

= Hurricane Hazel =

Hurricane Hazel was the deadliest and costliest hurricane of the 1954 Atlantic hurricane season . The storm killed at least 400 people in Haiti before striking the United States near the border between North and South Carolina , as a Category 4 hurricane . After causing 95 fatalities in the US , Hazel struck Canada as an extratropical storm , raising the death toll by 81 people , mostly in Toronto . As a result of the high death toll and the damage caused by Hazel , its name was retired from use for North Atlantic hurricanes .

In Haiti , Hazel destroyed 40 % of the coffee trees and 50 % of the cacao crop , affecting the economy for several years to come . The hurricane made landfall in the Carolinas , and destroyed most waterfront dwellings near its point of impact . From North Carolina , it traveled north along the Atlantic coast . Hazel affected Virginia , West Virginia , Maryland , Delaware , New Jersey , Pennsylvania , and New York ; it brought gusts near 160 km / h ( 100 mph ) and caused \$ 281 million ( 1954 USD ) in damage . When it was over Pennsylvania , Hazel consolidated with a cold front , and turned northwest towards Canada . When it hit Ontario as an extratropical storm , rivers and streams in and around Toronto , Ontario overflowed their banks , which caused severe flooding . As a result , many residential areas located in the local floodplains , such as the Raymore Drive area , were subsequently converted to parkland . In Canada alone , over C \$ 135 million ( 2009 : \$ 1 @. @ 1 billion ) of damage was incurred .

The effects of Hazel were particularly unprecedented in Toronto , as a result of a combination of a lack of experience in dealing with tropical storms and the storm 's unexpected retention of power . Hazel had traveled 1 @, @ 100 km ( 680 mi ) over land , but while approaching Canada , it had merged with an existing powerful cold front . The storm stalled over the Greater Toronto Area , and although it was now extratropical , it remained as powerful as a category 1 hurricane . To help with the cleanup , 800 members of the military were summoned , and a Hurricane Relief Fund was established that distributed \$ 5 @. @ 1 million ( 2009 : \$ 41 @. @ 7 million ) in aid .

= = Meteorological history = =

On October 5 , a tropical wave with tropical @-@ storm force winds was approaching the Lesser Antilles . Due to the potential for tropical storm formation , a Hurricane Hunters plane flew from San Juan , Puerto Rico to investigate the system . When the plane reached the system , they observed a tropical cyclone about 30 mi ( 50 km ) east of the island of Grenada with winds estimated at 100 mph ( 160 km / h ) . The United States Weather Bureau promptly classified the system as Hurricane Hazel . The Atlantic hurricane reanalysis later assessed that Hazel developed at 06 : 00 UTC on October 5 about 220 mi ( 350 km ) east of Grenada . Although the Hurricane Hunters observed hurricane @-@ force winds , the storm had a small eye 5 mi ( 8 km ) in diameter and a central barometric pressure of 1 @, @ 002 mbar ( 29 @. @ 6 inHg ) . The 100 mph ( 160 km / h ) winds were therefore revised downward to 65 mph ( 100 km / h ) late on October 5 , though it was estimated that the storm attained hurricane status at 00 : 00 UTC on October 6 . At the same time , Hazel made landfall on Grenada with winds of 75 mph ( 120 km / h ) .

After entering the Caribbean Sea , Hazel continued to present a small eye and wind diameter . The winds gradually increased as the storm moved westward , parallel to the northern Venezuela coast . On October 8 , the tiny eye increased to a diameter of 29 mi ( 46 km ) , while the winds reached 85 mph ( 135 km / h ) , although winds were estimated as high as 125 mph ( 201 km / h ) . That day , the Hurricane Hunters encountered severe turbulence , which hospitalized one crew member and injured another . For the next five days , there were no further flights into the core of the hurricane , although the planes continued to monitor the storm , with radar imagery indicating that the eye became open and ragged . Late on October 9 , it is estimated Hazel intensified into a major hurricane with winds of 115 mph ( 185 km / h ) . Originally , it was estimated that Hazel attained these winds the day prior . The intensification was confirmed on October 10 , when aircraft noted a well @-@ defined eye on radar imagery .

