CASE STUDY 5H

RISK FORECASTS

FORECASTING WILDLAND FIRE SMOKE HAZARDS IN URBAN AND RURAL AREAS IN MANITOBA, CANADA

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CONTEXT

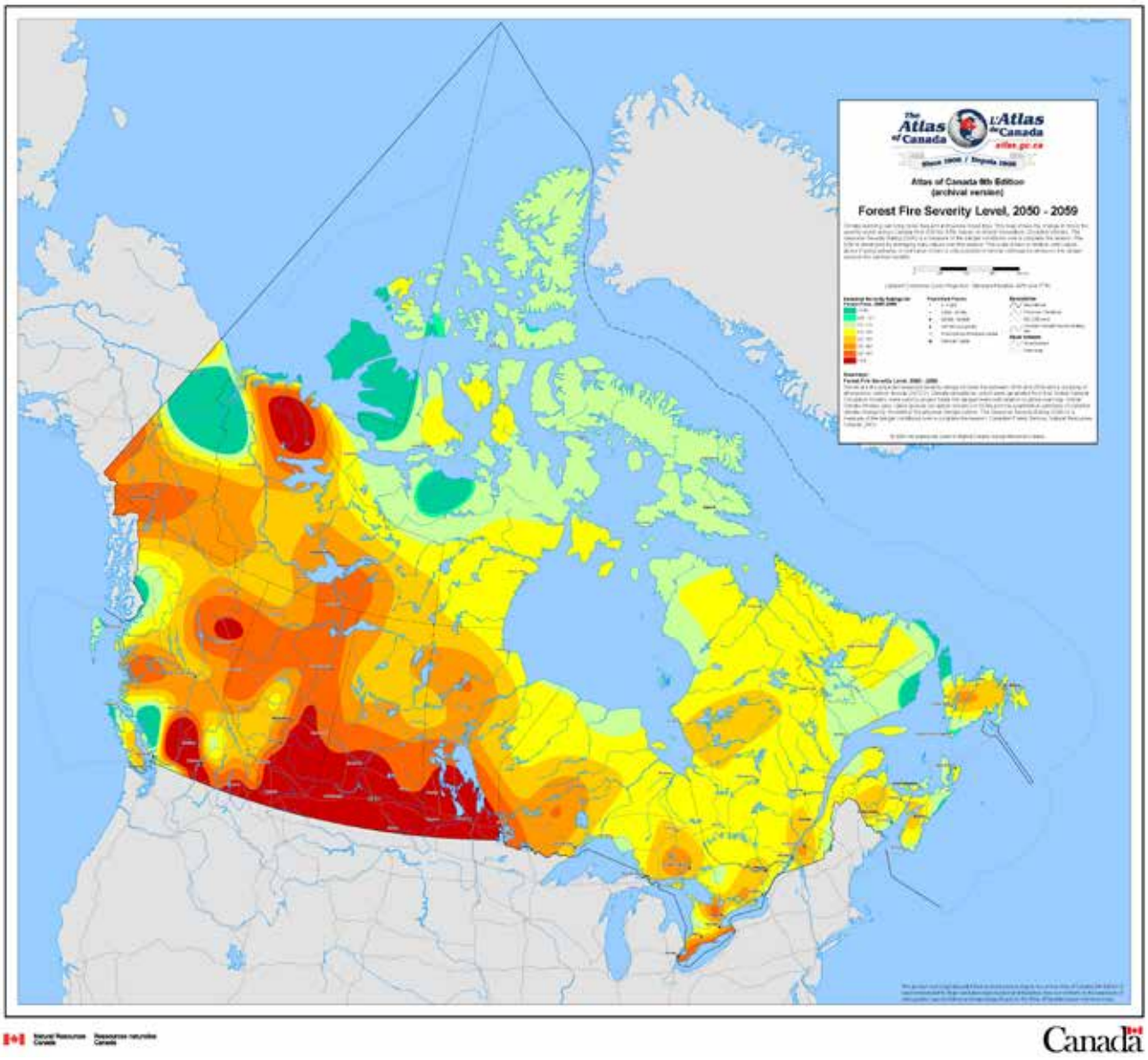
Air quality is a significant public health issue in many Canadian communities and will be impacted by wildland fires that are expected to increase with climate change *(42)*. Wildland fires are a common occurrence across Canada where forests cover more than 50% of the country's landmass. In a changing climate, increases of between 75% and 140% in the number of fires have been projected by the end of the 21st century, with significant regional variation *(43)*. Figure 5.20 shows the change in forest fire severity levels projected across Canada from 2050 to 2059, based on second-generation global circulation models.

Exposure to smoke from wildland fires can have direct and indirect impacts on health (Figure 5.19). Some individuals are more vulnerable, such as children, seniors, people with pre-existing heart or lung conditions and people geographically, culturally or socially isolated *(44)*.

