Glacier National Park a Climate Change Canary

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Grinnell Glacier 1900
Photo by Mathes

Grinnell Glacier 1998
Photo by McKeon

In 1910, 4,080 square kilometers of rugged Rocky Mountain terrain on the Montana--Canada border were set aside as Glacier National Park. In the mid to late 1800s, Glacier was home to the largest concentration of alpine glaciers in the lower 48 states. By 1980 a full two thirds of the park's glaciers had disappeared entirely, those that remained were dramatically smaller then at their peak around 1850. In the past 100 years the Rockies of the northern US and other alpine regions of the world have undergone a larger rise in temperature than the global average. The temperature around the park increased 1.66 degrees between 1910 and 1980 (Hall 2003). While the global change over the same time period was a little less then half a degree. The National Parks, and sensitive environmental attributes within them have been compared to canaries used in mining operations to warn of a dangerous atmosphere. In the same way, the glaciers of Glacier National Park, confined to the shadows of tall peaks, are possibly the best indicator we have of global environmental change. The only variables that affect the growth and recession of glaciers are the generational trends in climate. Glaciers are separate from externalities and the buffered nature of glacial change allows us to use it as a canary in understanding and monitoring climate change over time.

The park is situated over the continental divide, bordering both Alberta and British Columbia. The divide is the strongest weather controlling aspect of the mountains, having a great affect on the vegetation and hydrology of the park. More precipitation falls on the west slope. Prevailing winds are out of the west, leaving a majority of drift just east of the divide. Glacial ice was originally held at the peak of the western slope, in cirque basins, and valleys on the eastern side of the divide. The sun has most affect on south facing slopes with least affect in areas that never see sun. Thus, after much melt, most large glacial formations left are in cirque bowls just east of the continental divide with cliffs or high peaks to the south. The glaciers formed between 1400 and the mid 1800's during what is known as "the little ice age." It was a relatively short cooling that caused major ice buildup in the northern

Rockies and most other mountain ranges of the world. The glacial moraines in the park are very telling in that young moraines from the recent ice age are more extensive then the much older ones from 10,000 or so years ago (Key 1998). When Glacier was founded, it was for its mass of perennial ice and terrain formed by ancient glacial forces. Since before the founding of the park, the glaciers have undergone almost constant recession at varying rates.

Ice mass in the park thinned but did not reduce appreciably in area from 1850, the end of "the little ice age," and the turn of the century. This period saw very little retreat in terms of glacial moraines, but the volume loss was significant (Key 1998). The thinning set the stage for major dimensional regression in the next few decades. Around 1910 regression rates increased dramatically. In the mid to late 1940's the rate of recession slowed and in the mid to late 1970s some glaciers grew slightly. By this time the smaller glaciers, for the most part, had disappeared. Those that remained receded into the shadows of their neighboring peaks and seemed to reach a point of equilibrium. (Hall, 2003) (Key 1998). Hall and Fagre found that the rate of change in Glacier Park held true to studies from mountainous regions all over the world. They go further to point out that glaciers are an exceptionally good barometer of climate change. "Unlike plants and animals, glaciers do not adapt behaviorally or physiologically in ways that mitigate the impacts of climatic change." (Hall, 2003) In essence, even though there are thousands of variable aspects pushing the glacier, it can only melt grow or lie stagnant from year to year. It is one of the constants of the wild world that literally says, "it's getting hotter," or, "it's getting colder." They indicate trends from decade to decade rather then year to year.

We lost a lot of ice between 1910 and the middle 1970s. By 1980, the short stop in recession turned around and the larger glaciers continued to shrink. As large glaciers recede to more sheltered steeper slopes, the rate has slowed, but not stopped. The glaciers are protected from the strong melting

forces of the sun and the higher elevation provides lower summer temperatures, but high summer precipitation and constant warming air threatens to destroy the last year round mountain ice in the lower 48 within the foreseeable future. With this upward movement of perennial ice and warming of high elevation air, many changes have come about in the valleys and mountainsides below. These sensitive alpine ecosystems signal change just like the glaciers. The forest however, has many other factors that can be confused with pure changes in climate.

A recent study of Glacier Park and the surrounding national forest analyzed pictures from the same fire lookout stations, taken in the early 20th century, mid 20th century and current day (Butler, 2001). This study finds it obvious that the amount of ice has decreased drastically. More so then ice however, the forest below has changed from the original photography of 1910 and current day photos. The forests have become much more dense, and have pushed between 100 and 250 meters above previous altitude tree lines. Another theme is avalanche run-outs filling in most quickly in the period the glaciers receded most. A policy of total fire suppression was put into place from the beginning of formal land management till 1984. Much change to forested land was due to suppression of fires, but some is due to receding glaciers, changes in temperature at high elevation, and soil moisture content. All these things are happening at a rate unknown to evolution prior to the late 1800s.

More then 100 years ago, our fledgling country set out to protect the wild world that was quickly being gobbled up by progress. At the same time, the industrial revolution was coming into full swing; chemicals and pollutants were being introduced to the atmosphere for the first time. The human population was on the verge of using more energy in a short period of time then ever before in the history of the planet. It has been documented through glaciers and a variety of other reliable indicators that in this same period the planet has undergone the fastest known temperature shifts ever. This seems to support the hypothesis that around the turn of the century our inputs to the environment reached a

level that started a global warming cycle on a scale far from linear or inverse, but exponential. The other hypothesis is that in the mid 1850s, there was a general turn around from cooling to general warming and that this is a natural occurrence. This has not yet been fully disproved, but evidence of a non-linear scale of climate change is mounting.

Does this mean that we have no chance of protecting the natural evolutionary process's that compose our wild lands? Even the steadiest secluded slow changing aspects of our environment are changing at previously unknown rates. Have we crossed a line where our change to the environment is too fast for evolution to respond without great loss? It is becoming obvious that our idea of nature or wilderness, and how to conserve it, is not worth the land it sits on compared to the change that will happen if the hypothesis that pollutants are changing the climate is to be trusted. It would seem to mean that we have already crossed a point of commitment no one fully understands. Hall and Fagre come to the conclusion that the recession of glaciers today is a result of climate changes of 10-25 years ago. Meaning that the emissions we are putting into the air now will be changing the rules of the natural world in 2015 and later. Climate change is altering and will be altering what we are trying to conserve in ways we can't understand far into the future.

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