On October 10 , Hazel slowed in the central Caribbean and turned sharply to the north @-@

northeast toward Hispaniola , steered by an upper @-@ level low . At 09 : 00 UTC on October 12 , the hurricane made landfall near Chardonnières along the Tiburon Peninsula of Haiti as a Category 3 hurricane on the Saffir @-@ Simpson hurricane wind scale . There were no strong wind readings at landfall , but based on previous radar and aircraft observations the sustained winds were officially estimated at 120 mph ( 195 km / h ) . After moving through the Gulf of Gonâve , Hazel struck northwestern Haiti near Baie @-@ de @-@ Henne at 00 : 00 UTC on October 13 , as a Category 2 hurricane with winds estimated at 100 mph ( 160 km / h ) . Around that time , the hurricane curved more to the north and northwest due to an approaching trough , and the Hurricane Hunters resumed entering the center of Hazel , reporting an eye and hurricane force winds . At 14 : 00 UTC on October 13 , Hazel struck Inagua in the Bahamas with winds of 100 mph ( 160 km / h ) .

After affecting the Bahamas , Hazel accelerated northwest toward the southeastern United States , steered between a trough and a ridge . Hurricanes are generally expected to lose power after going north of Florida due to lower water temperatures , however , Hazel restrengthened as it tracked northward over the Gulf Stream . The Hurricane Hunters were unable to observe the core of the storm until it neared land , reporting an eye 18 mi ( 33 km ) in diameter on October 15 . Later that day , a ship just offshore South Carolina reported a central pressure of 938 mbar ( 27 @.@ 7 inHg ) , which was the lowest in association with the hurricane . At 15 : 30 UTC on October 15 , Hazel made landfall just west of the North Carolina / South Carolina border with a 40 mi ( 64 km ) eye , slightly northeast of Myrtle Beach in the latter state . Based on the pressure , a larger than average size , and the fast forward movement , the landfall intensity was estimated at 130 mph ( 215 km / h ) , or a Category 4 on the Saffir @-@ Simpson scale .

The eye of Hazel was tracked across several towns in North Carolina as the system continued northward . At 18 : 00 UTC on October 15 , the hurricane became extratropical near Raleigh , and within six hours had passed near Washington , D.C. The extratropical remnants of Hazel accelerated to the north through Pennsylvania and New York along an extended cold front . Despite widespread observations across the eastern United States , there was uncertainty in the track of Hazel as an extratropical storm . Although it was possible the original circulation dissipated over western Pennsylvania and a new one formed over western New York , the Atlantic hurricane reanalysis assessed the circulation as becoming elongated but continuous . On October 16 , the storm crossed into Ontario and over the Toronto region . Shortly thereafter , the former Hurricane Hazel dropped to gale @-@ force winds after moving almost almost 1 @, @ 000 km ( 620 mi ) over land . The storm slowed and turned northward , passing over James Bay early on October 17 . After turning to the northeast , the remnants of Hazel were absorbed by a larger extratropical storm over Canada on October 18 .

= = Preparations = =

On October 6 , small craft warnings were issued for the Dutch islands of Aruba , Bonaire , and Curaçao , despite predictions that Hazel would pass to the north ; these warnings were canceled a day later . After the storm had turned northward , tropical cyclone warnings were posted for Haiti , the Dominican Republic , and the waters of the Mona Passage . Small crafts near Jamaica were advised to head for port ahead of the storm . The U.S. Navy completed extensive preparations at its Guantanamo Bay base , ordering about 1 @, @ 000 civilians into fortified Quonset huts , flying aircraft out of the storm 's path , and positioning surface ships out at sea .

At on October 14 , the National Weather Bureau issued a warning for the Carolinas , with the caveat that the worst of the hurricane was expected to stay offshore . Instead , the storm took a northwest turn and headed toward land . By evening of the same day , the storm was forecast to make landfall near the Carolinas border . Further forecasts expected Hazel to lose its power and dissipate over the Allegheny Mountains .

In her book Hurricane Hazel , Betty Kennedy argues that in Canada , the impressions that Hazel was " the best @-@ kept secret in town " and that it was a " fully documented meteorological event that should have taken nobody by surprise " both " paradoxically [ ... ] contain a great deal of truth " . Meteorologists predicted that if Hazel merged with the cold front , the storm would not lose intensity ,

but would instead potentially strengthen . Two Special Weather Bulletins were issued by the Dominion Weather Office , but since it was expected that the storm would pass east of Toronto , few other warnings were given and there were no evacuations , which increased the eventual property damage and loss of life . The forecast called for high winds between 65 km / h ( 40 mph ) and 80 km / h ( 50 mph ) , with only occasional showers . On lakes Erie and Ontario , ships received warnings of strong winds , and the predicted wind speeds ranged from 65 km / h ( 40 mph ) to 120 km / h ( 75 mph ) . Toronto Hydro had called in standby crews as heavy winds were forecast , although they were almost sent home at one point due to a lull in the storm .

