Adapting for future climate

Senior Advisor for Climate Adaptation for the US Environment Protection Agency, Dr Joel D Scheraga recently visited colleagues at SEPA to discuss the challenges and opportunities we have to adapt effectively to climate change.

Dr Joel D Scheraga is the Senior Advisor for Climate Adaptation in the US Environmental Protection Agency's (EPA) Office of Policy, Economics and Innovation in the Office of the Administrator. His responsibilities include helping the agency design and implement effective climate change adaptation measures to protect human health and the environment. This work is done in partnership with other federal and state agencies, local communities, private enterprise, and universities around the country. He also links the agency's climate change work to its Sustainability, Smart Growth, and Environmental Justice programmes.

Dr Scheraga served as a Lead Author and Contributing Author for the Intergovernmental Panel on Climate Change (IPCC), which was awarded the 2007 Nobel Peace Prize.

Please note that the views expressed are the author's own and do not represent official EPA policy.

Climate change poses risks to every sector of our economies, across all environmental media (eg air, water and land), and to every individual in every location around the world. It poses risks to public health, the natural environment, treasured cultural resources, economies, and human systems.

The impacts of climate change can be found all around the world. The extent and thickness of sea ice in the Arctic is decreasing, opening the Northern Sea Route to commercial shipping traffic. Snow pack in mountains is melting earlier in the season in some locations, affecting the availability of drinking water in cities, water for irrigation on farms, water for the survival of wildlife and ecosystems, and water needed for hydropower. The frequency of intense storms that cause combined sewer systems to overflow in some cities is rising. Cold water species of fish are moving northward, having detrimental impacts on some subsistence cultures. Sea level rise and storm surges are threatening, and in some cases destroying, coastal communities, including irreplaceable cultural resources. Glaciers are receding and the extent of ice melt in Greenland is rapidly increasing.

All of these changes are part of an ongoing process. The climate has been changing for millions of years, it's changing today, and it will continue to change in the future. Some of this change is due to natural variation and some to human activities. But human activities that emit greenhouse gases into the atmosphere and enhance the natural greenhouse effect have become an increasingly significant driver of climate change. Not only is the Earth warmer than it would have been in the absence of human activities, people are causing the climate to warm at an increasingly rapid rate. This increase in the rate of change is of particular concern because it may challenge the ability of human and natural systems to adapt and survive.

"Climate change is a capstone issue for our generation and will continue to be so for our children."

Assistant Secretary of Commerce for Oceans and Atmosphere Dr. James R. Mahoney, speaking before the U.S. Senate Committee on Commerce, Science and Transportation, January 2003.

These images show the extent and devastation to the local community of coastal erosion in the village of Shishmaref, Alaska in 2007.

Smart policy portfolios

The reason we care about climate change is it can have significant impacts on the things people care about in their everyday lives: the health of their children, the availability of food and adequate nutrition, the quality of the air they breath and the availability of safe drinking water, the protection of ecosystem services (eg safe waters in which to swim and fish), and the safeguarding of cultural resources, to name a few. The goal of climate policy should be to protect these valued 'endpoints of concern'.

Any smart policy portfolio must therefore consist of both greenhouse gas mitigation policies and strategies for adapting to a changing climate. Greenhouse gas mitigation is essential to slow the rate of climate change. But regardless of what we do to limit human contributions to greenhouse gas concentrations in the atmosphere, the climate will continue to change – partly due to natural variations in the climate and partly due to human activities. And these future changes in climate will pose risks and opportunities to which society must adapt. Climate policies must therefore include 'anticipatory adaptation'; that is, actions that can be taken in anticipation of the future effects of climate change.

The development of smart policy portfolios should also take an integrated approach to the formulation of mitigation and adaptation policies. Mitigation and adaptation policies are usually developed in isolation from one another. However, by approaching the development of these policies in a more integrated fashion, opportunities exist to identify policies that yield multiple benefits (eg adaptation options that also lead to reductions in greenhouse gas emissions and emissions of criteria air pollutants; greenhouse gas mitigation policies that also increase the resilience of systems to climate change).

> "The climate has been changing for millions of years, it's changing today, and it will continue to change in the future."

