



FUTURE CLIMATE STRESSORS - IMPACTS ON CONTAMINATED SOIL

INSIGHTS FROM EU TAXONOMY-BASED CLIMATE RISK ASSESSMENTS

NORDROCS, 2026

WSP NORWAY v/ Ida Kristine Buraas Aasgaard



Photo: WSP-Norway

Agenda

Which future climate stressors will the Nordics expect?

How to identify the future climate stressors using the EU Taxonomy

Why is climate change and adaption relevant in the contaminated land setting?

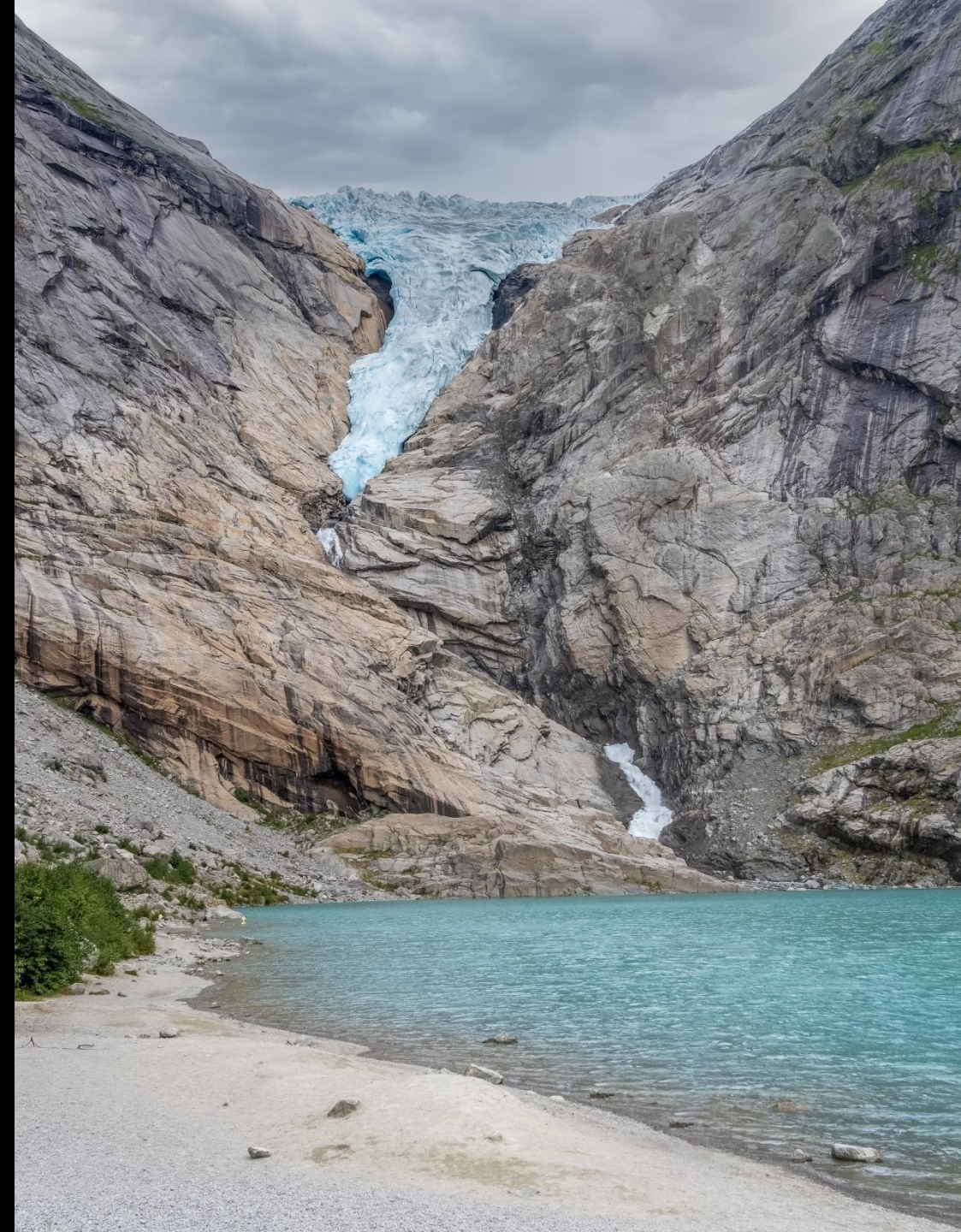
Climate Stressors Impacts on Contaminated Soil

Climate change is a fact

Climate change is already noticeable, and the situation is expected to escalate further in the decades ahead.