There had been significant rainfall in the Toronto area in the two weeks prior to Hazel , so the ground was already saturated . Few people in Canada had any experience with hurricanes , since it was unheard of for them to travel as far north and inland as Toronto . Kennedy also notes that if " Toronto had been about to face a blizzard , or was threatened by a 14 @-@ inch [ 36 @-@ cm ] snowfall , that [ sic ] would have been something understandable . [ ... ] This was different . This was the unknown , the unfamiliar , the totally unexpected crisis . Hurricanes belonged in the tropics . "

= = Impact = =

= = = Caribbean = = =

On October 8 , two crew members on Reconnaissance aircraft were injured due to turbulence while observing Hazel ; one was severely enough injured to require hospitalisation . The ABC Islands of Aruba , Bonaire and Curaçao , located north of Venezuela , received rough winds and rains of up to 9 @.@ 8 inches ( 250 mm ) when the intensifying cyclone passed to the north . Flash flooding in Aruba and Curaçao destroyed a bridge and several water dams and resulted in losses of \$ 350 @, @ 000 ( 1954 USD ) . Puerto Rico suffered its worst flooding since 1899 as a result of the hurricane . Due to timely warnings , only nine people were killed : eight by drowning and one by a landslide ; however , infrastructure , buildings , and agricultural areas suffered serious damage , and over 11 @, @ 000 people were evacuated from flooded areas .

In Haiti , Hazel brought flash floods which destroyed numerous villages , and high winds which caused considerable damage to major cities . The death toll was estimated to be as high as 1 @, @ 000 people ; most of the casualties drowned when the water flowed in a flood down the mountains , some of which were as high as 2 @, @ 400 m ( 8 @, @ 000 ft ) . The situation was exacerbated by deforestation , which lessened the ability of the soil to hold water . Haiti 's South Peninsula took the brunt of the storm : the largest town , Aux Cayes , reported at least 200 casualties , while the second @-@ largest town of Jérémie was reported to have been washed in the sea , with at least 200 more casualties . Damage in Aux Cayes was estimated to be \$ 500 @, @ 000 ( 1954 USD ) . Estimates of people left homeless in the wake of Hazel are as high as 100 @, @ 000 . Hazel destroyed about 40 % of the coffee trees and 50 % of the cacao crop , affecting the country 's economy for several years . Objects from Haiti , such as bowls , were reported to have been transported by the hurricane to the Carolinian coast .

West of Haiti , the hurricane brought hurricane @-@ force winds to Cuba . A fisherman on the eastern tip of Cuba was killed by rough seas while trying to secure his boats . Since the hurricane passed largely east of the Bahamas , only minor damage was reported there . Hazel passed directly over Inagua , where it claimed six lives when a sailboat capsized while taking shelter from the storm .

= = = United States = = =

In South Carolina , the storm produced 10 ? 11 ft ( 3 @. @ 0 ? 3 @. @ 4 m ) tides along the coast . Hundreds of buildings were destroyed , including about 80 % of waterfront dwellings in Myrtle Beach . As a result of the high storm surge , the low @-@ lying sandy barrier islands were completely flooded . Two piers in Myrtle Beach were damaged . In North Myrtle Beach , a 3 @-@ story hotel

and a 800 ft ( 240 m ) pier were washed out to sea . At Cherry Grove Beach , 75 residences were demolished , while at Pawleys Island , 40 homes were destroyed , while numerous others were damaged . One death occurred in South Carolina . Damage in the state totaled about \$ 27 million .

At landfall , the hurricane brought a storm surge of over 5 @. @ 5 m ( 18 ft ) to a large area of coastline , producing severe coastal damage ; the damage was greater since the hurricane coincided with the highest lunar tide of the year . Brunswick County , North Carolina , suffered the heaviest damage , where most coastal dwellings were either destroyed or severely damaged . For example , in Long Beach , North Carolina , only five of the 357 buildings were left standing . The official report from the Weather Bureau in Raleigh , North Carolina stated that as a result of Hazel , " all traces of civilization on the immediate waterfront between the state line and Cape Fear were practically annihilated . " According to NOAA , " every pier in a distance of 170 miles [ 270 kilometres ] of coastline was demolished " .