A recent study done at the University of Wisconsin provides an example of the power of such an integrated approach.[1] The researchers explored the possibility of replacing short car trips in Midwestern cities with bicycle trips to attain health and environmental co-benefits. They demonstrated that the health and environmental co-benefits of promoting bicycling could be substantial, leading to:

1) reductions in obesity and improvements in personal fitness and health;
2) improvements in local air quality (and associated health benefits);
3) reductions in greenhouse gas emissions.

Climate policy should also be placed in the larger context of 'sustainable development'. Climate change is a significant stress on the environment, but it is only one of many important stressors. Other factors can have impacts similar

[1]Grabow, Maggie L., *et al.*, "Health Co-Benefits from Green Transportation: The Triple-Win Biking Project," *Epidemiology*, Vol. 20, Issue 6, November 2009.

Photos: Muir Glacier in Glacier Bay National Park, Alaska, in 1941; the same glacier in 2004. Courtesy of the US Geological Survey.

in scope or magnitude; things like population growth, economic development and land-use practices (though, arguably, no single stressor is as pervasive and broad in scope and magnitude as climate change). The focus of environmental policy should not simply be on the mitigation of climate change and its effects. It should be on the broader, all-encompassing challenge of finding an optimal mix of policies that protect human health and the environment against all stressors.

To accomplish this, policy makers need to define the environmental, public health, and economic outcomes they want to attain and sustain for society (so-called 'sustainability goals'). These goals should then drive how they holistically address all environmental stressors, including climate change. This type of approach will encourage the identification of policies that provide multiple benefits ('co-benefits'). For example, policies that reduce energy consumption and greenhouse gas emissions may also reduce emissions of mercury and sulfur dioxide (the latter a precursor to acidic deposition into lakes and streams). Similarly, the development of riparian buffer zones that limit pollution run-off into rivers and streams can help adapt to more frequent and intense rainfall events expected with a changing climate.

