Current situation of the impact of climate change on the Sweden Refuge on Snow Hill Island (HSM No. 38)

English version provided by the author

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**Information Paper submitted by Argentina**

***Summary***

The “Sweden Shelter”, located in Snow Hill Island, was built by the Swedish Antarctic Expedition of Doctor Otto Nordenskjöld in February 1903, and used as a winter station until November 1903, when they were rescued by the corvette ARA Uruguay of the Argentine Navy. At present, this refuge is severely threatened by the impact of climate change that puts its structure at risk due to temperature changes and soil erosion, among other threats. This document summarizes what was observed during the last Antarctic campaign by researchers of the National Antarctic Programme of Argentina.

***Introduction***

The Swedish Shelter was built on Snow Hill Island by the Swedish Antarctic Expedition of Doctor Otto Nordenskjöld in February 1903, being used as a winter station until November 1903, when the expedition members were rescued by the corvette ARA Uruguay of the Argentine Navy. Nordenskjöld wintered in that refuge together with four others Swedish expeditionaries and the then Argentine Navy Ensign José María Sobral. In 1953, on the 50th anniversary of the rescue, the Argentine Republic got engaged in the refuge and in 1980 the National Directorate for Antarctica (DNA) and the Argentine Antarctic Institute (IAA) began the restoration of the shelter, with archaeological and conservational remedial works.

The Sweden Shelter is protected by the Antarctic Treaty System as Historic Site and Monument No. 38, as well as by Argentine legislation that designates it as a National Historic Site. It is one of the few Antarctic shelters of the "heroic era" whose original structure still remains, being key to the study and exploration of Antarctica. Therefore, as administrators of the HSM, ensuring its preservation for future generations is an unavoidable responsibility.

***Impacts of Climate Change***

The impacts of climate change and future threats from climate change have significant effects on facilities and particularly on historic sites and monuments. For this reason, climate change in Antarctica and its associated impacts are a matter of concern for the Antarctic Treaty Consultative Meeting and especially for the Committee for Environmental Protection (CEP). In the case of the Snow Hill Refuge, mitigation measures to minimize the impacts of climate change and ensure the stability of the Refuge have been studied and implemented for several years (see CPA VI - IP057, CPA XIII - IP021 and CPA XIV - IP130).

The Refuge has been impacted by the increase of the average annual temperature in the area, especially during the southern hemisphere summers. This causes an increase in thermokast and thermoreosion processes due to a rise in seasonal thawing and melting of subway ice (Silva Busso and Yermolín, 2017). Thus, the hut is exposed to these hazards. In particular, growing ground instability put in danger the proper stability of the Refuge. This situation is due to the vulnerable location of the hut on a natural embankment with ice-rich permafrost in its interior that is affected by changes in temperature.

***Mitigation background***

Since the 1990s the effects of climate change caused an acceleration in the erosion of the permafrost hill on which the refuge is located, which forced the DNA-IAA to carry out shoring and filling of the land to ensure the survival of the refuge.

In 2018 these works were paused to analyze the progress of the erosion process, while the conservation and preservation works of the heritage continued. In 2019 DNA-IAA initiated a cooperation with several Swedish research institutions to carry out these studies in order to deepen and survey the Antarctic heritage of the Nordenskjöld expedition. Four Swedish scientists took part in the DNA-IAA camp at the site during the 2019/20 campaign, carrying out a 3D laser digital survey at submillimeter level of the refuge, as well as orthophotography and drone mapping of the terrain at centimeter level. Also, automatic sensors were installed at different depths in the surrounding permafrost, plus an automatic weather station and humidity and temperature sensors inside the refuge.

DNA-IAA continued with the survey and heritage conservation work at the site, and currently possesses two years of data from the sensors, as well as new surveys that can be compared with the previous ones to assess the progress of erosion and resume the work of shoring up the land with greater precision. During the last Antarctic campaign, the Argentine scientists who camped at the site observed a pronounced acceleration in the erosion of the hill, which corresponds with the temperature records, having also recorded rainfall at the site. The advanced state of erosion of the permafrost, both due to the increase in temperatures, accompanied by the retreat of the adjacent glacier, as well as the fluvial erosion of the streams whose flow has increased considerably, means an imminent risk for the refuge, making it extremely necessary to resume the shoring tasks in order to avoid the loss of the Refuge due to the collapse of the terrain on which it is located.

***Future Plans***

In view of this situation, DNA-IAA plans to resume the shoring work in the 2022/23 Antarctic campaign with an extended camp. We consider that these measures are of an urgent nature and that all necessary management measures should be taken to ensure the integrity of the structure.

On the other hand, the CEP seeks - within the work programme on climate change - the identification of the potential impacts of climate change on historic sites and the subsequent preparation of the "Guideline for the evaluation and management of heritage in Antarctica" that provide possible solutions to this problem. In this regard, Argentina, New Zealand, Norway and the United Kingdom have recently submitted a working paper *(WP026 - Assessing the risk of climate change impacts on Antarctic heritage values)* to the ATCM, which aims to study proposals to advance the assessment of the risk of climate change impacts on Antarctic heritage values and also to seek the development of a climate change risk assessment tool.

Actions aimed at the management and conservation of the SHM have been sustained over the last decades. As a result of this policy, the Site now has management tools such as the Guidelines for Sites Receiving Visitors, updated in 2019 (CPAXXII - WP063), as well as internal guidelines of the National Antarctic Program of Argentina for the management of camps at the site. In that sense, based on the above considerations and the aforementioned Guidelines, and apart from the urgent actions of shoring up already mentioned, Argentina plans to develop a Management Plan for the site that will encompass the different aspects of the management, that is logistical, environmental, tourism and heritage conservation, with a view to improve conservation.

***Bibliography***

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