- The average temperature is estimated to increase by around 3.4 °C.
- Annual precipitation is estimated to increase by about 11%
- Torrential rain will occur more often and heavily.
- Floods triggered as a result of increased precipitation will increase in both scope and frequency.
- The snowmelt floods will decrease in scope and frequency.
- More landslides and floods are expected in connection with increased frequency and intensity of locally heavy torrential rainfall in the future climate.
- The glaciers will be significantly reduced or, in the worst case, disappear completely
- The average sea level will increase by 0.36 m along the Norwegian coast.

Source: Climate in Norway – knowledge base for climate change adaptation updated in 2025



Climate risk is a combination of Hazard, vulnerability and exposure

A climate **hazard** is a climate-related event or change that can cause harm

Exposure describes what is located in the affected area affected by climate hazards.

Vulnerability describes how sensitive a system is to climate change, and how well it can adapt or respond.

Climate risk increases when hazards become more severe, exposure increases, or vulnerability is high.

Climate adaptation aims to reduce exposure and vulnerability while preparing for future hazards.

The background of the slide is an aerial photograph of a mangrove forest. The forest is a dense, vibrant green, with numerous small, winding water channels (canals) that meander through the land. The water in the canals is a light, silty brown color. The overall scene is a lush, natural landscape.

HOW TO IDENTIFY THE FUTURE CLIMATE STRESSORS USING THE EU TAXONOMY

EU's taxonomy

The taxonomy requirements are in line with the ESRS standards in the CSRD

THE TAXONOMY'S ENVIRONMENTAL OBJECTIVES

Climate mitigation

Climate adaptation

Sustainable use and protection of water and marine resources

Transition to a circular economy, waste prevention and recycling

Pollution Prevention

Biodiversity

ESRS (CSRD)

European Sustainability Reporting Standards

CLIMATE AND ENVIRONMENT (E)

E1: Climate change

E2: Pollution

E3: Water and Marine Resources

E4: Biodiversity and ecosystems

E5: Resource use and circularity

SOCIAL CONDITIONS (S)

S1: Own labour force

S2: Workers in the value chain

S3: Affected communities

S4: Consumers and end-users

Governance (G)

G1: Business ethics



Example of climate risk assessment

	Temperature		Wind		Water		Soil masses
Long-term	Temperature changes		SSP 3-7.0 wind patterns		Changed precipitation and moisture conditions		Costal erosion
	RCP 4.5	SSP 3-7.0	RCP 4.5	SSP 3-7.0	RCP 4.5	SSP 3-7.0	
	Heat stress		More often stronger winds		Variations in precipitation		Soil degradation
	RCP 4.5	SSP 3-7.0	RCP 4.5	SSP 3-7.0	RCP 4.5	SSP 3-7.0	
	Temperature variations				Sea level rise and ocean acidification		Soil erosion
	RCP 4.5	SSP 3-7.0			RCP 4.5	SSP 3-7.0	
	Permafrost thawing				Saline intrusion		Solifluction
					RCP 4.5	SSP 3-7.0	
					Water stress		
		RCP 4.5	SSP 3-7.0				
Acute	Heat waves		Cyclone, Hurricane		Drought		Avalanche
	RCP 4.5	SSP 3-7.0			RCP 4.5	SSP 3-7.0	
	Cold waves		Storm (including blizzards and sandstorms)		Extreme precipitation (torrential rain, hail, snow)		Landslides
	RCP 4.5	SSP 3-7.0	*		RCP 4.5	SSP 3-7.0	
	Forest fire / Wild fire		Tornado		Floods and storm surges, stormwater and groundwater flooding		Subsidence
					RCP 4.5	SSP 3-7.0	
					Glacial lake outburst		

