

= Glacier National Park (Canada) =

Glacier National Park is one of seven national parks in British Columbia , and is part of a system of 43 parks and park reserves across Canada . Established in 1886 , the park encompasses 1 @, @ 349 km² (521 sq mi) , and includes a portion of the Columbia Mountains . It also contains the Rogers Pass National Historic Site .

The park 's history is closely tied to two primary Canadian transportation routes , the Canadian Pacific Railway (CPR) , completed in 1885 , and the Trans Canada Highway , completed in 1963 . The pass in the centre of the park eluded explorers until 1881 . The railway brought with it tourism , the establishment of Glacier National Park and the construction of a popular alpine hotel . The heavy winter snows and steep , avalanche @-@ prone valleys of the park have been a major obstacle to transportation , necessitating much railway engineering and avalanche control measures .

The park contains high peaks , large , active glaciers , and one of Canada 's largest cave systems . Its dense forests support populations of large mammals , birds , and alpine species . The region is noted for its heavy snowfall . The park has an extensive network of trails , three campgrounds , and four backcountry huts and cabins . Due to the major transportation routes that bisect it , Glacier National Park sees large numbers of visitors .

= = History = =

The Selkirk Mountains were first noted by Europeans when explorer David Thompson of the North West Company skirted around them on the Columbia River in 1811 . He named them Nelson 's Mountains , after Lord Horatio Nelson , but they were later renamed after an executive for the rival Hudson 's Bay Company , Lord Thomas Douglas Selkirk .

Finding a pass through the Selkirks became a priority after construction of the Canadian Pacific Railway began . Completion of the railway was a condition of the Colony of British Columbia upon entering Canadian Confederation in 1867 . In 1865 , CPR surveyor Walter Moberly led an expedition up the Illecillewaet River (which he named , using the Okanagan word for " swift water ") . Despite recently discovering Eagle Pass through the nearby Monashees , Moberly failed to find a pass through the Selkirks after getting sidetracked in the Tangier Creek drainage . His party refused to explore further due to the lateness of the season , and Moberly was forced to retreat .

= = = Rogers Pass = = =

An expedition led by Major Albert Bowman Rogers up the Illecillewaet discovered a viable pass in 1881 . Rogers was awarded a five thousand dollar prize for locating a route through the mountains . By 1885 , the CPR had constructed a line through Rogers Pass and trains were traveling west to the Pacific for the first time in Canada . The federal government and the CPR quickly realized the tourism potential of the mountainous , heavily glaciated area . Following a trip by Prime Minister John A. Macdonald and his wife Agnes through the Rockies on the newly @-@ completed Transcontinental Railroad , he returned to Ottawa inspired , and led the creation of Glacier and Yoho National Parks , both established on October 10 , 1886 . They were the second and third national parks in the country , after Banff , a year earlier .

= = = Glacier House = = =

The grade of the railway approaching Rogers Pass was too steep to allow for dining cars on the trains , so the CPR built a hotel west of the pass in 1886 . This added to a collection of CPR @-@ owned hotels across Canada , including Mount Stephen House in Yoho National Park , built in the same year and with the same floor plan . Glacier House , located near the terminus of the Illecillewaet Glacier (called the Great Glacier at the time) , became a center for tourism , mountaineering , glaciology , and photography in the Selkirks . The hotel was expanded in 1905 and

1911 . It was considered one of western Canada 's premier tourist destinations at the turn of the twentieth century .

The hotel attracted alpinists from around the world . Due to its elevation , climbers could be in the high alpine within hours of leaving their room . In 1899 , the CPR contracted the services of several Swiss guides to assist the less mountain @-@ savvy tourists through the high country . Throughout the Glacier House period , many first ascents were made on peaks within the park . The hotel also attracted naturalists and scientists keen to study the mountain environment . Mary Vaux Walcott and her brothers , George and William Vaux , visited the area many times , and began the first scientific studies of the Illecillewaet Glacier .

= = = Mountaineering = = =

Glacier House is considered " the first center of alpinism " in North America by American Alpine Club historian William Lowell Putnam . It saw an influx of European and American professional climbers in its first two decades of operation . William Spotswood Green was the first European climber to make note of the excellent climbing possibilities of peaks near the CPR line . Green and Henry Swanzy made the first recorded ascents of major peaks in the summer of 1888 , climbing Mount Bonney and Green 's Peak . Harold Topham , a British climber , made many first ascents in 1890 including Mount Fox ; he later joined with Henry Forster , and two Swiss climbers , Emil Huber and Carl Sulzer to explore the southern peaks of the park . Huber and Sulzer also claimed the prized first ascent of the dramatic Mount Sir Donald .

