International Institute for Sustainable Development
Institut international du développement durable

The Challenge of Extreme Events and their Impacts

Scott Vaughan

Canadian Climate Forum's Symposium on Extreme Weather and Adaptation

Ottawa, ON, April 23, 2014

Thank you and congratulations to Gordon McBean for steady and impressive leadership. Gordon is one of those Canadian treasures for his determination and deep commitment to link credible, robust science with public policy.

I wanted to set the stage for this morning's discussions by highlighting three main areas.

First, what the IPCC reports say about extreme climate events.

Second, what the IPCC says about longer-term, chronic climate-related events that will affect our oceans, freshwater abundance and food security systems.

And third, steps that are being taken to integrate climate vulnerability assessments into risk assessments, and the efforts to mainstream resilience within the natural disaster risk community.

I wanted to conclude with a brief comment on the climate mitigation agenda and the urgent need to formulate a plan for the 2015 global agenda.

Let me begin with the IPCC, and its 2012 special report on managing the risks of extreme weather events.

The IPCC report of two years ago plays a useful role not only in unpacking trends in extreme weather events and being clear about the level of scientific certainty related to observations, but also in linking those events to human risk exposure and vulnerability. This is a critical linkage, something that leaders in the insurance sector have underscored for years. For my colleagues at IISD, who are working with countries around the world, this underscores the need to look at extreme weather events within a sustainable development lens that connects environmental, social and economic factors.

The IPCC special report notes that there has been a change in the frequency, intensity, spatial extent, duration and timing of extreme weather events. The risks have steadily increased since then. The 2012 report notes that there have been a higher percentage of hotter days in recent years; the World Resources Institute notes more bluntly that each of the last 36 years has exceeded global average temperatures.

The IPCC observes with a medium degree of certainty that there has been an increase in heavy precipitation and associated flooding in certain regions and some increases in drought frequency associated with climate change.

I know Paul Kovacs will discuss this today, but the direct economic losses from these events have risen dramatically, as measured by insurance claims. Reported claims for flood damages alone increased from an average of $7 billion per year globally in the 1980s to over $24 billion in 2011. In the Canadian context, the Insurance Bureau of Canada

© 2014 The International Institute for Sustainable Development

reported that the ice storm in southern Ontario and eastern Canada in December 2013 resulted in $200 million in insured losses, for a total year-end severe weather insured loss of $3.2 billion, which is the highest in Canadian history.

Yet when Nicholas Stern made the suggestion that insurance coverage be increased to between 1–2 per cent of global GDP, he was attacked fiercely as a radical extremist.

There are unfortunately many examples of what this means. Let me illustrate with one country, Brazil, and one year, 2005.

In 2005, Brazil's southeastern region was hit with the first-ever recorded tropical cyclone. No cyclone had ever been recorded reaching landfall along Brazil's coast until then. Over 1,000 homes were destroyed. Another 40,000 were damaged. Most agricultural produce was severely damaged or destroyed, including more than three quarters of the banana crops, 40 per cent of rice crops. In total, there was more than $350 million in damages.

The same year—2005—Brazil also experienced a devastating drought in the upper Amazon basin, the most severe in 100 years. The Amazon River reached its lowest recorded levels in 25 years. Lower water levels in turn saw large fish kills, high rates of forest fires and human health impacts from water-borne diseases linked to lower water levels and higher concentration of water contaminants, as well as respiratory diseases from forest fires—all compounded by pre-existing poverty levels in the region.

The causes of both events are complex, but illustrate the key finding that extreme events are happening more frequently, where they haven't happened before, with devastating impacts on human communities—especially the poor—and from an economic risk perspective.

In the case of the Amazon drought, the 2005 episode illustrates a key warning of the latest IPCC report: In a global analysis of simulated stream-flows (1948–2004), about one third of the top 200 rivers (including the Congo, Mississippi and Uruguay rivers) showed significant trends in discharge; 45 recorded decreases and only 19 recorded increases. Decreasing trends in low and mid latitudes are consistent with recent drying and warming in Western Canada and the United States.

While there is no single explanation for these twin events, they were both triggered in part by warmer mid-Atlantic surface temperatures recorded that year—the SST effect.