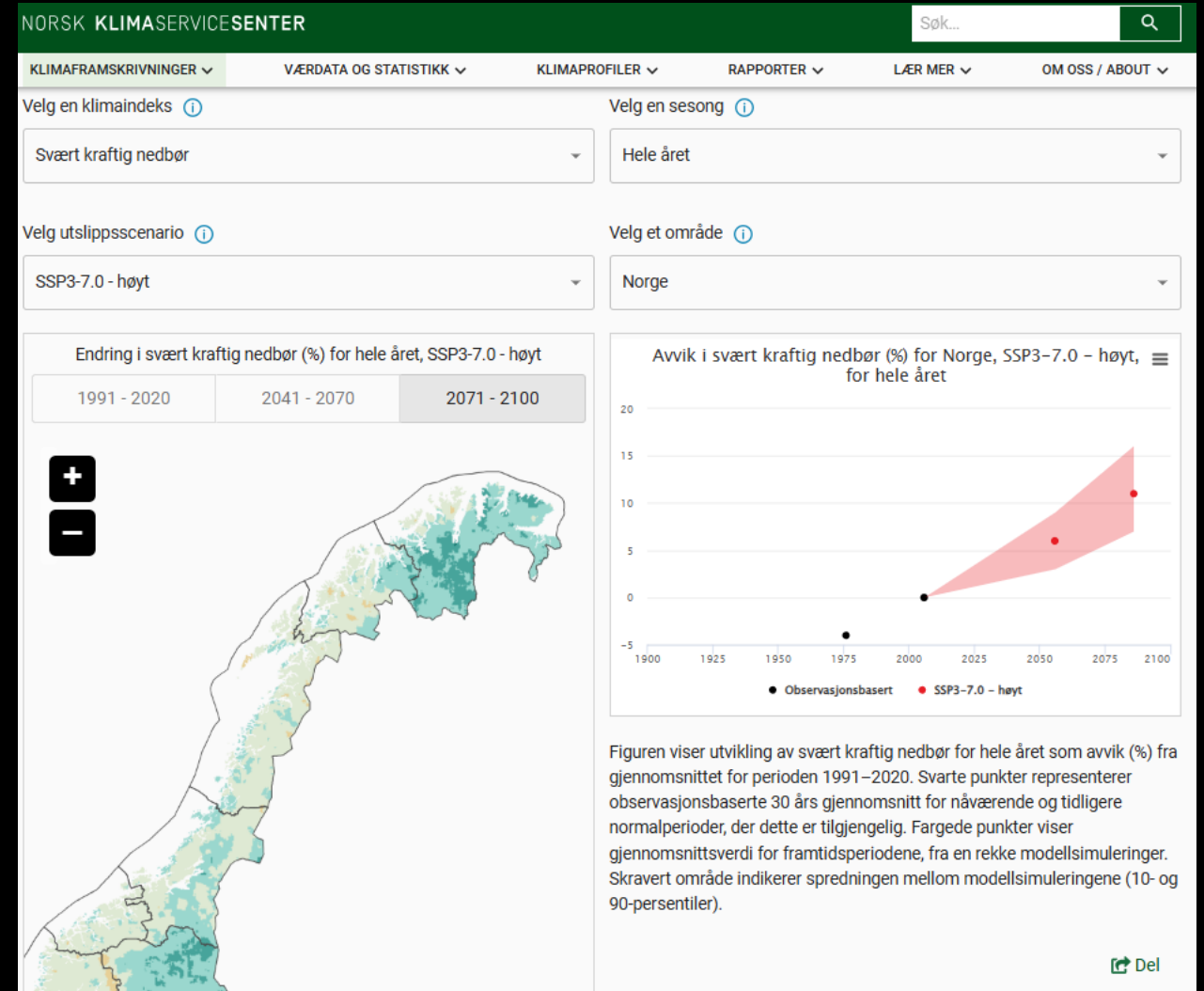
Climate projections and hazard maps

Climate projections estimates of how climate hazards, such as temperature, rainfall, and extreme weather, may change in the future.

Hazard maps showing areas that may be exposed to hazards such as flooding, landslides, or sea level rise today.

Climate risk assessment – Assessed by combining future climate projections with hazard maps and information about what is exposed, evaluate vulnerability, and then determine where the greatest risks may occur.

To assess future changes, we use **climate projections** from the Norwegian Centre for Climate Services:



Example: Climate Vulnerability Assessment of 104 Sites in Norway – Torrential rain

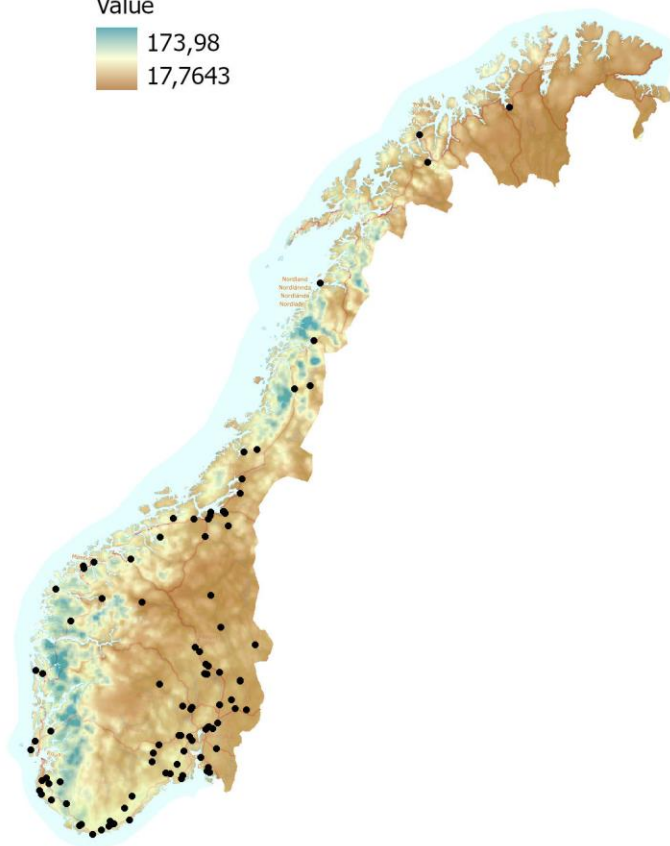
The map shows the change (in %) in **heavy precipitation (torrential rain)**, from the reference period 1991–2020 to 2071–2100 under the SSP3-7.0 climate projections. Based on data from the Norwegian Centre for Climate Services (NCCS)

