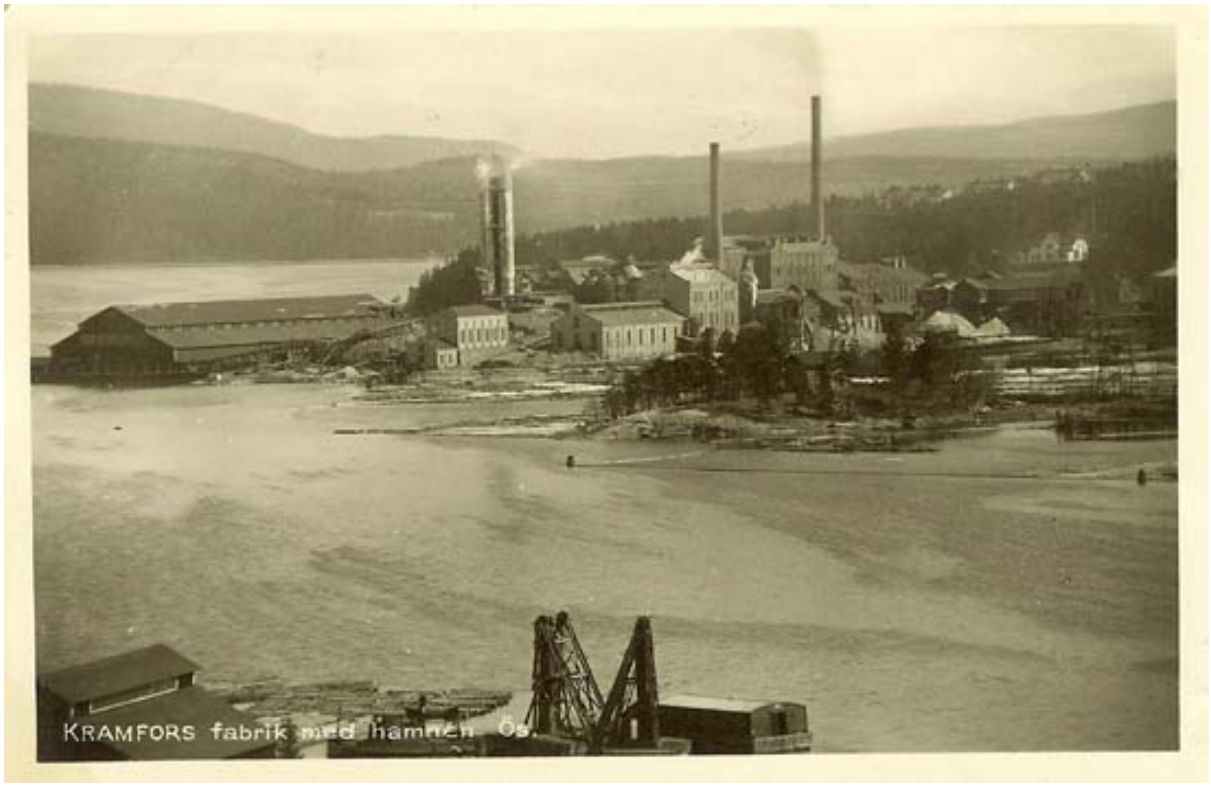
TREASURE: Targeting Emerging Contaminated Sediments Along The Uplifting Northern Baltic Coast Of Sweden For Remediation.

