

Adaptation

Adaptation is the process by which we as individuals and a society will increase our chance of survival in response to an altered geography. Unlike mitigation, which focuses on the global efforts to reduce carbon emissions, adaptation will be far more confronting. It presents to us the human face of rapid climate change and how people, and governments, respond to its effects on both regional and local scales.

Our concerns about the changes in climate have largely focused on the natural world, as other species will continue to adapt to changed rainfall and temperature patterns. Not all species will adapt fast enough. Extinctions of plant and animal species will occur, permanently altering our landscapes as deserts expand, glaciers melt and sea levels rise. While many see this as part of a distant future, the evidence suggests that the ground is already shifting beneath our feet. For a growing population of 7 billion people who rely on these natural ecosystems to survive, it is no longer a question of *whether* we will have to adapt to the consequences of climate change, but *when* and *by how much*.

The decisions made at the COP15 conference and beyond will establish the basis on which adaptation measures need to be planned. Regardless of whether these targets are set at 450, 550, or 650ppm of CO₂, change is inevitable and already built within the climate system, with the effects occurring over the coming decades and centuries. The global efforts to reduce our carbon emissions will in all probability still commit us to a minimum 2-3°C increase in average global temperatures by 2100 leaving us *no choice but to adapt*. In the short to medium term, some nations will actually benefit from the changes in climate. However, the negative outcomes that will be encountered by the many far outweigh the small gains of the geographically fortunate few.

While each will have its own individual approach, tailored to their social and economic circumstances, the capacity to adapt will depend upon their inherent vulnerabilities.

The rich, the poor and the vulnerable

The developing countries near the equator and within the tropics are the most vulnerable. These are the regions that have the greatest exposure to the impacts of future climate change, where the increased risk of disease, extreme heat and drought conditions will have a major impact on their respective economies. Adaptation measures for these nations are neither a lifestyle choice nor a behavioural change; rather they emerge as a simple matter of survival. It adds to the problems that already exist for the vast majority of these countries, whose incomes depend on climate-sensitive industries such as agriculture, fishing and tourism. Many if not all of these developing nations have lower per capita incomes, smaller economic capacities and weaker institutions that further reduces their capabilities to adapt.

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It will be in developed nations' own interests to work cooperatively with these countries in assisting them to enhance their own adaptive capacities. This is already happening on a small scale, where disaster management plans coupled with improved weather forecasting, warning systems and community education are being used to reduce the loss of life and lessen the economic impact of extreme weather events. The benefits of such programs assist some of the countries that are most at risk from future climate change such as Bangladesh and the small island states of the Pacific. In the longer term a vast array of similar low cost activities will need to be employed, acting as insurance against any large-scale climate-induced socio-economic change and ensuring greater regional security and stability.

A collective challenge

The common concerns wrapped up in the new terminologies of water, food and energy security and the adaptive capacities of nations are already starting to appear within the thirty-second sound-bites delivered by politicians and the media. We are only beginning to understand how the failure to act within a climate of uncertainty will carry a large cost in human, economic and ecological terms. The problems encountered by our world leaders in negotiating and reaching an agreement on emission targets, will pale into insignificance when compared to the challenges that each of them will face at home.

As the effects of climate change start to become apparent, they will need to make decisions based on the best available science and risk management analysis where there will be a losing side to the equation in every case and fewer advantages the further emissions increase. Ideally, the levels at which greenhouse gas concentrations are set through the COP process would be below the limits of which *all* nations can adapt. Given that the impacts of climate change will be unevenly distributed, specific mechanisms must be in place to achieve equity in any international agreement.

The difficulty that local, state and national governments will have is in balancing the competing demands for funding the adaptation measures necessary for coastal cities, regional towns, farms, and the need to ensure that ecological frameworks are maintained. Every region is different, for example; the challenges and timing of taking measures for those living in urban coastal areas to combat sea-level rise, are far removed from the farming regions whose water supplies are under threat due to the increased intensity and frequency of drought conditions. All adaptation measures will cost money and limits will be placed on the amounts of where, when and how it can actually be spent.

It is only once the limits of adaptability are reached and the costs can no longer justify any long term benefits that the hardest decisions will have to be made. Blaming the inactions of the past, while convenient, will be of little comfort for those whose homes and livelihoods are lost or have to be abandoned. The potential for

civil unrest, as people come to the realisation that they are no longer able to receive the support they expect from their governments' in the aftermath of natural disasters or permanent climate shifts, cannot be discounted, much less ignored. This will be the catalyst for some of the largest human migrations in history as many people become unintended environmental refugees.

Agree but Ignore

The moral, ethical and economic questions that surround adaptation, take climate change beyond the science and into the series of value judgements that are intertwined within the political decision-making process. While the G8 leaders may have agreed at the L'Aquila summit in 2009 that global temperatures must remain below two degrees, they are unlikely to achieve this outcome. Each and every nation will be dependent on the "other" to cooperate in ensuring they are meeting their emissions target. A prospect that has so far been found wanting within the negotiation process. Whether this is due to individual nations citing issues of equity or economic disadvantage, the search for any international agreement may never truly resolve the dilemma between economic development, emissions and sustainability. This fundamental lack of urgency of acting on climate change reflects our own history which suggests that we ignore the cues of slow-moving large-scale environmental change, often not recognising the signs.