- Short-duration extreme rainfall is expected to increase
- One-day extreme precipitation may increase by 10-30%
- Heavy rainfall events will become more frequent and intense

Referanseverdier 1991-2020

Ekstremnedbør 99.7p

Value

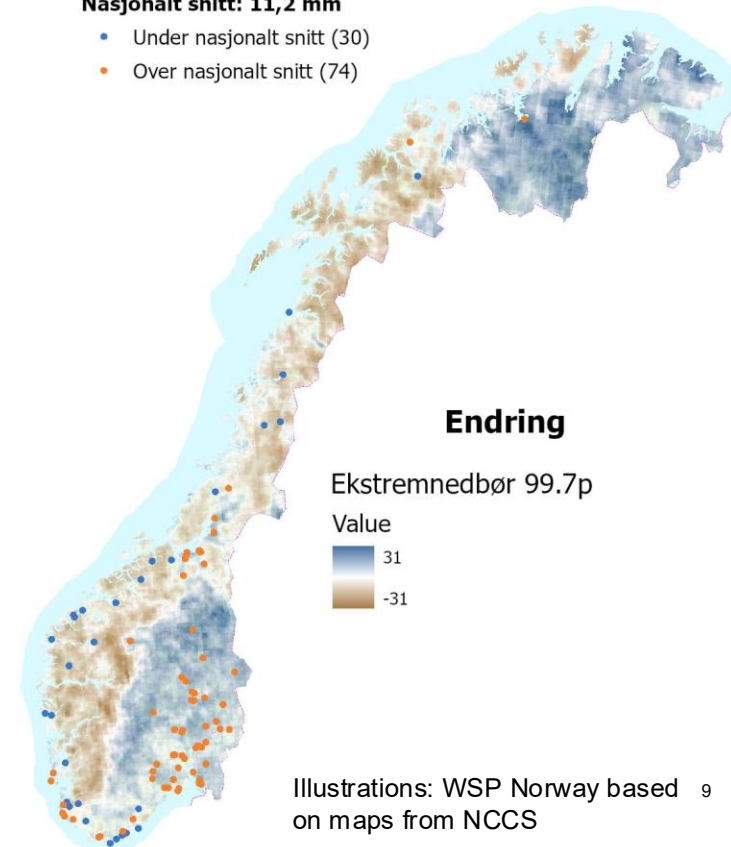


Fremskrivning 2071-2100

Ekstremnedbør 99.7p

Nasjonalt snitt: 11,2 mm

- Under nasjonalt snitt (30)
- Over nasjonalt snitt (74)

