


HURRICANE JUAN: THE TERRIBLE STORM

Introduction

Focus

This *News in Review* module looks at the impact of Hurricane Juan, which came ashore near Halifax, Nova Scotia, shortly after midnight on September 29, 2003. We examine the preparedness of Nova Scotia for the storm, and the physical and economic effects of its devastation. We also look at how hurricanes are formed, and look back at Hurricane Hazel, the most damaging hurricane to ever hit Canada.

 Sections marked with this symbol indicate content suitable for younger viewers.

The year 2003 will definitely go down in history as a challenging one for Canada. British Columbia faced two different natural disasters: the most destructive forest fires in its history during the summer, and severe floods in western portions of the province in the fall. The Prairies dealt with another year of drought or near-drought, grasshopper infestations, and the severe economic fallout of a single case of mad cow disease. Ontario was shaken by not one but two outbreaks of SARS in its hospitals. And, at the end of September, to make sure that no one felt left out, the Maritimes—especially Nova Scotia and Prince Edward Island—were battered by the most damaging hurricane to hit the country since Hurricane Hazel in 1954.

Hurricane Juan came ashore near Halifax shortly after midnight on September 29. Residents had been warned that the hurricane was on its way, but the expectation was that it would arrive as a Category 1 storm, the weakest category, and that damage would not be severe. What arrived was a Category 2 storm with higher winds and a higher storm surge than anticipated.

The destruction was breathtaking. Halifax, a city known for the number and beauty of its old-growth trees, lost thousands of specimens. The Public Gardens, a park truly loved by the city's residents, was almost totally flattened. Hospitals, schools, and homes were damaged. Boats sank in the harbour. Wharves, boardwalks and sidewalks were destroyed.

Farms and fisheries also suffered. Silos and barns were destroyed, and animals were killed. Many fishers lost

their wharves, sheds and gear; some lost their boats. Of the estimated \$100-million dollar loss in Nova Scotia, \$40-million was to farms and fisheries.

At the height of the storm, approximately 300 000 Nova Scotia homes were without power. Nova Scotia Power did not fully restore hydro until October 12, adding to the frustration for many residents.

Once again, as during the B.C. forest fires, Canadian Forces personnel were brought in to assist local officials with the clean-up. The federal government provided 1000 members of the army and navy to aid in clearing downed trees to enable hydro crews to do their job.

The storm swept on through Truro into Prince Edward Island, where it continued to do damage—especially to trees—and left about half the island's households without power. Despite the storm the province went ahead with its provincial election on September 29. The chief electoral officer, Merrill Wigginton, had to use a chainsaw to clear his driveway so he could get to his office to supervise the election. Despite the difficulties, 83 per cent of eligible voters cast their ballots, and gave Conservative premier Pat Binns his third majority.

Nova Scotians, in particular, have been left with a number of questions in the aftermath of Hurricane Juan. Why did so many people underestimate the force of the storm? Even forecasters seem to have downplayed its potential for destruction, and the media failed to convey the potential seriousness of the event. Most of the public appeared to remain blasé even when the true inten-

Quote

"It was heaven here, and then it was hell. Some day it will be heaven again." Hurricane Juan survivor — *Toronto Star*, October 5, 2003

sity of the storm became apparent. Even if Juan had been taken more seriously, could the amount of damage have been reduced?

There are also questions about the cleanup and the restoration of power that remain to be answered. Why did it take so long for many homes to be reconnected? Why was it so difficult to get accurate information from Nova Scotia Power (a failure that Nova Scotia Power admits in a recent report)?

Another important question involves future preparedness. The Maritime provinces are on a pathway that hurricanes often follow. While severe storms do not often make landfall in the Maritimes, the possibility of future storm activity remains. How can Environment Canada, local governments, and the media better prepare for such events?

Discussion

Many of the victims of Hurricane Juan were inadequately insured—some because they were unable to get insurance, others because they couldn't afford it. As governments plan their disaster relief contributions, should they take victims' lack of insurance into account in deciding the amount of aid for which they are eligible? Carefully outline the major arguments for and against public funding for disaster relief.

