadly, they need to *take their publics with them* – by building *shared awareness* of the nature of the challenge, and *shared platforms* to move from recognition of the problem to implementation of the solution: coalitions of governments, international organizations and non-state actors that work to open up the political space needed.

Governments must also be ready to move in the very short term when political windows of opportunity materialize – usually suddenly, and briefly. Given that the political conditions for comprehensive solutions are not yet in place, it is likely that impacts of one kind or another – extreme weather events, price spikes and other shocks and stresses – will play an important role in changing political conditions.

These kinds of acute event can play out in either a positive or a negative way. At best, they can have a transformative attitude on public perceptions, creating a willingness to 'think the unthinkable' and move forward with much more ambitious action. At worst, they can lead to counterproductive kneejerk reactions (again, the example of food export restrictions stands out) – or simply to a failure to capitalize on the window of opportunity, followed by a wait for things to 'return to normal' without the root causes of the crisis having been addressed. Accordingly, the issue of readiness for crisis becomes crucial.

What are the key tasks for multilateral cooperation?

Seeking to contain the risk of strategic resource competition is a broad area, and the kinds of actions involved in doing so equally diverse. Nevertheless, a range of tasks can be identified, including both specific tasks in the immediate term and longer term agendas that will take time to build up.

Short term tasks

In the immediate term, a key starting point is the need for **stress-testing of existing multilateral architecture against climate change and scarcity**. Already, a great range of international organizations is exploring what climate change will mean for them operationally – but the same is not yet true for scarcity more generally.

In particular, the UN, World Bank and other international organizations with broad remits should audit existing governance arrangements at global, regional and national level, to search for potential scarcity flashpoints in advance. One example of a case where such auditing is needed is international agreements for sharing freshwater resources, as discussed above. The fact that 158 of the world's 263 international basins lack any type of cooperative management framework should prompt a wider range of international policy actors to want to know where those 158 river basins are situated, how they map across to existing conflict risk drivers, fragile states and concentrations of vulnerability, what lessons could be applied in these instances and so on – but nothing like such a systematic approach is yet evident in the international system.

Key Multilateral Tasks for Managing Scarcity: Containing Strategic Resource Competition

Short term (e.g. actions that could be agreed at summit meetings in 2011 or 2012)

- Undertake stress testing of existing multilateral architecture
- Build up foresight and surprise anticipation capacities
- Invest in resilience, e.g. development policies and trade measures as discussed earlier
- Start developing options for shared global operating systems to manage scarcity

Medium term (actions requiring greater political heavy lifting, likely to take 3-5 years)

- Start building up international system bandwidth and inter-agency interoperability
- Commission relevant international agencies to produce a joint World Resources Outlook
- Develop political narratives centered on 'fair shares', especially on food, energy and climate

Key questions and issues

- Will policymakers be ready to take advantage of political windows of opportunity for further-reaching action as and when they open up?

More broadly, international organizations and national governments alike need to tackle **foresight, futures analysis and surprise anticipation** in a much more rigorous way. As the policy analyst Leon Fuerth, a former National Security Adviser to Al Gore, has put it:

> "Leaders are not unmindful of the need to think of the longer-term implications of their actions, but they also know that representing the interests of the future often involves significant political risk to themselves in the present. Faced with such a choice, they frequently take comfort from the bromide that it is impossible to predict the future. That is certainly true in a literal sense, but it obscures a much more important fact: that it is entirely feasible to think about the future in disciplined fashion and to reach conclusions about it that ought to be important factors in the making of contemporary policy."[198]

In particular, a 'challenge function' is needed within the international system, with the task of analyzing non-financial systemic risks, and designing options for addressing them (thus complementing the work of the Financial Stability Board on financial vulnerabilities). This work would need to be tackled by an agile, flexible and relatively independent 'networked' organization, able to draw on external expertise, and reporting to a forum that brings together national and international heads of policy planning.

A third area of work, touched on in several places earlier in the paper, is the need to focus on **building up resilience throughout the international system**. As this section has noted, the fact that the political space needed for comprehensive solutions is not yet open means that the world is likely to experience more shocks and stresses in future, on scarcity and on other fronts, with increasing intensity. At the same time as trying to capitalize on the windows of opportunity that such crises may offer, policymakers also need to try to ensure that moments of system breakdown lead to renewal, rather than to outright collapse. Resilience is the quality that will determine the difference between these two outcomes. Accordingly, the measures suggested earlier in the trade and development / fragile states contexts will be critical; many of the measures proposed in this section are also designed with an emphasis on resilience in mind.