At the Raleigh @-@ Durham Airport in North Carolina , gusts of 90 mph ( 140 km / h ) were recorded ; in surrounding cities , including Kinston , Goldsboro , and Faison , wind gusts were estimated to have reached 120 mph ( 190 km / h ) . With such high winds state @-@ wide , heavy damage was caused to forests , and to property as a result of falling trees . However , since the Carolinas , like the rest of the Southeastern United States , were suffering from a severe drought , the heavy rainfall brought by Hazel was welcome . In North Carolina , the most rain was received in the interior of the state : Robbins received 286 mm ( 11 @. @ 3 in ) of rain , and Carthage received 247 mm ( 9 @. @ 7 in ) .

Nineteen people were killed in North Carolina , with several hundred more injured ; 15 @, @ 000 homes were destroyed and another 39 @, @ 000 were damaged . The number of people left homeless by the storm was " uncounted thousands " . Damages in the Carolinas amounted to \$ 163 million , with \$ 61 million incurred by beachfront property . Total damage in the United States ranged from \$ 281 million to \$ 308 million .

While Hazel caused the most damage in the Carolinas , the storm did not lose all of its intensity . Going north , Hazel turned extratropical by midday when it merged with a cold front ; however , it retained hurricane @-@ strength winds and it was continuing to drop heavy rainfall .

In Virginia , wind gusts of over 100 mph ( 160 km / h ) were observed at the Weather Bureau office in Norfolk . Roofs were blown off , trees and power lines were toppled , windows were shattered , and awnings were torn . The naval station suffered mainly minor damage to its temporary installations . The tugboat Indian , carrying five barges , sank in the James River ; four of the eight crew members drowned . One building was demolished and several others were damaged in Portsmouth . The ferry Princess Anne was beached into the docks at Kiptopeke . An unfinished vessel at the Newport News Shipbuilding in Newport News broke from its moorings and was swept into the shore of the James River . The roof of the Custom house was detached and landed on the street . In Richmond , 200 store fronts were damaged , while part of the steeple at Trinity Methodist Church was toppled . Additionally , a 150 ft ( 46 m ) microwave tower in Warsaw was knocked over . Approximately 50 % of residents in Virginia lost telephone and electrical service for six days . The storm damaged approximately 18 @, @ 000 homes and businesses . Overall , there were 12 deaths and about \$ 15 million in damage .

After North Carolina , the storm went through Virginia , West Virginia , Maryland , Delaware , New Jersey , Pennsylvania , and New York . In general , power was knocked out and trees were downed . Wind gusts throughout the area reached 160 km / h ( 99 mph ) . Though not near the center , a gust of 182 km / h ( 113 mph ) was recorded in Battery Park , the highest wind speed ever recorded within the municipal boundaries of New York City .

Rain amounts were heavier on the western side of the storm . In West Virginia , the average amount of rain received was 230 mm ( 9 in ) with localized amounts of 300 mm ( 12 in ) reported in the Appalachians . To the north in Pittsburgh , only 90 mm ( 3 @. @ 5 in ) of rain was reported .

To the east , the Washington , D.C. area was particularly affected , and considerable flooding was reported in Virginia and Maryland . Much of the grounds of the Naval Academy in Annapolis , MD were flooded and the Midshipmen were put to work the next day cleaning up debris . New Jersey escaped major flooding as the high tide was low enough , but to the south in Chesapeake Bay , the

majority of crab pots were destroyed . Hazel lost a considerable amount of moisture when crossing the Allegheny Mountains , which raised rivers and streams in the Pittsburgh area significantly above the flood mark . In Pennsylvania , the winds were still high enough to unroof several homes .

In upstate New York , the storm blocked highways and railroads .

= = = Canada = = =

After weeks of unusually high rainfall saturated the Greater Toronto Area , Hazel dropped additional rainfall , peaking at 8 @. @ 4 in ( 214 mm ) in Snelgrove , Ontario . In three hours , the city received 3 @. @ 5 in ( 90 mm ) of precipitation . Most of these rains ran off into rivers and creeks of Toronto , which raised water levels by as much as 20 ? 26 ft ( 6 ? 8 m ) . Not built to withstand heavy flooding , Toronto 's infrastructure took a heavy hit : over 50 bridges , many parts of important highways , as well as numerous roads and railways were destroyed when the high water washed them out or carried debris and smashed them .

