

Newly waterproofed Arctic seed vault hits 1m samples

Rapid climate change forced urgent upgrade of 'failsafe' doomsday storage facility

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Construction workers add the finishing touches to the seed vault. Photograph: Ragnhild Utne/Statsbygg

The Arctic global seed vault has reached the milestone of having 1m varieties stored in its deep freeze. The new deposits are being made after unexpected flooding of its entrance tunnel in 2017 prompted an upgrade.

Seeds from 60,000 crop varieties from across the world are being placed in the vault to back up those held in other seed banks.

The €9m (£7.5m) underground facility in the Norwegian archipelago of Svalbard opened in 2008 as a “failsafe” store. But the unexpectedly rapid pace of global heating led to melting of the permafrost that had encased it.

Now, a €20m refurbishment by the Norwegian government means the vault is secure for the future and “absolutely watertight”, according to officials.

The destruction of nature means vital diversity of crops and their wild relatives are being lost, at a time when the impact of the climate emergency means new varieties are needed to cope with changing weather and pests. Seed banks can also be destroyed by power loss and war, as happened in Aleppo, Syria, making the Svalbard vault crucial.



The vault, which holds seeds from 60,000 crop varieties, has been carved into solid rock. Photograph: Jim Richardson/NG/Alamy

Tuesday's deposits, from 36 institutions, are the most diverse and include seeds of 27 wild plants from Prince Charles's Highgrove estates as well as seeds of the candy roaster squash, which are being deposited by the Cherokee Nation in the US.

Wild emmer wheat, known as the “mother of wheat” when it was discovered in 1906, is being deposited by Haifa University in Israel, alongside potato varieties from Peru and other crops from Mongolia, Morocco, Myanmar and New Zealand. Each sample contains roughly 500 seeds.

The Svalbard vault, which is carved into solid rock, houses samples of about 1,050,000 crop varieties from 5,000 species. This represents two-fifths of the estimated 2.4m varieties in the world, and the vault has plenty of room to accommodate them.

“Crop diversity is an essential basis of food production,” said Hannes Dempewolf, a scientist at Crop Trust, which operates the vault alongside the Nordic Genetic Resource Centre. “And the Svalbard vault is the essential backup facility for seed banks around the world, safeguarding the biodiversity they hold.”

Many crop varieties have been lost, including 93% of fruit and vegetable varieties in the US.

“The issue of some water intrusion in the entrance tunnel was certainly not foreseen during construction,” Dempewolf said. “No one thought summers would be so warm.

“A major upgrade was the only right thing to do and the Norwegian government has certainly put the resources up to make sure that it is absolutely watertight now.”

Hege Njaa Aschim, a spokeswoman for the government, which owns the vault, said: "The entrance tunnel and the upgrade will secure the seed vault for the future."



The vault was built to protect millions of food crops from climate change, wars and natural disasters. Photograph: Renato Granieri/Alamy

In 2017, she told the *Guardian*: "A lot of water went into the start of the tunnel ... The vault was supposed to [operate] without the help of humans." No water reached the seed vaults.

The 130-metre entrance tunnel has been fully waterproofed and the cooling equipment that keeps the vault at -18C moved to a new service building, so heat from the machinery can be released outside. The vault is 130 metres above sea level and designed for a "virtually infinite lifetime".

"It is always dangerous to talk about something being completely failsafe and impregnable," Dempewolf said. "In 20, 30, 40 years down the line, we will continue to monitor the situation to see whether any other upgrades are necessary."

Arctic stronghold of world's seeds flooded after permafrost melts

No seeds were lost but the ability of the rock vault to provide failsafe protection against all disasters is now threatened by climate change

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The Svalbard 'doomsday' seed vault was built to protect millions of food crops from climate change, wars and natural disasters. Photograph: John Mcconnico/AP

It was designed as an impregnable deep-freeze to protect the world's most precious seeds from any global disaster and ensure humanity's food supply forever. But the **Global Seed Vault**, buried in a mountain deep inside the Arctic circle, has been breached after global warming produced extraordinary temperatures over the winter, sending meltwater gushing into the entrance tunnel.

The vault is on the Norwegian island of Spitsbergen and contains almost a million packets of seeds, each a variety of an important food crop. When it was opened in 2008, the deep permafrost through which the vault was sunk was expected to provide "failsafe" protection against "the challenge of natural or man-made disasters".

But **soaring temperatures in the Arctic** at the end of the **world's hottest ever recorded year** led to melting and heavy rain, when light snow should have been falling. "It was not in our plans to think that the permafrost would not be there and that it would experience extreme weather like that," said Hege Njaa Aschim, from the Norwegian government, which owns the vault.

"A lot of water went into the start of the tunnel and then it froze to ice, so it was like a glacier when you went in," she told the *Guardian*. Fortunately, the meltwater did not reach the vault itself, the ice has been hacked out, and the precious seeds remain safe for now at the required storage temperature of -18C.

But the breach has questioned the ability of the vault to survive as a lifeline for humanity if catastrophe strikes. "It was supposed to [operate] without the help of humans, but now we are watching the seed vault 24 hours a day," Aschim said. "We must see what we can do to minimise all the risks and make sure the seed bank can take care of itself."

The vault's managers are now waiting to see if the extreme heat of this winter was a one-off or will be repeated or even exceeded as climate change heats the planet. The end of 2016 saw average temperatures over 7°C above normal on Spitsbergen, pushing the permafrost above melting point. "The question is whether this is just happening now, or will it escalate?" said Aschim. The Svalbard archipelago, of which Spitsbergen is part, has warmed rapidly in recent decades, according to Ketil Isaksen, from Norway's Meteorological Institute.

"The Arctic and especially Svalbard warms up faster than the rest of the world. The climate is changing dramatically and we are all amazed at how quickly it is going," Isaksen told the Norwegian newspaper *Dagbladet*.



The vault managers are now taking precautions, including major work to waterproof the 100m-long tunnel into the mountain and digging trenches into the mountainside to channel meltwater and rain away. They have also removed electrical equipment from the tunnel that produced some heat and installed pumps in the vault itself in case of a future flood.

Aschim said there was no option but to find solutions to ensure the enduring safety of the vault: "We have to find solutions. It is a big responsibility and we take it very seriously. We are doing this for the world."

"This is supposed to last for eternity," said Åsmund Asdal at the Nordic Genetic Resource Centre, which operates the seed vault.