Another area of work for the immediate term is **developing options for the global 'operating systems' needed to manage scarcity**. As already noted, taking advantage of crisis-driven windows of opportunity fundamentally depends on readiness, in particular Milton Friedman's emphasis on "the ideas that are lying around".

However, the fact that progress is so slow on so many key multilateral agendas means that much political energy is directed at the multilateral equivalent of trench warfare (think of the complexity of climate negotiations in the run-up to Copenhagen) rather than at thinking about what really comprehensive frameworks for managing global risk issues, including scarcity, would look like. Accordingly, when windows of opportunity for thinking the unthinkable

do open, the ideas needed are often nowhere to be seen – as for example in the immediate aftermath of the financial crisis.

This paper is intended as a small step in the process of thinking through what it will take to manage scarcity issues – but the *real* thinking needs to be done inside the multilateral and intergovernmental system, by the people tasked with agreeing and executing policy.

Finally, governments should commission relevant international organizations agencies to work together on producing a **World Resources Outlook report**.

At present, the Food and Agriculture Organization produces a World Agricultural Report each year jointly with the OECD; the International Energy Agency produces an annual World Energy Outlook; and the Intergovernmental Panel on Climate Change produces what is in effect a World Climate Outlook. Other important parts of the picture are covered elsewhere: the UN Environment Programme's Global Environmental Outlook report, for instance, comes out every five years (most recently in 2007) and covers water availability, forests and other data.

Yet there is no single outlook report that pulls together a strategic synthesis across all of these issues and explores the linkages between them thoroughly. This could be done, however, if member states requested the IEA, FAO, IPCC, World Bank, IMF, UNEP and OCHA to produce a World Resources Outlook, that would examine:

- the state of scientific knowledge about the availability of key resources, including oil, food, water, and potentially also land, together with how climate change will affect each of them;
- the economic dimensions of resource availability, including the risk of price spikes, inflationary trends, and how resource prices interact with wider trends in the international economy; and
- vulnerability to scarcity trends among poor people and fragile states.

Such a report would provide policymakers with a valuable, integrated analysis that they currently lack. Without it, the risk of unintended consequences from policy may remain unaddressed. The case of biofuels – where the possible food security implications of measures taken to promote energy security were inadequately considered – is a vivid example of such unintended consequences in practice.

More fundamentally, a World Resources Outlook would force officials from key international organizations to spend time together, compare their analyses and expectations of the future, draw outside experts and member state officials into the process, and in the process build shared awareness among potential change agents in the international system.

Developing more of a culture of jointness across international organizations would, in turn, help to create the supporting bandwidth that leaders forums like the G8 and the G20 currently lack. At present, there is a clear trend to escalate more and more of the hardest global issues to leaders' level forums – yet the performance of these forums to date does not necessarily imply much basis for confidence, with the G8 in particular sometimes appearing to be little more than a 'communiqué machine'.

While proposals have been made to improve the bandwidth of bodies like the G8 or the G20, it appears unlikely that heads of government would be willing to cede such a powerful role to a semi-independent body. If, on the other, existing international organizations proved themselves capable of taking on more of the burden of providing analytical support, and perhaps even agenda management, to bodies like the G8 and G20 then this could prove to be more palatable alternative.

Medium term tasks

Over the medium term, the challenge of **building greater interoperability between international agencies** will remain crucial: while energy, food and climate security are thoroughly integrated, the same cannot be said of either the international institutions or the government bureaucracies meant to tackle them.

At present, international agencies – like their counterpart ministries in capitals – tend to align along sectoral 'silo' lines. As the UN High-level Panel on Threats, Challenges and Change noted in 2004,

> "The fragmented sectoral approaches of international institutions mirror the fragmented sectoral approaches of Governments: for example, finance ministries tend to work only with the international financial institutions, development ministers only with development programs, ministers of agriculture only with food programs and environment ministers only with environmental agencies…" [199]

Similar observations could be made of the clusters of agencies, government ministries and experts that surround each of the key scarcity issues. This, in turn, hampers their ability to identify and act on the crucial inter-linkages between scarcity issues.

In the immediate term, one important way of improving coherence would be to institute regular meetings between the most directly relevant international agencies, both at agency heads' level and at working level, as a means of improving shared awareness of cross-cutting issues (and, with luck, of helping governments to take a more integrated approach themselves in the process). The list of agencies involved should be kept as short as possible, but should at a minimum include the UN Secretary-General's office, World Bank, International Energy Agency, Food and Agriculture Organization, UNFCCC Secretariat and the OECD Secretariat.