For many Nova Scotians, however, the biggest issue is how the recovery is going to be funded, and how soon the money is going to be available. Many farmers and fishers are especially vulnerable, with little or no insurance. Lobster fishers who lost boats and equipment are among the worst off. The season opens at the end of November, and they have little time left before it begins to replace equipment. Bankruptcy is staring many of them in the face.

The Nova Scotia government has promised \$10-million in assistance, and is waiting to hear from Ottawa about how much they can expect. With the many demands that the federal government is facing for disaster relief this year, few are willing to predict how large the contribution will be. All hope that some of it will at least begin to flow soon.

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Video Review

This video review is in two parts. Part I is a series of recall questions to be completed during an initial viewing of the video. Part II should be completed following a second viewing of the video, with discussion to follow.

Did you know . . .
Some captains and crews risked their lives by staying in their vessels during the hurricane in order to try to protect their property?

Part I

Answer the following questions in the space provided.

1. How many days before Hurricane Juan hit did the Canadian Hurricane Centre warn Nova Scotia that the storm was coming?

2. How do most residents of the province seem to have reacted to the warning?

3. When was a state of emergency declared for Halifax?

4. What were the two major worries of the local power company?

5. How many people were killed during the storm? _____
6. What happened to the staff at the hurricane centre in Dartmouth during the height of the storm?

7. What two major rural Nova Scotia industries were hard-hit by Hurricane Juan?
_____ and _____
8. What is the anticipated total cost of the damage done by Hurricane Juan in Nova Scotia alone?

Part II

During a second viewing of the video, pay particular attention to those comments dealing with how prepared residents were to deal with a destructive hurricane. What does the video indicate was the level of preparedness of each of the following?

1. The average resident of Nova Scotia

2. Environment Canada

3. Information sources in the media

4. The government

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The Life Cycle of Hurricanes

Further Research

As one might expect, interested students will find excellent information on hurricanes on the Internet. For junior students, Dan Falk's "Nature's Fury" on the CBC Web site at www.cbc.ca/news/indepth/weather/hurricanes.html is a good introduction. There is also useful material from the Miami Museum of Science at www.miamisci.org/hurricane/index.html. Senior students especially will appreciate the University of Chicago Web site at [http://ww2010.atmos.uiuc.edu/\(Gh\)/wwhlpr/hurr_graphic.rxml?hret=/indexlist.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/wwhlpr/hurr_graphic.rxml?hret=/indexlist.rxml), and the sophisticated FAQ from the Atlantic Oceanographic and Meteorological Laboratory at www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html.

Hurricanes are part of a category of storms properly known as tropical cyclones. The name *hurricane* is given to those storms that take form in the Atlantic Ocean, and the word itself comes from the Carib Indian word *hurican*, which refers to the tribe's god of evil. Many etymologists (people who study the origins of words) believe that *hurican* is in turn derived from the name of a Mayan god, who created dry land by blowing on the oceans.

Similar storms formed in other oceans are known by different names. Those formed in the western Pacific are called typhoons, based on the Chinese words for "great wind." Storms from the Indian Ocean are cyclones, based on the ancient Greek word for coil, which describes the movement of the winds within the storm.

Formation

Hurricanes form over warm tropical waters close to the equator. A low-pressure system is created when evaporation of warm ocean water (at least 26.5 degrees centigrade) forces large amounts of moisture into a calm atmosphere. This atmosphere must also cool quickly with height, which means that it is potentially unstable. Condensation of water vapour releases heat. The heat provides the power for circular winds. As the storm develops, rainfall begins. This rainfall releases still more heat, resulting in convection that draws more moisture up through the centre of the storm system. As this process continues, the storm continues to grow. In appearance, the storm consists of two parts: an eye in the centre, surrounded by a wall of clouds.

The annual hurricane season runs from June 1 to November 30, when warmer water encourages storm formation. The storms that batter eastern North America form in three different areas, depending on the time of year: the Gulf of Mexico at the beginning of the season; the eastern Atlantic in mid-season; and the Caribbean in late season. The most dangerous storms tend to form mid-August through mid-October.

