Case Study: Captain Robert Falcon Scott's 1910-13 British Antarctic Expedition Hut at Cape Evans

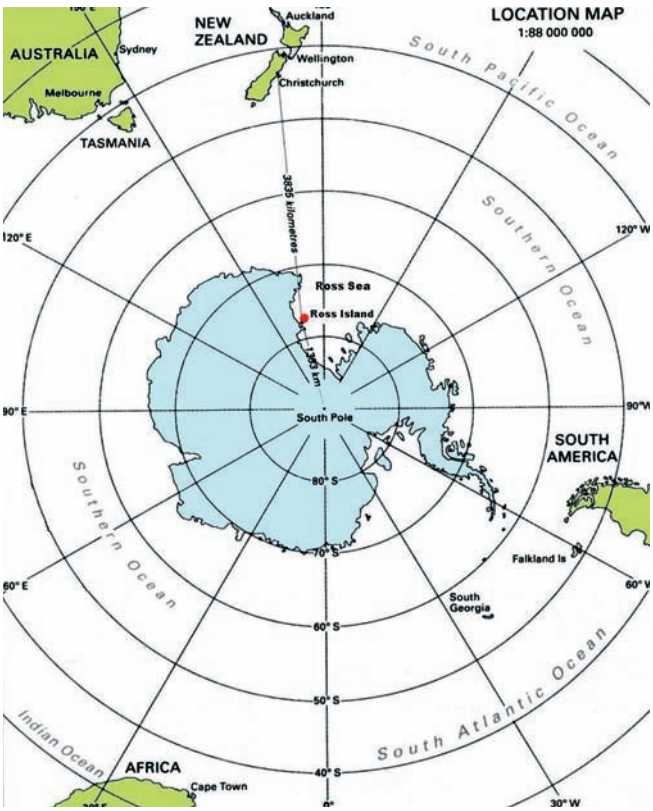
Vast amounts of data about former changes in the climate of our planet lie locked in the ice of Antarctica, a continent that has been the focus of climate studies dating back to the "heroic-era" expeditions at the beginning of the last century. These studies provided the first observations and climate data in these high southern latitudes and built the foundation for today's scientists who are literally drilling for information about the climatic conditions on Earth millenniums ago. These days Antarctica often makes headlines as a place that is reacting dramatically to global climate change - events that may be precursors to changes that are currently only predictions.

It's ironic, therefore, that Antarctica is the location for a few of the most unique historic sites on Earth that are now threatened by global climate changes.

While threats also occur to sites in more temperate climates, Antarctic sites face some problems that are quite different. They can also differ from problems identified in Arctic regions. The severity of the threats varies from place to place, but there is one site that suffers more than most and it serves well to illustrate the issues involved.

Captain Robert Falcon Scott's hut is situated on Ross Island about 25 kilometres north of New Zealand's Scott Base and the large US base of McMurdo. Listed as Historic Site Number 16 in the Antarctic Treaty System register, the hut is also included within an area designated as Antarctic Specially Protected Area (ASPA - 155). This gives it some protection from 'man-made' threats, but it is in no way immune from natural forces.

Map: Antarctica and Southern Ocean (Credit: International Polar Heritage Committee)



Historic significance

It is from this hut that Scott launched his bid for the South Pole from which he and 4 companions never returned. Four years later it served as a refuge and source of provisions for Sir Ernest Shackleton's "Ross Sea Party" that was stranded there when their ship was blown out to sea in a storm. Believing that Shackleton had begun his trans-Antarctic expedition they continued to lay depots towards the South Pole to support him on the second stage of his journey out to Ross Island. The Ross Sea Party had no way of knowing that Shackleton's "Endurance" had been trapped and crushed in the Weddell Sea ice and that he and his men were fighting for their lives on the other side of the continent.

Recorded and observed climate changes

While a large amount of climate data has been collected at the nearby bases, this was not available to the writer in an analysed form prior to the deadline for this publication. It is however known that there are many different micro-climates in the region and these could influence the validity of such data if it was applied to Cape Evans. There is however a wealth of anecdotal evidence that supports the submissions made below.

Potential impacts

As a result of observations in recent years this site is facing a number of new and very real risks. Predictions of future climate change remain uncertain but give no cause for complacency.

The effect of increased snowfall and snow-drift build up

In recent years a significant increase in the winter build up of snow on and around the hut has been observed. The cause of this can possibly be attributed to increased precipitation as well as possible wind pattern changes that combine to increase snow drift.

This build up of snow has two serious adverse affects, the first being the increase of mechanical loading on the structure. In summer 2006-07 it was estimated that over 100 tonnes of snow were removed from in and around the hut. Much of this was taken from roof areas, in particular over the stables where it has cracked rafters in both of the last two years.