This is partly fuelled by a false optimism that technological solutions will enable us to avoid the most serious threats of climate change. It leads to a situation where the most likely trigger that will drive the large-scale changes necessary, in both mitigating our carbon emissions and the adaptation measures needed to cope, is the clear and present dangers of very real and increasingly life-threatening disruptions to our daily lives. While there is no doubt that we have the capabilities to adapt to a new set of climate circumstances within certain limits, what remains unclear is how we would counter a series of climate shocks. The vast array of options and measures that are available to us now, will steadily diminish with each passing year as we move towards the verge of dangerous climate change.

The shape of the uncertain

We are already seeing glimpses of our future climate conditions across the globe. Record breaking droughts, heat waves, floods and storm events form a background that is overlaid with projected sea level rises and large scale changes that threaten the survival of ecosystems. What remains uncertain is the speed at which the changes will continue to occur and the tipping points from where there is no return. Even if emissions are negotiated down to 450ppm of CO₂, events such as these will become more common and the damage this will cause will be significant. The continuing advancement of the science is filling in the knowledge gaps to provide a more complete picture of the trajectories we are likely to follow and the consequences we can expect on global and national scales.

Future leaders of every nation are faced with the prospects of having to resolve a simultaneous series of seemingly impossible situations whose additional economic burden may far outweigh the efforts to mitigate carbon emissions. It will be the political and economic realities of the time that determine the application of any adaptation measures where the focus of governments will be on ensuring that essential services are maintained.

The legacy that the leaders of today leave behind through their decisions will be judged by those left to cope with the consequences. As time and emissions march on, poor decisions could become part of a downward spiral that leads to an increased conflict within and between communities and nations.

Below are the just some of the alternatives that face our future political leaders. As you move further down the list, the decisions themselves become more perilous and involve a heightening of the moral, ethical and economic challenges which will need to be addressed. Each have their own cost in terms of carbon emissions, dollars, public acceptance and loss of services.

Pushing against the sea

Preparing for increasing sea level and storm surges

- Planning laws preventing future development on at-risk areas of coastal land and flood plains
- Building standards for all new dwellings incorporating enhanced structural support, raised decking and water tolerant foundations or moveable dwellings
- New and high value settlements and productive land protected behind extended sea walls and dyke systems.
- Increased insurance premiums restrict coastal developments and the purchase of low lying real estate
- Canals designed in place of roads to create "New Venice's" with bridge upgrades to cope with higher flood levels
- Low energy desalination plants replacing freshwater sources now contaminated by salt water
- Shifting coastal infrastructure such as port facilities to protected areas.
- Dismantling, removal, abandonment and relocation of settlements
- Evacuation, relocation and assistance for low lying countries such as the Maldives and Tuvalu

Not a drop to drink

Preparing for drought and water shortages

- Water restrictions applied to all urban areas
- Increasing charges for domestic and industrial uses of drinking water supplies
- All industrial processes, except food production, switch to secondary water

- The increased use of closed loop water cycles for industrial processes
- Desalinated seawater, recycled treated sewage water and storm water increasingly added to current drinking water supplies.
- Reduced water supplies to non-essential food production
- Migrations of people towards water sources and main cities to reduce transport costs
- Selective abandonment of regions under severe water stress that can no longer be sustained

Food on the table

Preparing for shifts in productive land

- Improved weather forecasting services allow for shifts in planting times
- Banning inefficient irrigation practices and enforcing best farming practices to improve yields
- Select existing crops more suited to new climate regimes
- Movement towards zero-till farming techniques
- Diversification of farm incomes through the integration of agro-forestry that support native species, reduce erosion and provide additional economic benefits through carbon capture
- Introduce more drought, disease and heat tolerant strains
- Relocation of agricultural activity into more productive areas
- Reductions in exports and a movement towards self-sustainability
- De-stocking with landholders supported to become custodians of the landscape
- Regions that are no longer viable are completely shut-down and rehabilitated with owners assisted in the acquisition of land, relocation and employment

How's your health?

Preparing for diseases and heat stress

- Improvement in sanitation and the availability of clean fresh drinking water for developing countries
- Improved health resources, facilities, education and training for developing countries
- Increased monitoring and international cooperation for the spread of tropical and novel infectious disease outbreaks
- Forecasting the spread of infectious tropical disease
- Plans and stricter regulations to reduce the chance of vectors and handling outbreaks
- Green-scaping cities and lifestyle changes to reduce the heat island effect and deaths due to heat stress

- Emergency response plans to deal with large scale climate induced disasters and evacuation

Life in the corridor

Preparing for migrating species

- Quantifying forested “carbon reserves” and assisting developing countries to reduce tropical deforestation
- Support for afforestation projects to reduce rates of desertification
- Improvement in monitoring, forecasting and reporting of potential changes in vegetation due to alteration in rainfall and temperature regimes for environmental managers
- Improve resilience of remaining ecosystems by reducing or eliminating other environmental stressors
- Large scale redevelopment and rehabilitation of degraded ecosystems and water ways
- Establishment of large scale terrestrial and marine peace parks and wildlife corridors to enable the shift of organisms across habitat fragments and [national](#) boundaries
- Possible forced migration of species to more suitable locations to lessen the risk of extinction.
- Fire shelters and evacuation corridors for communities at risk from increasingly frequent wild fires

Infrastructure

Preparing for fossil fuel shortages and stress on infrastructure

- Increase in resilience of road, rail and power infrastructure to prolonged temperature extremes
- Create smart power grids that switch on demand between a number of sources of energy (coal fire, nuclear, biomass, wind, wave, solar)
- Shortening of life spans for major infrastructure projects to cope with changes in conditions with increased monitoring for degradation.
- Deconstruction, removal and recycling of infrastructure such as power, water, sewer and communication networks for those areas that are deemed non-recoverable from the effects of climate change