FACT SHEET: WATER & CLIMATE CHANGE

Climate change impacts water resources in a myriad of ways, but due a mismatch in scale between global climate change models and catchment scale water management, predicting exactly where and how climate change will affect water is extremely difficult. While detailed projections remain illusive, there is certainty that "hydrological characteristics will change in the future". These changes will require new policies that enable communities to adapt.

Global Trends Impacting Water

- Rising temperatures and sea levels, and increasing variability in precipitation are the climate change factors poised to have the greatest impacts on fresh water resources and management.
- Some regions may benefit from increased levels of runoff, while others will suffer losses due to more extreme weather and changes in seasonal runoff, which will cause shifts in water supply, water quality and flood risks.
- Sea level rise will increase the salinity of groundwater and estuaries in coastal areas, reducing the amount of fresh water available to local humans and ecosystems.
- The risks of floods and droughts are expected to rise as temperatures change and climate variability increases. A host of non-climate related factors (including water and land-use, as well as local adaptive capacity) influence how these extreme water situations impact communities and aquatic ecosystems.
- Increasing precipitation variability will heavily impact semi-arid and arid regions, by decreasing the amount of water available, and lowering the amount of groundwater recharge. These vulnerabilities are even more severe when combined with growing populations and new water demands.
- Many forms of pollution (such as sediments, nutrients, dissolved organic carbon, pathogens, salt, and thermal) are likely to be exacerbated by higher temperatures, more intense storms, and longer periods of low flows. Declining water quality affects water supply reliability and costs, as well as human and ecosystem health.
- As snow fall turns increasingly to rainfall, the volume and intensity of rain events will lead to greater soil erosion.
- Population growth and increasing affluence will increase demands for water, particularly demands for irrigation water to support greater food production.
- Traditional water management practices "are very likely to be inadequate to reduce the negative impacts of climate change on water supply reliability, flood risk, health, energy, and aquatic ecosystems".

Sources For the Global sections: Kundzewicz, Z.W, L.J. Mata, N.W. Arnell, P. Doll, P. Kabat, B. Jimenez, K.A. Miller, T. Oki, Z. Sen and I.A. Shiklomanov, 2007: Freshwater resources and their management, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 173-210. For the Canadian sections: Lemmen, D.S, Warren, F.J., Lacroix, J. and Bush, E. editors (2008): From Impacts to Adaptation: Canada in a Changing Climate 2007; Government of Canada, Ottawa, ON.

Climate Change Impacts in Canada

Globally, climate change has already impacted numerous communities and ecosystems, mainly through the increasing occurrence of extreme climatic events and changes in water resources; "these impacts…are mostly adverse and are expected to continue and intensify in the future". The following impacts on water resources have already been observed in Canada.

Impacts on Biological & Physical Systems Related to Water

- ***Glacier cover*** has been declining (in both mass and area). In Canada's Arctic an estimated 25km³/a of ice mass has been lost from 1995-2000. BC's glaciers are currently retreating "at rates unprecedented in the last 8,000 years".
- ***Snow cover*** has diminished in both area and duration. For the period 1972-2003 there has been a 10% reduction in snow cover over the Northern Hemisphere. Since 1950 there has been a loss of 20 days in the annual duration of Arctic snow cover.
- ***Sea-, lake-, and river-ice cover*** reduced extent and duration.
- ***Permafrost*** has been warming, particularly in the western arctic, while the annual summer thaw has been deepening.
- ***River & lake levels*** have been changing due to variations in runoff and earlier spring peak flow events.
- ***Distributions of species*** are changing. For example, cool and warm water fish species are becoming increasingly abundant relative to cold water species.
- ***Coastal erosion*** is increasing due to a combination of climatic changes (less ice-cover, sea-level rise, storm severity) and non-climatic factors (development, etc.).

Impacts on Human Systems – social, economic, built environments

- Built systems, such as water and wastewater infrastructure, were designed based on historical climate trends. As climate change impacts the timing, volume, and intensity of weather events, taking them beyond the 'normal' design parameters, both the risks and costs associated with drinking water increase.
- Transboundary water agreements between Canada and the United States "were developed without consideration of a changing climate, and some may not be appropriate to protect future Canadian interests or responsibilities in water".
- As ice cover diminishes in the arctic, marine traffic and development will increase.

Adaptation

Adaptation, "any activity that reduces the negative impacts of climate change and/or takes advantage of new opportunities that may be presented", cannot stop changes in climate from impacting water resources, but can help to reduce the severity of negative impacts on communities and ecosystems.

- Adaptation may occur before (anticipatory), during (concurrent), or after (reactive) the observed changes. Anticipatory adaptations tend to be made over the long-term and are generally less costly and more effective than reactive adaptations.
- Tailoring adaptation measures to the particular situation is important, and special attention needs to be given to the "feasibility, likelihood and mechanisms for uptake" if adaptations are to be successful.
- Integrated Water Resources Management is paradigm recommended by the Intergovernmental Panel on Climate Change to deal with increasing climate uncertainty through adaptive measures.

Sources For the Global sections: Kundzewicz, Z.W, L.J. Mata, N.W. Arnell, P. Doll, P. Kabat, B. Jimenez, K.A. Miller, T. Oki, Z. Sen and I.A. Shiklomanov, 2007: Freshwater resources and their management, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 173-210. For the Canadian sections: Lemmen, D.S, Warren, F.J., Lacroix, J. and Bush, E. editors (2008): From Impacts to Adaptation: Canada in a Changing Climate 2007; Government of Canada, Ottawa, ON.