Floodwaters slowly rose in Holland Marsh ? a bowl @-@ shaped valley near Bradford ? allowing people to escape to the town . Highway 400 , which passes through the marsh , was under as much as 10 ft ( 3 m ) of water in some places when as much 6 m ( 20 ft ) of water backed up . Much of the crops in the area were either swept away or ruined . After the water pumps failed due to debris , better equipment allowed the Holland Marsh to be drained by November 13 . The Humber River in the west end of Toronto caused the most destruction as a result of an intense flash flood , after most minor rivers and creeks drained into it . A team of five volunteer firefighters were killed when their fire truck was swept away as they were responding to help a stranded motorist . Communities in the Humber floodplain were devastated . At Woodbridge , the river swelled from its usual width of 20 to 107 m ( 66 to 351 ft ) at its narrowest point , and left hundreds homeless and nine dead . The Humber swept away 366 m ( 1 @, @ 201 ft ) of Raymore Drive and 14 nearby homes , killing 35 people out of the 81 Canadian fatalities . The rise of the river was unprecedented and the residents did not evacuate , which led to the high death toll . The Etobicoke Creek also overflowed its banks at the village of Long Branch , killing seven people after many dwellings were swept into Lake Ontario .

The death toll of 81 people has not since been equaled by a natural disaster in Canada . In addition to the casualties , over 4 @, @ 000 families were left homeless . The Department of Public Safety and Emergency Preparedness Canada estimates the total cost of Hurricane Hazel for Canada , taking into account long @-@ term effects such as economic disruption , the cost of lost property , and recovery costs , to be C \$ 137 @, @ 552 @, @ 400 .

= = Aftermath = =

= = = Haiti = = =

In the aftermath of Hazel , a three @-@ day period of national mourning was declared in Haiti for hurricane victims . With existing infrastructure already poor , the recovery was very slow since many of the few existing roads were blocked , and communications equipment was either out , damaged , or destroyed . The Haitian Red Cross appealed for assistance to the International Red Cross , while the American Red Cross made a donation of \$ 25 @, @ 000 ( 1954 USD ) . Pan American World Airways offered the use of its planes to assist with the delivery of aid , and the US aircraft carrier USS Saipan deployed 18 helicopters to help deliver supplies . Despite the relief effort , there was an outbreak of typhoid fever following Hazel due to a lack of clean water .

= = = United States = = =

In the Carolinas , the National Guard was mobilised by the evening of October 15 to prevent looting along affected areas of the coastline . On October 17 , President Dwight D. Eisenhower declared a "

major disaster " in the Carolinas , and offered " immediate and unlimited federal assistance . " Recovery was quick , and by October 24 , all but two units were demobilised . Another concern was the rebuilding of the sand dunes along waterfronts . An artificial sand dune barrier , 39 km ( 24 mi ) long , was completed by October 30 , which in the long run led to a more rapid natural build @-@ up of larger dunes . With Myrtle Beach a popular tourist destination , the Chamber of Commerce began an information campaign to inform the public , which might have erroneously concluded from the massive media coverage that the city had been destroyed , that the city would be ready for the coming summer . The rebuilding after the partial destruction would transform Myrtle Beach from a " quaint summer colony to a high @-@ rise resort city " .

= = = Canada = = =

The army sent about 800 soldiers to Toronto to assist with the cleanup , providing blankets and mattresses . Toronto residents helped out with the relief effort : the Salvation Army received so many donations of clothes , footwear , blankets , food , and money that its storage facilities were overfilled , forcing it to advise against further donations until they were needed . A Hurricane Relief Fund was established to coordinate financial donations , ultimately raising about \$ 5 @.@ 3 million ( CAD ) . The fund received donations from organisations , companies , and individuals including Pope Pius XII , the Ford Motor Company , the United Church of Canada , Laura Secord Candy Shops , and the British @-@ American Oil Company . A portion of the fund was set aside as a contingency reserve in the event of unresolved claims and also toward administrative expenses .

The Toronto and Region Conservation Authority was created after the storm to manage the area 's floodplains and rivers , such as building dams . The heavily flooded areas were expropriated and barred from rebuilding homes , and most of the land was later converted into an extensive park system along Toronto 's rivers . A footbridge dedicated to the victims crosses the Humber river in Raymore Park , which was the former Raymore Drive .

= = = Retirement = = =

As a result of the catastrophic damage and severe death tolls in the Caribbean , United States and Canada , the name Hazel was retired , and will never again be used for an Atlantic hurricane . However , since it was retired before the inception of naming lists with the modern six @-@ year cycle , it was not directly replaced with any particular name .