So let me turn briefly to the most recent IPCC Fifth Assessment Report, and begin with oceans. There are three main warnings from the report: first, the high probability of rising sea levels, by as much as half a metre by the end of the century, putting at risk tens of millions of people living in lower-level coastal cities and communities.

Second, the changes already underway in oceanic acidification: increased levels of carbon are literally changing the chemistry of the planet's oceans, at a rate millions of times faster than observed at any time. Studies are now showing that average warmer temperatures and altered chemistry may already be changing marine ecosystem patterns, from shrinking average fish sizes for some species to changing predator interactions.

Third, the impacts of climate change on fish populations more broadly. The IPCC notes that there may be gains in some northern fish productivity, but this will be offset by a significant decline in tropical fisheries yields by as much as 50 per cent.

Today, over one billion people rely on fish as their main source of protein. The projected decrease in tropical fish populations is thus alarming in terms of putting increased pressure on global food security.

The other big impact of climate change on food security is of course changes in average precipitation.

The IPCC warns that for every one degree of warming, it is expected that there will be a corresponding decrease in renewable water resources by at least 20 per cent for a significant proportion of the global population. At the same time, it notes that by the end of this century what we currently call a 100-year flood event is expected to increase three-fold.

The amount of available renewable surface water and groundwater resources is expected to be reduced dramatically in most dry subtropical regions. This will further compound water scarcity and water trade-offs among different users—such as industry, households, farming and energy—while the combined effects of altered stream flow regimes, average river water levels, and extent and timing of inundation.

Precipitation extremes will thus have a clear impact on food security, from prolonged drought to soil erosion and changes in stream sediment loads. A warmer climate may affect soil moisture, litter cover and biomass production. When you couple these trends with global population growth, we are now facing an urgent need to dramatically transform food production in the coming decade.

We have already witnessed unprecedented crop failures in Australia, China, the United States and elsewhere. The FAO now warns that the combined impacts of climate change, population growth and other factors will require a 70 per cent increase in food productivity in the coming decade.

The IPCC Fifth Assessment Report projects a decline in net agricultural productivity in major North American crops by the end of the 21st century in the absence of adaptation efforts, due to higher temperatures, lower precipitation and more frequent extreme events.

So let me turn briefly to adaptation efforts, which is based on efforts from my colleagues at IISD, who work with national governments and local communities around the world, across Canada and in developing countries.

The first is that extreme events create space for innovative adaptation. It is clear from a few of the examples I have just listed that climate change is not a recipe for business as usual or incremental steps. Efforts are needed for businesses, households and governments to take precautionary steps. This is easy to say, but questions about the precise impact of climate change make longer-term resilience investments very difficult for any community or company. To take one example, we know from experience that infrastructure in Canada's North is already bearing the signs of climate change: melting permafrost, buckling roads and pipelines, and cracking foundations that are driving up a range of others costs.

A short-term fix is to replace that infrastructure and maintain what you can. Moving to a longer-term assessment and doing infrastructure planning takes policy leadership.

A concept that does show signs of hope is the foothold resilience has taken in the climate adaptation field. Ten years ago, experts in disaster risk reduction management and climate adaptation were oddly working in largely isolated fields.

That is not the case today. There are synergies that still need to be examined in bringing these two fields together. It looks good on paper, but more needs to be done in coordinated planning IPCC 5th Assessment Report. Here in Canada, for example, synergies not only with Environment Canada and others—as we reported in my previous job as doing useful work—but also with Public Safety Canada, Public Health Agency, and Finance Canada need to be forged to begin assessing longer-term risks.

I'm really pleased that NRCAN will be updating its 2008 *From Impacts to Adaptation*, which Don Lemmen will discuss tomorrow, and I sincerely hope that the public roll-out of this report will be ambitious, sustained and used as a vehicle to reach city, provincial and federal disaster management agencies.

There are two aspects to mainstream resilience: how to link risk assessment with risk management and the development of indicators capable of showing key information points.

One of the challenges in this is not only to scale up resilience efforts, moving from slow, incremental steps to what is being called transformative adaptation. We are not very good at thinking about cumulative risks any more than we are good at assessing cumulative impacts of complex project proposals like the Northern Gateway.