Intensity

The intensity of hurricanes is classified according to the Saffir-Simpson scale, which takes into account both the speed of the winds and the size of the accompanying storm surge. Hurricanes range from Category 1 "Minimal," with winds from 119 to 153 kilometres per hour, to Category 5 "Catastrophic," with winds over 250 km/h.

Hurricane Juan was expected to be a Category 1 storm, described by Environment Canada as follows: "Damage primarily to shrubbery, trees, foliage, and unanchored homes. No real damage to other structures. Some damage to poorly constructed signs. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings."

It was subsequently reclassified as Category 2 "Moderate." Here is Environment Canada's description of a Category 2 storm: "Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to buildings.

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The High Cost of Hurricane Juan

Further Research

Extensive scientific and technical information on Hurricane Juan is available from the Environment Canada Web site at www.atl.ec.gc.ca/weather/hurricane/juan/. Photographs of some of the damage to Nova Scotia caused by Juan are at www.atl.ec.gc.ca/weather/hurricane/juan/photos_e.html.

Did you know. . .

Park officials estimated that 40 000 trees were blown down during the storm?

At 12:10 a.m. on Monday, September 29, 2003, Hurricane Juan struck Nova Scotia with a ferocity that had not been anticipated. It left behind damage that will be apparent for years to come. Juan was the first direct hit on Nova Scotia by a hurricane in 40 years. It is already recorded as the most damaging storm in modern history to strike Halifax.

Eight people died as a result of the storm. Two were killed when trees fell on the vehicles in which they were riding. Two fishers were lost off the coast of Anticosti Island in Quebec. A mother and two children died in a house fire probably started by candles they were using during the power outage. A final person involved in relief work died weeks after the storm.

Initially it was thought that Juan landed as a Category 1 hurricane. It has now been determined that the storm came ashore as a Category 2 hurricane, with 158-kilometre-per-hour winds accompanied by gusts of 185 km/h. The winds were accompanied by a storm surge of between 1.0 and over 1.5 metres. (For further information of hurricane intensity and storm surges, see the section titled “The Life Cycle of Hurricanes.”)

At the height of the storm, 300 000 homes were without electricity. More than 150 000 remained without power two days after the hurricane, and it was almost two weeks before power was restored throughout Nova Scotia, on October 12. Most schools and universities in areas affected by the storm remained closed for a week; non-essential workers were told to stay home. Hospitals cancelled elective surgery for the week.

Halifax

In Halifax, thousands of old-growth trees were destroyed—the very trees for which Halifax is famous. Some were snapped at their roots, others were cracked in two by lightning. Point Pleasant Park suffered severe damage, and the Public Gardens were almost totally destroyed. The number of downed trees was directly responsible for many of the delays encountered by Nova Scotia Power as it tried to restore electrical service.

The largest hospital in Halifax had half its roof torn away, windows broken, and several floors flooded by the storm. Two hundred patients had to be moved.

Several sailboats sank in Halifax harbour. The ferry terminal was badly damaged. One of the two bridges between Halifax and Dartmouth was closed because its tollbooths were demolished by the storm.

Describing the scene for the Canadian Press, Alison Auld wrote (September 29, 2003): “In downtown Halifax, boulders the size of garbage cans were hurled from the water’s edge like pebbles. Sections of paved parking lots buckled and sections of wharf were thrown from the pitching waters and smashed into the ground.”

Approximately 1000 Canadian Forces personnel helped with the clean-up. Tree-trimming crews were sent from Maine, and power workers came from St. John and Moncton, New Brunswick.

Rural Nova Scotia

Other parts of the province were also hard-hit. Some fishing villages were literally flattened by the storm surge.

Further Research

More CBC resources are at www.cbc.ca/newsreal/teachers.html.

Select "Past Lesson Plans" then "Oct 01, 2003 Hurricane Juan; Weather; Wind Power; Food Safety"

(www.cbc.ca/cgibin/newsworld/viewer.cgi?FILE=NL20031001.html&TEMPLATE=newsreal_archive.ssi&SC=NL).