Arthur Oliver Wheeler , a cartographer , climber , and founding member of the Alpine Club of Canada (ACC) , came to Glacier House in 1901 . This started a thirty @-@ year relationship with the northern Selkirks , which saw Wheeler map the region , publish large reference works on its geography , and explore much of the park 's terrain . An ACC hut near the Illecillewaet campground bears his name , as well as a peak and a pass . Professor Charles Ernest Fay , first president of the American Alpine Club , after visiting the park in the 1890s , publicized it in the club 's magazine . By the 1900s , almost all of the park 's prominent peaks had seen human tracks .

= = = Connaught Tunnel and the Trans Canada = = =

After its first winter in operation in 1886 , it became clear to the CPR that the heavy snows of Rogers Pass were going to be a serious challenge . Extensive snow sheds were built to shelter the rails from frequent avalanches . These wood sheds became a fire hazard in the summer months , so a separate summer track was built . In 1910 , while clearing one slide , another avalanche came down Avalanche Mountain , killing 62 men . More than half the workers killed in the slide were of Japanese descent . In all , two hundred railway employees were killed between 1886 and 1916 . In 1912 , the CPR admitted defeat and started the construction of an eight @-@ kilometer tunnel under the pass and Mount Macdonald . The Connaught Tunnel opened in 1916 .

The new tunnel bypassed Glacier House 's siding , and the resulting lack of rail passengers spelled the end for the once @-@ popular hotel . It was closed in 1925 , and torn down four years later . The park saw few visitors besides campers from the Alpine Club of Canada 's summer camps for the next thirty years . Until this point , automobile travelers crossing the Columbia Mountains had to use the circuitous " Big Bend Highway " , which followed the upper reaches of the Columbia River north in a large loop . With the planned inundation of much of that valley by hydro projects outlined in the Columbia River Treaty , a new highway route was needed . In 1963 , the Trans Canada Highway was built through Rogers Pass , bringing tourists back to the park in large numbers . Parks Canada built several new campgrounds and expanded the trail system .

= = Geography = =

The park covers the northern part of the Selkirk Mountains , a sub @-@ range of the Columbia Mountains . It contains numerous glaciers and large , swift waterways . The park is bisected by two

major transportation routes , the Trans Canada Highway and the Canadian Pacific Railway . The nearest towns are Revelstoke to the west , and Golden to the east . The only settlement in the park is the complex at the Rogers Pass summit .

== = Mountains = = =

The Columbia Mountains rise from the plateaus of the Central Interior and extend eastward to the Rocky Mountain Trench . Geologically distinct from the nearby Rockies , the range is divided into four sub @-@ ranges : the Cariboos , Monashees , Selkirks , and the Purcells . Glacier encompasses a portion of the northern Selkirks and a narrow strip of the northern Purcells . The topography of the park varies between rounded mountains and ridges in the east , north , and west , and sharp , steep @-@ sided peaks in the central and southern regions . A.O. Wheeler measured many of the park 's mountains in 1901 and 1902 using a complex system of fixed points and photographs . In the early 20th century , the area was referred to as the " Canadian Alps " . Most names are from historical figures , including explorers , surveyors , mountaineers , and railway and Hudson 's Bay Company executives .

== = Major peaks and ranges = = =

The highest point in the park is Mount Dawson , at 3 @,@ 377 metres (11 @,@ 079 ft) . Peaks of the Hermit Range , the Bonney and Bostock Groups , the Van Horne Range , Purity Range , Dawson Range , and the precipitous Sir Donald Range all lie wholly or in part within the park .

== = Glaciers = = =

The park has 131 glaciers over 0 @.@ 05 square kilometres (0 @.@ 019 sq mi) in size , covering 133 square kilometres (51 sq mi) of the park . Throughout its history , North America has seen cycles of glaciation , where ice sheets advanced and retreated across the terrain . The last glacial period ended about 12 @,@ 000 years ago , before which all but the highest peaks of the park were covered in ice . The movements of these rivers of ice formed the steep @-@ sided , U @-@ shaped valleys of the park . They also rounded the lesser peaks ; ranges in the west of the park show this effect . The glaciers in the park are on whole shrinking and retreating ; they are also some of the most studied glaciers in North America .

The glaciers of the park have been dramatically reduced in size in the late 20th and early 21st centuries . Precise measurements of glacial areas started with the Vaux family and A.O. Wheeler in the 1900s . Modern measurements using satellite imagery began with Simon Ommaney 's work in the 1980s . Regular inventories of the parks glaciers have been performed since , with the latest collating data up to 2011 . The most recent inventory noted a reduction of 19 @.@ 4 square kilometres (7 @.@ 5 sq mi) of glacial surface area from 2000 to 2011 .