Figure 5.19 Direct and indirect health impacts from wildland fires (Adapted from 45 and 46).

DIRECT IMPACTS	**Respiratory effects** Asthma exacerbations New cases of asthma or respiratory disease Respiratory symptoms and deteriorating lung function Dyspnoea, cough, chest tightness, wheeze and sputum production Chronic respiratory issues **Cardiovascular effects** Heart disease Cardiovascular mortality/ cardiac failure Dehydration	**Burns** Direct burns Burn-related casualties Organ failure Inhalational burns **Heat induced illness** Heat stroke, heat exhaustion Cardiovascular mortality **Ophthalmic effects** Eye irritation Reduced visibility Corneal abrasions	**Psychological effects** Anxiety Mental exhaustion Stress from lives lost and impacts to livelihoods, homes and communities Depression (including major) Post traumatic stress disorder Somatisation Hostility Paranoia Chronic psychiatric morbidity Paediatric psychological morbidity
INDIRECT IMPACTS	Trauma during evacuations Increased demand on health services Inability of patients with chronic health conditions to access health care facilities Diseases associated with water and land pollution		

Figure 5.20 Change in forest fire severity levels across Canada from 2050 to 2059.



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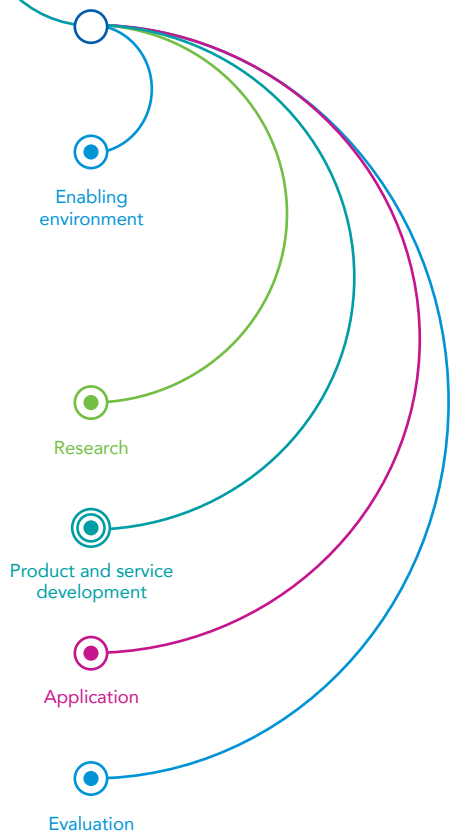