Many fishers lost wharves, sheds, traps, lines, and bait worth thousands of dollars. Grant Garrison of Sambro saved his lobster boat but lost most of his gear when it washed into the sea.

"Two months before the lobster season and we've lost everything" (*Ottawa Citizen*, September 30, 2003).

Many farmers also suffered. Dairy farmer Ralph Bellam saw the tops torn off four silos, his machinery barn collapse, and about 40 of his Holsteins wander onto the highway when his heifer barn lost its doors. His neighbours were even less fortunate. They lost more than half their cows when the roof collapsed on their main barn.

Fishing and farming are not high-profit businesses, and without immediate financial assistance, many fishers and farmers face bankruptcy. Many carry inadequate or no insurance to cover their losses. Nova Scotia has announced it will provide \$10-million

to assist uninsured victims of Juan. Ernie Fage, the minister responsible for emergency measures, defined the scope of the aid in the *Halifax Daily News* (October 11, 2003): "If the loss affects basic habitability of your home or puts your livelihood in jeopardy, then you may be eligible." Victims will, however, have to cover the first \$1000 of any loss.

Estimates place the damage done by Hurricane Juan at over \$100-million. Of that amount, the fishery suffered about \$20-million, and agriculture another \$20-million. Federal disaster relief will fund some of this, but how much and when it will arrive remain unanswered questions as of November 1, 2003.

Premier Hamm has asked the Prime Minister to speed up the process. John McCallum, the defence minister who is responsible for the decision, has indicated that the monies should begin to flow soon.

Responding

1. Briefly summarize the damage done by Hurricane Juan throughout Nova Scotia.

2. In your view what type of destruction was most significant? Explain.

3. Do you think that the federal government should provide relief? Explain.

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In the Hurricane's Eye: A Visitor's Story

Les Luka is a retired Ontario teacher. His daughter Mary Elizabeth and her partner Brian live and work in Halifax. Luka and his wife Blythe thought that visiting Mary Elizabeth to celebrate her birthday would be a perfect short holiday. They arrived on Thursday; Juan joined them on Sunday night. This is an account of their experience.

Archives

To learn more about the terrible devastation of the Halifax explosion of 1917, visit cbc.ca/halifax-explosion or view the recent CBC productions *Shattered City: The Halifax Explosion* and *City of Ruins*.

Les Luka reports that when he and Blythe flew to Halifax they were “vaguely aware” that there was an impending storm, but most of the information they were hearing was fairly low-key. Everyone in Halifax, he says, seemed unconcerned right through until Sunday. Even then, when there was talk of a “big blow,” there was no real alarm about the expected storm. At this time, Juan was predicted to be a Category 1, or minimal, hurricane.

Sunday itself was a beautiful day, if somewhat windy. The Word on the Street book and author festival attracted thousands of Haligonians to the waterfront. Luka and his family joined them, and then visited some of the tourist areas around the harbour. No one seemed anxious about the hurricane. Some owners talked of closing their shops early, but voiced no expectation of any real threat from the impending storm.

Sunday was to be Les and Blythe’s last night in Halifax, and they enjoyed a pleasant dinner with Mary Elizabeth and Brian at their home on Roome Street in the north end of the city. It is somewhat ironic that the north end is one area that was devastated by the Halifax Explosion of 1917. The CBC had recently completed and was soon to air a new miniseries on the explosion. Mary Elizabeth had worked on parts of it, and Les and Blythe had a chance to see some of the work she had done.

By 9:30 it was becoming apparent that Juan was more than the usual storm. The wind had picked up and it was raining heavily. Mary Elizabeth and Brian stepped outside and returned soaked through, despite heavy rain-

coats. Les Luka noted that it was now blowing so hard that water was seeping in around the seals on the doors—coming through both the storm doors and the main doors. Television stations were beginning to report that Juan’s impact might, after all, be significant.