The challenge of producing a 'culture of jointness' will also depend on structuring career paths in governments and international agencies differently. At present, it is entirely possible for national or international civil servants to spend their whole career in one agency, or in one city, or working on one specialized issue area – a fact that is entirely antithetical to real interoperability and shared awareness. Instead, secondments 'elsewhere' should be a central, recurrent feature of all staff careers in both governments and international agencies. Experts on one scarcity issue – climate change, say – should be required to spend time working on other scarcity issues. Officials from one department need to spend time in other sectoral departments – or other governments. Staffers in international agencies should spend time working in national governments, and vice versa.

Above all, there is no substitute for officials from different sectors and agencies spending time working together collaboratively. *Talking* about joined-up working is not the same as *doing* it. Leon Fuerth gives the example of structured thinking about possible future scenarios as one kind of useful collaborative working; another might be for officials from different backgrounds to be immersed in simulated situations ('war games') in which they can evaluate their own performance after real time exercises.

Finally, policymakers need to start to **develop political narratives centered on the idea of 'fair shares', especially in the areas of food, energy and climate change**, as a way of preparing the ground for managing scarcity more effectively.

Previous sections have touched on a range of pressing distributional issues arising from climate change and scarcity, among them access to oil supplies, trans-boundary water resources, the allocation of a future global emissions budget, and even diets in developed and emerging economies, given that 'western diets' that are richer in meat and dairy products are also more intensive in energy, grain and water use and in greenhouse gas emissions.

Admittedly, there are significant dissimilarities between the examples cited above. Some sit at the global level, while others are regional; some are about resources that are renewable (like water), while others concern finite supplies (such as oil); some (like the sharing out of a global emissions budget) are readily amenable to government action, while others (such as individual consumers' decisions about what to eat) are less so, even if they still fundamentally involve questions of collective action.

Yet the similarities outweigh the differences, above all in that all of these examples are fundamentally about fairness. Policymakers who recognize the need for collective action, and actively want to reach international deals on climate change and scarcity, will help themselves and each other if they can start to shape consensus on what a 'fair' solution looks like – which involves creating simple, clear and widely-shared yardsticks to moderate the debate on scarcity issues.

In the climate change context, for example, policymakers could usefully focus debate around the variable of per capita emissions, which leads on to an intuitively recognizable metric of fairness. At present, countries cluster in four rough groups in terms of their per capita emissions:

- *High per capita emitters* like the US or Australia (at 19.5 and 18.1 tonnes of CO2 emitted per capita respectively);
- *Medium high emitters* like Japan or Germany (9.6 and 9.5 tonnes respectively);
- *Medium low emitters* like China or Mexico (4.3 and 4.1 tonnes respectively, close to the world average of 4.5 tonnes); and
- *Low emitters* like Brazil, India or Burkina Faso (1.7, 1.3 and 0.1 tonnes respectively).[200]

If leaders who genuinely want a deal on climate change start to talk consistently in terms of equalizing per capita emission entitlements within a global emissions budget, then, they can help to build understanding of climate solutions that combine a long term objective with a measure of fairness, while also indicating countries' proportionate contribution to the problem – and how they fit into the solution. Similar moves are needed on other scarcity issues too.

Conclusion

Climate change and resource scarcity have the potential to pose an existential challenge to globalization. While interdependence, complexity and prosperity have all increased massively over the past few decades as globalization has accelerated, the process has been neither sustainable, nor resilient, nor equitable.

Now, scarcity issues – together with other global risks such as financial crises, pandemics like swine flu, or trans-boundary security risks such as terrorism and arms proliferation – are part of a range of threats to globalization that epitomize why this greater sustainability, equity and resilience is needed.

Inevitably, the fact that increasing globalization has come with 'shadow sides' will lead some voices to argue that the process of globalization should be slowed, halted or even reversed. The risk of protectionism as a misguided response to the credit crunch and the ensuing global downturn remains very real. A global flu pandemic could lead to borders becoming less porous to international travel and migration. Scarcity issues could provide an even larger impetus for pulling away from global interdependence – whether towards greater, or towards intensifying competition (or conflict) for dwindling resources.

This paper, however, has suggested that there is an alternative – that rests on more globalization and interdependence, not less. Crucially, though, it has argued that effective multilateral institutions and responsible sovereignty are the key to effecting this shift, and to nudging international relations towards increased levels of non-zero sum cooperation on scarcity issues instead of an intensifying zero sum competition for resources.

It is not yet clear whether the process of creating a multilateralism capable of coping with scarcity will be a big bang (perhaps following a systemic crisis) or a slow, evolutionary process. What is already clear, though, is that it is a process that policymakers and publics have no real choice but to embark on together – and soon.

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