Due to its location near the highway and railway , the Illecillewaet Glacier is the most visited and photographed . Formerly known as the Great Glacier , it was a major tourist attraction during the Glacier House period from 1886 to 1925 . The glacier 's terminus , formerly a short walk from the Glacier House site , has retreated far up the mountainside . The névé of the glacier spreads far to the south , also spawning the Geikie Glacier . Most of the large glacial features are south of the Trans @-@ Canada corridor . Other large features include the Deville , Dawson , Asulkan , Bishops , Black , Duncan , Grand , and Avalanche . The park 's glaciers have a variety of appearances , with high altitude features smooth and uniform , cracked and riddled with crevasses on the slopes , and black with debris on the valley bottoms . In summer , many of the glaciers take on a red tint ; this is the result of a variety of snow algae known as watermelon snow .

== = Rivers = = =

All watercourses in the park are part of the Columbia River drainage basin . Park rivers are swift

@-@ running and glacially @-@ fed , and have helped carve out the steep valleys and canyons . They carry much silt and rocky debris with them , and often have a milky white appearance . In the summer months , these rivers have noticeable diurnal cycles ; they run high in the afternoons as the snow and ice melt is at its peak , then drop considerably with lower nighttime temperatures .

The major rivers are the Illecillewaet , the Beaver , and the headwaters of the Incomappleux and Duncan Rivers . Large creeks and brooks include Mountain , Cougar (which runs underground through the Nakimu Caves) , and Battle . The Beaver and Illecillewaet flood occasionally ; 1983 and 2012 saw flooding damage to the highway and railway .

= = Geology = =

The geology of the northern Selkirks reveals the tremendous tectonic changes that have shaped the terrain of western North America . Like much of British Columbia , the region was first studied by the prolific surveyor and geologist Dr. George Mercer Dawson in 1890 . Topographical maps were first produced by A.O. Wheeler in the early 1900s , and in the 1970s , Wheeler 's grandson , Dr. John Wheeler , conducted an extensive geological survey from land and air .

From Rogers Pass , layers of quartzite and slate are visible , revealing the fact that the range was part of a large , silty continental shelf 600 million years ago . 185 million years ago , successive plate movements from the west began to crumple and compress this material , driving some of it deep underground , and some into the heights of the Selkirks . Lime from coral and other organic life was compressed into limestone , which is seen in the Cougar Brook area . Veins of marble are present in the metamorphic rock of the high peaks . Although erosion and the effects of the glaciers are constantly grinding down the mountain peaks , the pressure of the underlying rock continues to drive them upward . Geologists have classed the rocks of the Columbia Mountains into groups , several of which appear in the northern Selkirks . The slates are in the Horsethief Creek and Lardeau groups , quartzite is in the Hamill group , limestone is part of the Badshot Formation , while the metamorphic rocks are classed in the Shuswap Metamorphic Complex .

= = = Caves = = =

The limestone strata in the park is subject to water erosion by Cougar Brook , a process that has formed the Nakimu Caves . First discovered in 1907 , and originally named the Caves of Cheops , then Deutchmann Caves , this 6 @-@ kilometer (3 @.@ 7 mi) long cave system is one of the largest in Canada . The limestone is broken down and softened by carbonic acid in the brook 's water . The water also contains pulverised rock from glacial processes , which serve to further etch and cut new passages in the rock . The caves contain a large concentration of a rare substance known as moonmilk - this is a suspension of calcium carbonate kept intact by bacteria . Due to its sensitive nature , and damage done to cave environments by early tourists , Parks Canada has closed the caves to the general public . Access by organized groups and experienced speleologists is allowed with a permit .

= = Ecology = =

Glacier National Park covers a range of habitats , from lush temperate rainforest in the western valleys , to inhospitable ice- and rock @-@ covered alpine areas , to drier fir and pine forests on the eastern boundary . Four of British Columbia 's biogeoclimatic zones are found within the park : Interior cedar / hemlock , Engelmann spruce / subalpine fir , Interior Douglas @-@ fir in the eastern extremities , and alpine tundra at high elevations . Parks Canada characterizes these zones as " rainforest , snow forest , and no forest " . Animal life in the park ranges from large mammals like caribou and grizzly bear to bird species such as Steller 's jay and the golden eagle .

= = = Flora = = =

The valleys on the western side of the park support dense wet forests , with a thick understory . The widest valleys , such as the Illecillewaet , contain a rare wetlands environment , featuring skunk cabbage and water hemlock . Outside of the wetlands , the lower valleys are covered by Western Red cedar , western white pine , western hemlock , Interior douglas fir , and white birch . Ground species include devil 's club , blueberries , liverwort , and fern species .