At 10:30 the power went off. Across the narrows, in Dartmouth, power remained on. Looking out at the lights, everyone in the house suddenly became aware of some of what was happening to the trees around them. “Trees that were 50 or 60 years old were bending like saplings, over as much as 45 degrees,” says Luka. Those on Roome Street survived pretty much intact. Luka and his family were not aware that one street over “trees were being halved and torn apart.” That street, Duffus Street, was completely closed by fallen trees.

Between 11:00 and 11:30, Dartmouth also lost its power. But Brian owned a hand-cranked radio, and the house was well supplied with candles and flashlights, so everyone felt they would be self-sufficient during any blackout. After all, Les and Blythe had been through the big eastern blackout in August and survived without problems. Since they were leaving for Ontario the following morning, everyone decided to call it a night. All slept well, despite the big storm. And that’s all it really seemed to be, when they went to bed—a big storm. While they slept, Juan came ashore.

Power remained off in the morning, but because Brian and Mary Elizabeth had recently purchased a propane gas stove, breakfast was not a problem. They noted that a crab apple tree in the front yard had been uprooted, but still

remained unaware of the real damage caused by the storm.

Halifax airport had closed, but did reopen in time for Les and Blythe's flight to Toronto on Monday afternoon. Although Air Canada had cancelled all its flights out of Halifax, their airline was still flying.

It was only when they left for the airport that they really began to understand the impact of the hurricane. Brian was unable to find a gas station that was open. Trees were down everywhere. (Downed trees were to become *the* symbol, for Luka as for the residents of Halifax, of how serious the storm had been.)

Luka says that one of the most amazing things they saw on the way to the airport was a Tim Horton's that was open for business (almost everything else in Halifax was closed). The line-up was out the door and about 50 people

deep. Even more impressive was the line-up of cars for the drive-through. It was about two kilometres long.

It was when they returned to Toronto and turned on the television news that Les and Blythe were able to see the true extent of the storm. They were especially stunned by the pictures of Point Pleasant Park and the Public Gardens, both of which they had visited while in Halifax, and both of which had been devastated by Juan's high winds.

Les Luka says it was another bit of irony that he ended up phoning Mary Elizabeth and describing the damage to her. Because of the power outages across the city, accurate news was hard to come by. Many Haligonians, despite requests by authorities that they stay at home, went out to see the damage for themselves. For at least a few days, the safest and most accurate reports came from outside the city.

To Consider

1. What appears to be most remarkable about the events described in this account?

2. Write a brief description of any severe storm or hurricane you have personally encountered.

3. For you what would be the hardest part of a hurricane to experience? Explain.

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Hazel Was No Lady

Further Research

"She was no lady ... Hurricane Hazel"
For an anecdotal remembrance of the Great Canadian Hurricane by Wallace Rombrough, an eyewitness, visit www.ec.gc.ca/water/en/manage/floodgen/e_hazel1.htm. An outstanding source for contemporary coverage of Hazel is the CBC Archive at archives.cbc.ca/300c.asp?id=1-70-7. Also very useful is Betty Kennedy's book, *Hurricane Hazel* (Toronto: Macmillan of Canada, 1979).

Canada's most destructive hurricane began as a tropical storm in the Atlantic Ocean in early October 1954. By the time it hit Toronto on October 15, it had already unleashed a path of destruction through parts of the Caribbean and the United States.

A Killer Storm

Hurricane Hazel was one of the strangest hurricanes in history, following an erratic course most unusual for tropical cyclones. Beginning in the Caribbean, it grew in strength to a Category 4 hurricane, with winds of 213 kilometres per hour at its peak. It roared over Haiti, leaving widespread destruction and as many as 1000 dead in its wake.

Hazel came ashore in North America in the Carolinas, arriving in the fall, at high tide, during a full moon—conditions that meant that seas on the coast were already well above their usual levels. Both North and South Carolina were hard-hit, with at least 100 people killed, and an estimated \$1.5-billion worth of damage.