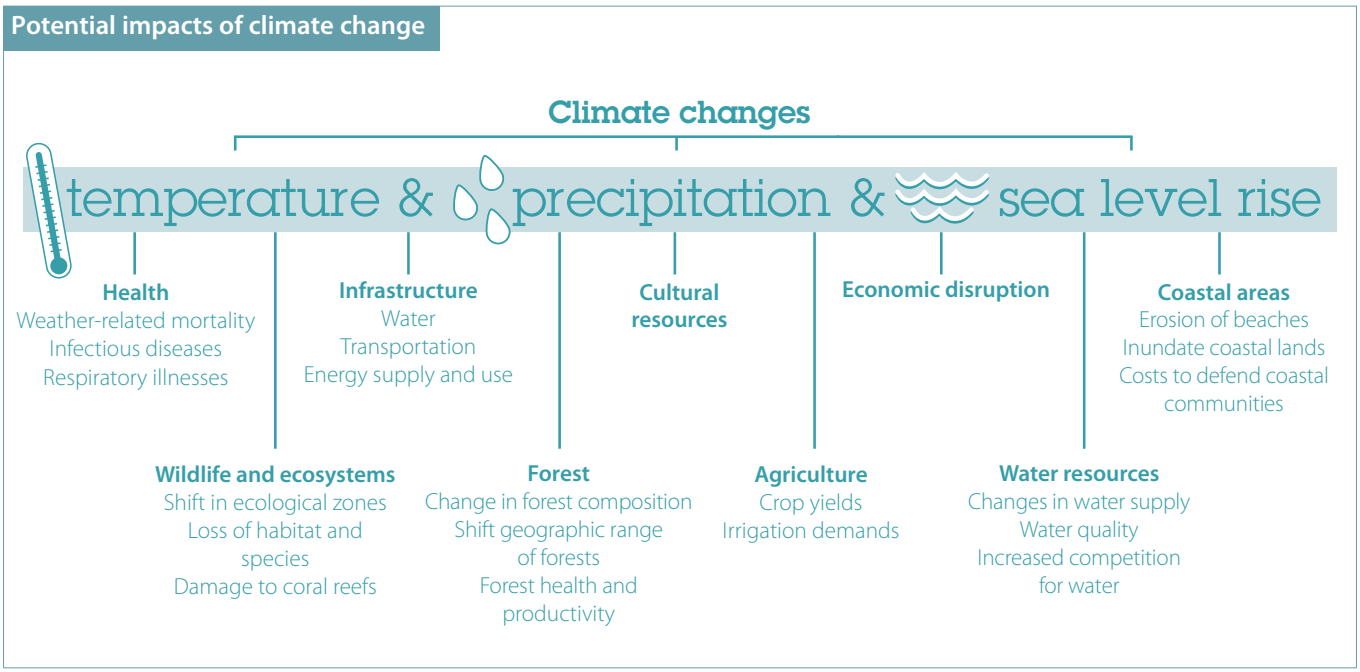
Barriers to effective adaptation

Opportunities to adapt to a changing climate abound. But lest we be cavalier, there are many challenges to adapting effectively to climate change. There is a temptation among some to assume that it is easy for wealthy and technologically advanced nations like the United States and the Member States of the European Union to anticipate and avoid the negative impacts of climate change. But even a cursory examination of the resilience of systems under current climate suggests otherwise.

Alaskan tribal communities like Newtok, Shishmaref and Kivalina have had limited success avoiding damages from sea level rise. Newtok's sacred cemetery is now underwater – as is its landfill site. Its homes are falling into the sea as they are pummeled by more severe storm surges. (The protection provided to the community by ice cover along the coast is diminishing as ice cover is disappearing with warming.) All of these impacts were anticipated and could have been avoided.

Something is broken. Some barriers exist that made it impossible for Newtok to effectively protect its community, infrastructure and cultural resources from climate change.

The prolonged heat wave that struck Europe in 2003 provides another stark example. It's well known that heat stress kills, and certain demographic groups (the elderly, young children, the infirm) are particularly vulnerable to heat



stress. The adaptation strategies for protecting against heat stress are well known, and yet approximately 30,000 people died during the 2003 heat wave.

Some of the barriers to effective adaptation may be economic. For example, adaptation comes at a cost and can be too expensive for some individuals or communities. Some barriers may be social; some of the elderly who died in Chicago during the heat wave of 1995 perished because they were unable to leave their apartments, and also nailed their windows shut for fear of crime and break-ins. Other barriers may be technological or institutional.

This suggests that the question of effective adaptation to climate change is a multi-disciplinary problem. It will require collaboration among physical scientists, biologists, social scientists and economists, political scientists, engineers, and experts from other disciplines.

Decision support tools

The good news is that some tools already exist, and more are being developed, to help overcome some of the barriers and facilitate climate adaptive management decisions. Many of these tools are non-prescriptive. They don't tell the decision-maker the 'right' answer, rather, they allow the user to explore alternative plausible climate futures and the implications of different decisions they might make. The approach taken to the development of these tools reflects the belief that policy and resource management decisions entail social value judgements. It is the prerogative of the decision maker, not the tool developer, to reflect the values of society.

One example of a non-prescriptive tool designed to facilitate adaptive management decisions is the US Environment Protection Agency's 'BASINS' system. BASINS is designed for use by regional, state, and local agencies to perform watershed and water-quality based studies and they explore different ways to meet the US Environment Protection Agency's water quality standards.

The latest version of BASINS contains a Climate Assessment Tool, which enables users to explore how the water resources they manage could be affected by a range of potential changes in climate. It also enables the users to explore the effectiveness of alternative management practices for increasing the resilience of water resources to changes in climate. Such a tool can help lead to consensus about appropriate management practices that should be implemented.

It's important that these tools are developed through partnerships. The tool developers and the users must interact to ensure the right tools are developed and will be used, and partners from multiple disciplines need to be engaged.

The development of robust toolkits that can support adaptive management decisions in locations all around the world also offers an opportunity for international partnerships. Agencies like the US Environmental Protection Agency and SEPA have expertise that can be leveraged, and they can play a leadership role in the development of such toolkits.

Working together, we can help communities around the world effectively adapt to a changing climate – and ultimately protect public health, the environment, and social well-being. SV

Further information

To find out more about the BASINS planning tool, visit:
www.epa.gov/waterscience/BASINS