At middle elevations , the subalpine zone appears . This forest has Engelmann spruce , mountain hemlock , and subalpine fir . The understory is thick here with rhododendron and berry species , as well as deep beds of moss and lichens . At higher elevations , this forest opens up to meadows and slide chutes , which are covered in a lush growth of grasses , herbaceous shrubs , and alpine wildflowers . Parks botanists and others have identified 546 species of flowering plants in the park . Late July to mid @-@ September see an impressive display of alpine blooms .

The alpine meadows continue into the harsh alpine tundra zone , where poor soil , heavy snowfall , cold temperatures , and a very short growing season discourage all but the hardiest sedge grasses , heathers , and lichens .

= = = Fauna = = =

Glacier 's rich forests support a large wildlife population , which Parks staff monitor regularly . There are fifty @-@ three mammal species found within the park . Bears dominate the snow zone ; the berry @-@ rich avalanche slides provide an important food source for both black and grizzly species . They spend the winters in deep dens hibernating . Other predators include the wolverine , cougar , and lynx .

Mountain goats are the most common ungulates in Glacier National Park ; a 1985 study counted 300 in the high peaks and valleys of the park . Caribou migrate through certain park valleys , while elk , mule and white @-@ tail deer can be found throughout . The deep snows of winter drive most ungulates out of the park into the lower elevations of the nearby Rocky Mountain Trench and Columbia valleys . Moose are seen in the park on rare occasions . Several species of squirrels are found in the lower forests , and alpine mammals include pika , hoary marmots , and martens .

Glacier has 235 observed bird species , but the majority are migratory and only seen in the summer months . The 30 species who are year @-@ round residents include woodpeckers , golden eagles , owls , ravens , Steller 's jays , and golden @-@ crowned kinglets . Unpredictable explosions of pine siskins , sometimes reaching hundreds of thousands in number , will appear and stay year round , but be gone the next year . American dippers feed in the many waterfalls and cascades of the park .

= = Climate = =

Located within the Interior Wetbelt , precipitation is a major environmental factor in the area . The park straddles two prevalent weather systems , with warmer , wetter air from the Pacific meeting the colder , drier air of continental weather systems . The moist air is driven to higher elevations by the mass of the Columbia Mountains . The result is frequent rain and snowstorms , especially during winter months . The mean annual precipitation in subalpine areas is 1 @.@ 995 metres (6 ft 6 @.@ 5 in) This contributes to the large icefields and glaciers that cover much of the park 's high elevations . Rogers Pass can receive up to 17 metres (56 ft) of snow over the course of a winter .

The eastern edge of the park , along the Purcells , is in the rain shadow and is relatively drier . The area can see wide variations in temperature and weather due to the extreme topography . Winter temperatures in the Selkirks are moderate compared to similar elevations in the Rockies to the east , with summer average highs reaching the high teens Celsius .

= = = Avalanche control = = =

Maintaining the Trans Canada Highway through the snowy Rogers Pass is a constant battle . Parks Canada works with provincial highways crews and the Canadian Armed Forces to keep the highway

open as much as possible . Parks staff play both a research and prevention role by monitoring snowpack levels and predicting avalanche probability , as well as working with the Canadian Forces to trigger controlled avalanches . The Royal Canadian Horse Artillery operate 105mm Howitzer cannons , based at circular gun positions along the highway . The highway is closed to traffic , shells are fired at trigger points identified by Parks forecasters , and smaller , more controlled avalanches are started .

= = Facilities = =

Although the park sees over four million visitors each year , the majority are only passing through on the Trans @-@ Canada Highway . About 15 % stop to use park facilities . Of the visitors who experience the park from outside their vehicles , two @-@ thirds are from outside of Canada . There are 140 kilometers (87 mi) of established hiking trails in the park .

The Parks Canada administration and Rogers Pass Discovery Centre are located at Rogers Pass . The interpretive program for Glacier and Mount Revelstoke National Parks is based at the centre . It includes a theatre , an exhibit hall with railway models , natural history displays and wildlife specimens , and a bookstore .

There are three campgrounds in the park . Illecillewaet is the largest , with two smaller campgrounds located at Loop Brook and Sir Donald . There are also five designated backcountry camping areas . Parks and the Alpine Club of Canada maintain four alpine huts and cabins for backcountry users . The Wheeler Hut is the oldest and largest , and is located near the Illecillewaet camping area . The Asulkan hut sits at 2 @,@ 100 metres (6 @,@ 900 ft) on the Asulkan Pass , the Sapphire Col hut is a basic shelter near The Dome , and the Glacier Circle cabin in the Beaver River valley is a base for travelling in the southern areas of the park . None of the camping facilities in the park are maintained during winter months .