A second complication arises during warmer periods in summer when temperatures rise above zero and this snow melts. Increased quantities of snow create increased melt-water and this has begun to run through the hut where it freezes and builds up when cooler conditions occur. This water and ice not only causes damage to artefacts

Scott's hut at Cape Evans is located on a shingle beach less than 50 metres from the water's edge and no more than 2 metres above high water level. Little more than a kilometre to the north the Barne Glacier terminates in a massive wall of ice up to 50 metres high that floats out onto the sea. (Credit: Paul Chaplin)

in the hut, but the expansion effect of freezing is further source of mechanical damage to structural materials and objects in the hut.

For many years there has also been a separate process of "ice heave" caused by smaller amounts of melt-water running under the hut and freezing. The "heaving" effect of this on the structure has caused deformation of the flooring. This problem has been closely monitored but increased quantities of water are exacerbating it.

Temperature change

It can be easily understood that one effect of increases in average temperature in polar regions is an increase in the number of freeze/thaw cycles that occur. This contributes to a breakdown of many building and other materials. Wooden structures tend to absorb free water from the surrounding snow and ice, and when this re-freezes, it expands and begins to break down the surface fibres. Increased average temperatures, therefore, are likely to accelerate the mechanical breakdown of a wide range of materials.

Increases in ambient air temperature can also exacerbate the effects of solar warming. Solar energy is transmitted through the roof and walls of the hut causing an increase of internal temperature and when this occurs relative humidity (RH) increases. Objects within the hut do not warm so quickly, so when higher RH internal air contacts them, condensation forms on the cold surfaces. This dampness causes a breakdown of materials such as paper (labels on metal cans) and it provides a "fertile" medium for forms of biological decay. When interior temperatures cool again, the condensation freezes and contributes to the freeze/thaw problems and mechanical damage already mentioned.

Increased forms of biological decay

There is a popular belief that freezing conditions prevent biological decay, but this is far from the truth. Many forms of organisms continue to function in sub-zero temperatures and when temperatures periodically rise above freezing during summer months, bacteria, fungal and other organisms flourish. This not only causes decay in these wooden structures but in the many other materials, such as paper and fabrics, that can be found in the huge variety of artefacts remaining in the hut. Even a slight increase in average temperatures can magnify this problem.

In recent years there has been a significant increase in the build up of snow on and around the hut during winter. September 2003. (Credit: Scott Base Winter Staff)

Wind action

While actual changes in wind patterns in this area have yet to be analysed, it appears that this factor has contributed to the increased snow drift referred to above. Any change, therefore, raises the possibility that existing problems with windblown salt spray could be exacerbated. Salt acts as a catalyst in the oxidation of ferrous materials and this has always been a problem with iron fastenings and other components in the hut structure. Ferrous content of the artefacts within, such as food cans and implements, are also adversely affected.

Inundation/Flooding

One of the most dramatic illustrations of global warming often seen on the media is the spectacular collapse of ice-shelves and glacier faces. It is not difficult therefore to imagine the effect of the collapse of a huge mass of ice into the sea near the hut, and we have surely all seen examples of the mini tsunami that this can cause.

Scott's hut is located on a shingle beach less than 50 metres from the water's edge and no more than 2 metres above high water level. Little more than a kilometre away to the north is the Barne Glacier which terminates in a massive wall of ice up to 50 metres high that floats out onto the sea. In winter the hut is "shielded" by the sea-ice but for several weeks in summer there is only a short stretch of open water between it and the glacier.

As yet there have been no recorded dramatic collapses from this glacier, but if global warming continues, a major collapse from the face of the Barne Glacier is a real possibility. Such a collapse could easily create a wave capable of sweeping up the beach and destroying the hut and its contents. It goes without saying that any increase in global sea levels not only increases this risk, but creates a risk of its own.

Site management

The organisation responsible for this, and other sites in the Ross Sea region, is the Antarctic Heritage Trust. AHT, an international organisation based in New Zealand, has charitable status in several countries. It has a proven record of successful conservation projects and is acknowledged as a competent organisation achieving internationally recognised conservation standards in its work.

Despite such competent management, however, there remain some very real practical and economic considerations with work at Antarctic sites. These only serve to compound the effects of Global Climate Change. *(See "Cape Adare" in this issue of Heritage at Risk)*

The Trust has a continuing annual programme of remedial work and monitoring, and more detailed analysis of climate data is being done in an attempt to quantify and anticipate problems.

Paul Chaplin
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Objects within the hut do not warm as quickly as the air inside the hut so when the higher RH air contacts them condensation occurs on the cold surfaces. Freeze/thaw problems and dampness can cause a breakdown of materials such as paper (labels on metal cans) and it provides a "fertile" medium for forms of biological decay. (Credit: Paul Chaplin)