Given the warnings about food security and challenge set out by the FAO, one example of transformative change is to alter current public policy tools like farm income support for increasingly vulnerable, water-intensive crops to farming practices that take into account long-term climate scenarios. The same holds true for a range of other areas, from building codes to no-go zoning planning.

One area that is gaining ground is green infrastructure and nature-based solutions to some elements of climate risk. There is now more attention focused on natural barriers, from reforestation to address soil erosion and slope stabilization, to mangrove planting and sand-dune stabilization to create natural and more resilience barriers. There is potential here, but what is missing are again clear indicators in order to do standard qualitative and even quantitative assessments.

Before turning briefly to the mitigation side and ending, I wanted to mention the importance of research more broadly, beyond the effectiveness of natural barriers. There has obviously been a huge increase in scientific research around climate change. Yet the IPCC notes that of the disciplines we would look to first in some of the steps I have mentioned this morning, like linking risk or vulnerability assessments with on-the-ground risk management options—such as engineering—have seen the least increase in peer-reviewed journal articles.

The IPCC reports that literature published on the topic of "climate change" has increased in most scientific fields, but has not has not changed appreciably over the past four decades in engineering journals. To address the complex climate change problem, we will need solutions from all experts.

I wanted to close with a word on mitigation.

Twenty years ago, the worst case scenario in discussing climate change was an increase between 0.5 to 1.5 degrees Celsius. Today the world is losing on its commitment to cap average global atmospheric carbon part per million at 450 and an average temperature increase of 2 degrees Celsius. The IPCC is now running scenarios from 3 to over 5 degrees Celsius.

Just as we need to think about transformative rather than incremental approaches to adaptation, we need to put in place transformative changes to energy systems. Climate change debates are not about science. The science is now clear, and it tells us that we need anywhere from a 40 per cent to over 60 per cent decrease in greenhouse gas emissions in the near term, and net zero emissions must be achieved between 2050 and 2100 to keep under the 2 degree Celsius cap. This is therefore not a matter of more analysis, but simple arithmetic: what steps are needed to cap emissions and keep within a simple concept we all understand? How to have a balanced carbon budget?

The simple challenge is to make clean energy—from renewables, from convention with carbon capture and storage—cheaper than dirty energy. One place to begin is ending the $500 billion to $600 billion each year globally that governments spend on fossil subsidies, and finding ways—through fiscal policies, public procurement, clear policy direction for oil and gas regulations—to ramp up clean energy.

International action to address climate change is a crucial part of the solution. We could spend all day criticizing the UNFCCC and speculating about the likelihood of success for the COP meeting in Paris in 2015. Yet this needs to succeed and Canada has very little time in putting together its formal position going into the Paris COP. My colleagues work closely with provinces and they, with industry, are increasingly anxious that there is little open, transparent consultation about Canada's 2015 strategy.

It will likely look very different from the top-down Kyoto Protocol. But the international community needs an international system that spurs bottom-up and top-down action, that is able to count up and compare national actions through strong levels of ambitions for climate finance both for mitigation and adaptation, and that has in place coherent monitoring, reporting and verification systems.

There are climate change tipping points beyond which it will no longer be possible for some systems to achieve sustainable development. More mitigation in the near term can reduce the need for adaptation in the future. There are strategies that we can pursue now that will put us onto climate-resilient pathways while also helping to improve livelihoods, social and economic well-being, and environmental integrity.

We are already seeing the impacts of climate change and the science is clear on what we will continue to see. We need national leadership and coordination on disaster risk reduction, adaptation and mitigation; and if we do not work with the international community on mitigation, then we will have a much larger task for adaptation in the future.

Thank you again for inviting me and I wish you all the best in your deliberations over the next two days.

Published by the International Institute for Sustainable Development.

International Institute for Sustainable Development
Head Office
161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4
Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Web site: www.iisd.org

About IISD

The International Institute for Sustainable Development (IISD) contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change and energy, and management of natural and social capital, as well as the enabling role of communication technologies in these areas. We report on international negotiations and disseminate knowledge gained through collaborative projects, resulting in more rigorous research, capacity building in developing countries, better networks spanning the North and the South, and better global connections among researchers, practitioners, citizens and policy-makers.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the International Development Research Centre (IDRC), from the Danish Ministry of Foreign Affairs and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

Check against delivery.

© 2014 The International Institute for Sustainable Development