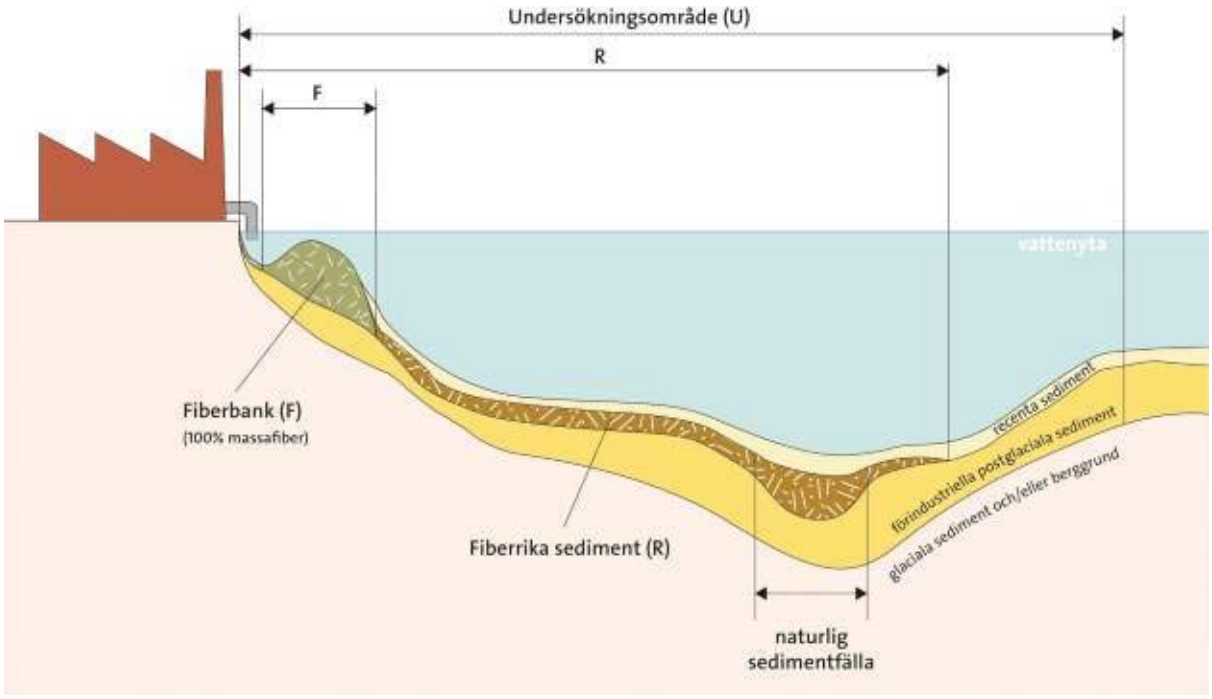
Dumping of untreated waste products into the sea by the paper and pulp industry has caused large banks of contaminant laden cellulose (fibre banks) to form on the seafloor along the eastern coastal zone of Sweden. Their shallow submarine location adjacent to the open sea makes them a challenging target for remediation. This project focusses on the Ångermanälven estuary in Västernorrland. Dumping along this coast began as early as AD 1740 and although many of the hazardous substances in the fibre banks were banned by legislation in the 1970's by then masses of material had already accumulated on the sea floor. Contaminants identified in the fibre banks include persistent organic pollutants (POPs) including dichloro-diphenyl-trichloroethane (DDT), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs), and high concentrations of heavy metals (Hg, Pb, Cd, Cr, and Zn). Many of the contaminants are known to persist and bio-accumulate in the environment. For example, levels of POPs in the eggs of the white-tailed sea eagle (*Haliaeetus albicilla*) on the Baltic Sea coast outside Ångermanälven have risen to levels that pushed this sensitive indicator species to the edge of extinction 40 years ago.



The Kramfors pulp and paper factory in 1934. Although the dumping of many contaminants is now regulated, there are banks of waste that were created before the legislation was introduced that are now threatening the ecosystem as they are dispersed. Photo from http://www.famgus.se/Gudmund/SagFab-Kramfors.htm

The TREASURE project looks at the complex interplay between contaminant levels **and** the risk of their dispersal. TREASURE is led by Prof. Ian Snowball (Uppsala University) and was awarded 7 million SEK via a special call from FORMAS targeting contaminated areas. In addition to Lund and Uppsala Universities, partners include the Swedish Geological Survey (SGU), Swedish Geotechnical Institute (SGI), Swedish Agricultural University (SLU) and Stockholm University.

In Lund, Dr. Catherine Paul (Forskassistant/ Assistant Professor; Water Resources Engineering; and Applied Microbiology, LTH) is looking at how knowledge of microbes living within the fibre banks could contribute to a remediation strategy. We hope to explore the idea of *in situ* remediation by the microbes that are already present in the fibre banks. Key enzymes and members of microbial communities associated with remediation of the fibre banks pollutant profile will be determined, and their prevalence in natural samples, and laboratory microcosms, followed using quantitative polymerase chain reaction (qPCR).



A drawing showing dispersal of the fibre material from the factory and out into the Baltic Sea. Samples in the study have been taken from the banks and sediments at several sites along the Swedish coast.

Successful remedial action will reduce the environmental threat that these contaminated sediments represent and requires an understanding of their physical, chemical and biological stability. The most heavily polluted fibre banks may not be the most hazardous ones if organisms are present in these areas that can detoxify some of the contaminants. Due to the potential negative impact of a remediation technique on slope stability, a less efficient one (or no remediation) may be the most environmentally friendly and cost effective solution. The ultimate goal for TREASURE is to deliver science-based recommendations to environmental managers and geo-engineers who will be involved in remediation.