Arctic Erosion, Svalbard Case Study

Svalbard is a Norwegian archipelago located between the Norwegian mainland and the North Pole in the Arctic Ocean. It is home to several permanent settlements, such as Longyearbyen and Barentsburg, as well as the permanent research stations of Ny-Ålesund and Hornsund. Various elements of climate change such as melting and changing sea ice patterns, increased precipitation and storms, and less stable weather patterns have led to a situation where now Svalbard is under an increased period for erosion to occur. To combat this, the CLIMAREST demo site utilized both nature-based and hybrid solutions to prevent further coastal erosion within the built environment.

Contents

Introduction to the site

Driving factors, motivations, and goals for initiating restoration actions

The main driving factor for the restoration activity has been the hazard of coastal erosion threatening the nearby road and infrastructure. From this has arrived motivation to control this erosion in a sustainable manner. In combining the driving factor with the motivation for a sustainable solution, the Svalbard demonstration has worked to implement a blue-grey restoration solution.

Description of the restoration project location

The restoration site is located at Longyearbyen, Svalbard, specifically on a coastal stretch between the Tourist pier and the Old pier.

Assessment Phase

General description of the background and the Initial site assessment

The restoration site is a coastal stretch in an urban environment. In this location, there has been continuous permafrost in the terrestrial part of the coastal zone. This coastal stretch also serves as a landfill, thus the rational for the replication solution that was selected. Upon initial assessment of the restoration area, the following factors were considered:

- Biodiversity
- Site conditions (geocryological conditions)
- Coastal dynamics
- Environmental pollution
- Metocen and map data
- Needs of stakeholders in the area

Planning and Design Phase

Permits applied for and from where

Three permits were obtained to carry out this restoration project.

1. Environmental permit from the central, Norwegian government
2. Building permit from the local, Longyearbyen government
3. Permit from the port authorities from the local, Longyearbyen government

Restoration objectives of the project

The overall goal is to develop a prototype for erosion control at the site, while also rehabilitating 30% of the area so that it can provide habitats for natural biodiversity after project end. This restoration area will also provide recreational services to the local community. The target for the

rehabilitation is to replicate a stable coastline resembling a natural rocky shoreline in a prototype area.

Protocol for the restoration project

Selection of appropriate restoration techniques: The coastal stretch in the prototype site is artificial, in terms of that it is a landfill designated to increase the proportion of the coastal stretch that can be used for commercial or recreational purposes. Since this area originally was a cobble/sand beach with a relatively long intertidal zone it was modified by using various materials from Svalbard and from the mainland to create an area that could be used as a boat harbor. Hence, the coastal stretch in the prototype site is man-made. Despite this, sections of the man-made coastal stretch are still subjected to significant erosion. Ecological restoration of the man-made sections in the prototype site is not feasible since these sections also represent important and necessary infrastructures for the society in Longyearbyen. While there is a need for controlling erosion in these sections it is also possible to do this in a way that offers possibilities for native biodiversity to establish and thrive. One way of doing this is to replicate a naturally occurring rocky shoreline that is resilient to erosion. However, it would not be realistic to construct a semi-natural rocky shoreline along the entire prototype stretch, as this will impede the utility of the area as a boat harbor. Hence, a practical and realistic solution would be to construct sections with a semi-natural rocky beach interspersed by sections of timber structures, made by recycled timber, as these will reduce erosion and serve as structures for mooring of small boats.

Control/reference sites:

- Reference site 1 -- located on the same coastal stretch as the prototype, in ca. 50 m to the East
- Reference site 2 -- Hiorthhamn, located in 1.5 km across the fjord, cohesive shoreline
- Reference site 3 -- Vestpynten, located in ca. 5 km to the West, gravelly beach
- Reference site 4 -- Revneset, located in ca. 2.5 km North-West across the fjord, rocky shore

Success/benefits indicators

- Stabilization of coastal erosion
- Improvement of biodiversity (measured by means of eDNA).

Implementation Phase

Description of the Implementation of the protocol

eDNA sampling before and after the construction, monitoring of stability of the prototype and bathymetry.

Data collection, analysis, and assessments of ecological Indicators

eDNA samling, geodetical survey.

Ongoing Management, Monitoring, and Evaluation Phase

Final results of the demonstration site

The work is ongoing.

Major Issues and problems encountered

1. Cost of the prototype is higher then initially estimated
2. Installation requires full set of permits that are obtained for any industrial project

Sharing and Communication

- Popular science article
- Article in local newspaper
- Co-creation workshop
- LinkedIn posts
- Meetings with all key stakeholders