As Hazel moved north, through New York and Pennsylvania, its winds seemed to lose much of their strength, and forecasters downgraded the hurricane to a tropical storm. It was expected that the winds would lose even more velocity as the storm crossed the Allegheny Mountains. While the storm was headed for Southern Ontario and Toronto, it was expected that it would have mostly blown itself out by the time it hit. The Toronto weather office put out a weather advisory, which most people ignored.

The Fury Redevelops

As Hazel approached, however, it met up with a low-pressure system moving across the Plains. Warm, moisture-laden air from the south met up with a cold front from the north. The result was a redeveloping storm that deposited record levels of rainfall.

It had been raining in the Toronto area for some days prior to Hazel's arrival, and the ground was already waterlogged. Hazel arrived with 110 km/h winds, and deposited more than 300 million tonnes of rain in the city of Toronto alone—between 180 and 210 millimetres over a 30-hour period. By midnight of October 15, most of the rain had fallen; but the water had nowhere to go. All of the area's rivers were soon overflowing their banks.

The damage to the city's bridges was especially severe. Many were completely destroyed or damaged beyond repair. For days, all traffic into the city from the west was completely blocked.

The most severe flooding was of the Humber River and Etobicoke Creek in the west end of Toronto. On October 16, the flow of the Humber was four times anything that had been previously recorded. The collapse of the Humber's bridges spread the river's water all over its floodplain.

The Humber was responsible for the devastation of Toronto's hardest-hit street, Raymore Drive. Raymore Drive was a neighbourhood built along the Humber on its floodplain. It had experienced the odd spring flooding, but nothing like what was about to happen. Within one hour, the river rose six

metres and flooded the street, lifting homes right off their foundations. On this one street alone, 32 people were killed, and 60 families made homeless.

In total, floods caused by Hurricane Hazel were responsible for 81 deaths in Toronto. Four thousand people—1868 families—were left homeless. Hazel’s rains also caused heavy damage north of the city. All roads to the town of Markham were destroyed, leaving it completely isolated. In the Holland Marsh, a prime agricultural region, 3000 people were forced to abandon their homes. Total damage to southern Ontario was estimated at \$100-million.

cane did also leave behind a positive legacy. To ensure that such devastation would never again take place, what is now the Toronto and Region Conservation Authority was created. The authority was given full responsibility for safe regulation of all regional rivers and streams. It bought up the properties devastated by Hazel, ensuring that no one could build on the floodplain. As a result, Toronto’s ravine lands have now been turned into parks, and are a recreational resource heavily used by its citizens. One of the parks, Raymore, keeps alive the memory of those who were killed during Canada’s worst hurricane.

Hazel’s Legacy

Cleaning up after Hazel was a lengthy and expensive process. But the hurri-

Discussion

1. Why is Hurricane Hazel considered to be a “killer storm”?

2. Hurricane Hazel did leave behind a beautiful legacy for Toronto’s citizens by inspiring the creation of a major system of parks. Do you think Hurricane Juan will have any positive results for Halifax’s future?

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Activity: Retiring Juan

Further Research

You may wish to look at the results of other major hurricanes to help put Juan in perspective. One good Web site is "Hurricane History" maintained by the (U.S.) National Oceanic and Atmospheric Administration at www.nhc.noaa.gov/HAW2/english/history.shtml.

The Plan

The World Meteorological Organization (WMO) controls the rotating list of names that is used to identify hurricanes. These names begin with the letters A to U, and are repeated every six years. The association drops the names of the most devastating storms from the list, retiring them so that they

are permanently attached to the severe hurricane they represent. The first name to be retired was Hazel, in 1954.

Environment Canada has decided to apply to have the name Juan retired by the WMO, pointing to the impact it had on the Maritime provinces. This will be the first request Canada has made on its own to the WMO.

The Procedure

Your task is to prepare a short letter to the Sub-Committee for Hurricane Names of the World Meteorological Organization stating your view on whether the WMO should retire Juan from the list of active names. You should include information you have gathered from the video and/or print portions of this *News in Review* module to justify your position. Use the organizer below to clarify your ideas.

My Arguments for Retiring Juan	My Arguments for Not Retiring Juan