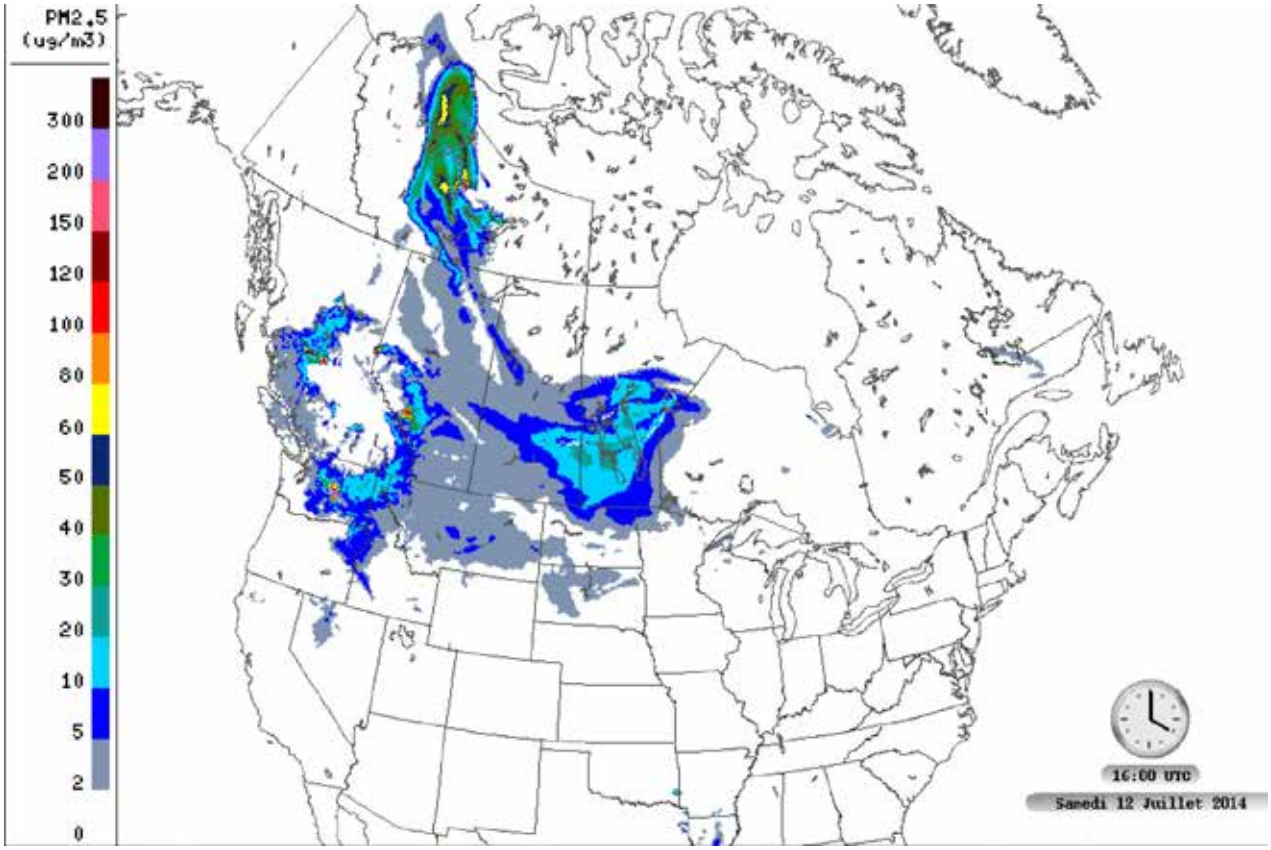
NEW APPROACHES

In Manitoba, wildland fires and extreme weather events already place significant pressures on health and emergency management systems that may be further compromised by climate change *(47)*. The Office of Disaster Management (ODM) within the Manitoba Department of Health is reducing health risks from wildland fires by using a suite of tools to forecast, monitor and communicate risks from wildland fire smoke to partners and the public. The suite of tools includes field-deployable smoke monitors (DustTrak), communications hardware (Thamis), and a map-centric web-based application, called the Common Operating Picture (COP). These tools provide information on the location and concentration of wildland fire smoke on an hour-by-hour basis up to 48 hours into the future (Figure 5.21). The ODM has been working with Environment and Climate Change Canada and other partners to validate the forecasting system. The DustTrak air quality monitors are pre-positioned across the province and are used to identify smoke hazard risks in populated areas during wildland fires. Using a cellular network, smoke particulate levels picked up from monitors are displayed on the COP to provide health decision-makers with remote, real-time access to air pollutant data.

The COP is built using web-based GIS technologies that provide a graphical yet spatially accurate view of both real-time and forecasted wildfire information. In addition to smoke-specific data, many other layers of information can be displayed such as fire boundaries, the location of health care facilities, highway conditions, and administrative boundaries. Decision-makers have been trained to use the COP to implement effective and targeted public health and emergency management measures, such as evacuations).

Climate forecasting and wildland fire monitoring data are being used by ODM to reduce risks to health. ODM is determining if the Air Quality Health Index (AQHI), an air quality communications and forecasting system, is an appropriate mechanism to communicate health risks from wildland fire smoke. The AQHI is used in many communities in Canada to provide information on short-term health risks posed by air pollution *(48)*. In Manitoba, the AQHI is currently available in urban areas but not readily available in rural settings where wildland fires are a major contributor to adverse air quality changes. Until the AQHI is developed for use in rural areas, forecasts from deterministic models which account for the emissions and transport of particulate matter will be relied upon to project wildland fire smoke health risks. As of 2015, ODM assessed two such systems: the FireWork forecasting system *(49)*, based on a comprehensive air quality model and operated by Environment and Climate Change Canada as part of its air quality program, and the BlueSky Canada wildfire smoke forecasting system, based on a sophisticated dispersion model and operated by the University of British Columbia as part of a collaboration with various Canadian provincial and federal partners *(50)*. Efforts are being made by the Manitoba Department of Health to develop specific smoke event health messaging for vulnerable groups. Research is also underway to understand the health impacts of smoke events occurring at the same time as extreme heat episodes. If sufficient evidence of risk exists, health messaging for combined health risks of smoke and heat will be developed. Collectively, these tools will help decision-makers target adaptation efforts towards vulnerable individuals and communities (e.g. aboriginal and First Nations) and enhance capabilities for effective risk management and decision-making.

Figure 5.21 Sample firework output of wildfire emission contributions to total forecasted PM 2.5 micrograms per cubic metre in western Canada on July 12, 2014. Environment and Climate Change Canada, 2014.



ACKNOWLEDGEMENTS

Manitoba

Environment and Climate Change Canada

BENEFITS AND LESSONS

The BlueSky and Firework forecasting systems assist ODM officials to alert health services and the public of wildland fire smoke risks, inform emergency management actions (e.g. evacuations), and identify and address confirmed risks of smoke and heat exposure. Its operation and testing has demonstrated the need for real-time air quality data to validate predictive models and to combine multiple layers of data into one common operating picture that supports decision-making. Continued implementation of this system is expected to reduce health risks to Manitobans from wildland fire smoke events.