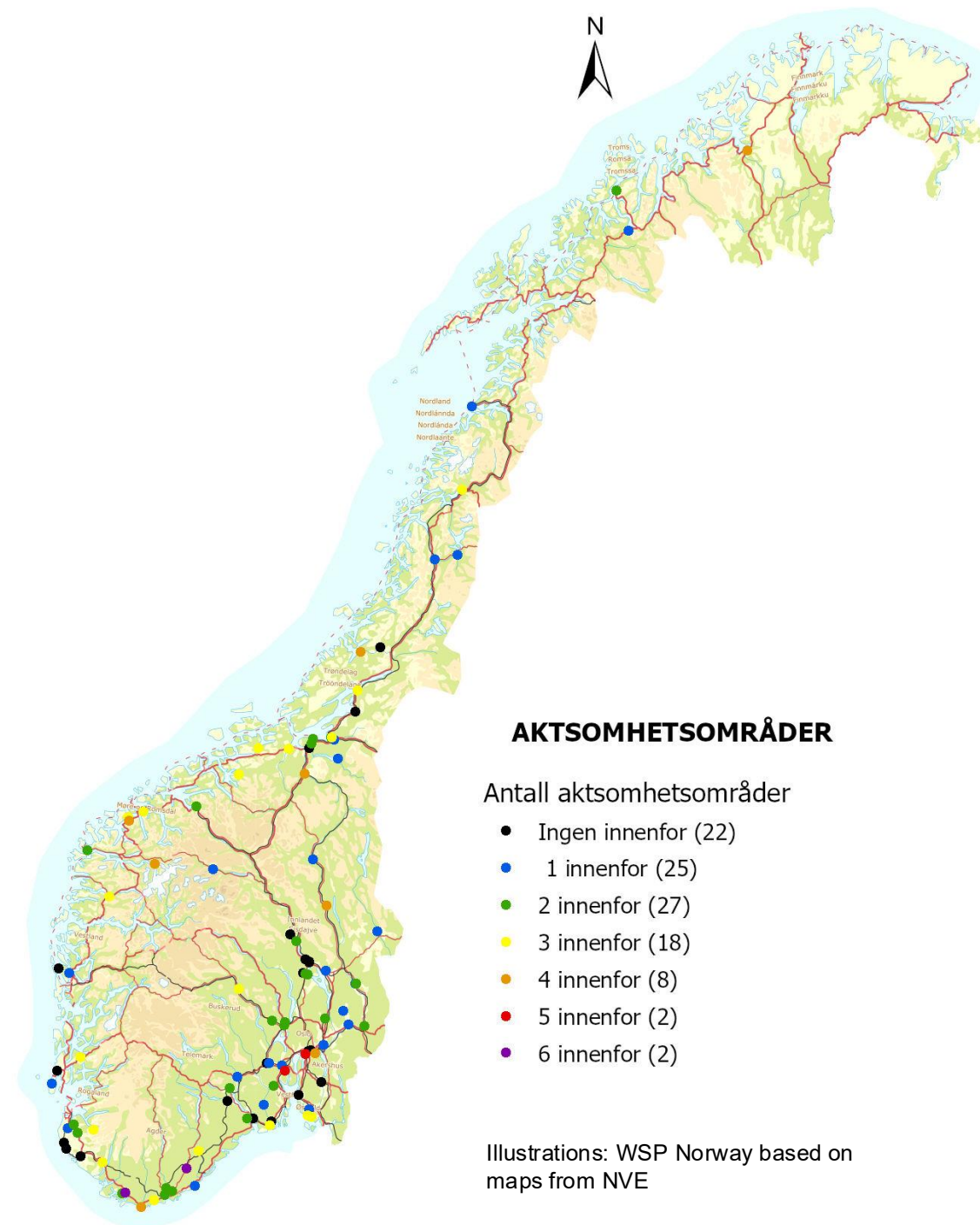


Example: Climate Vulnerability Assessment - Hazard awareness

A large proportion of the activities operate in areas with an increased probability of natural events.

- 82 sites located within one or more hazard awareness zones
- Only 22 sites located outside identified hazard zones
- 12 sites located within four or more hazard zones

Presence within a hazard zone does not mean an event will occur – it indicates a potential exposure that should be assessed further



Key findings from Climate Risk Assessments

- **More Precipitation**

More intense rain → Greater pressure on stormwater systems → Capacity exceedance in drainage systems → increased risk of flooding and operational disruptions

- **Increased risk of acute climate events** such as floods and landslides

- **Temperature variability**

More frequent cycles of wetting and drying and freezing and thawing → increased soil degradation → erosion and higher risk of ground settlement and subsidence.

- **Changes in Hydrology**

Altered groundwater conditions and runoff pathways → changing how water moves



“The risk of acute climate events such as floods and landslides is more relevant than the assets itself thinks”

Climate stressors relevant to contaminated soil



Heavy precipitation

Increased infiltration
Greater surface runoff.



Flooding

Erosion
Sediment redistribution



Temperature variability

Freeze-thaw cycles
Geochemical changes



Soil moisture change

Altered recharge conditions
Modified redox environments



Sea level rise

Rising groundwater levels
Increased storm surge exposure



Saltwater intrusion

Change groundwater chemistry

More Water may mobilise more Contamination

Infiltration

- More water passes through contaminated layers
- Increased leaching of contaminants to groundwater

Surface runoff

- Increased transport of particle-bound contaminants

Erosion

- Exposure of contaminated soil

Groundwater rise

- Contact with previously unsaturated contaminated soils

Hydrological changes

- New contaminant flow pathways

A contaminated site that appears stable today may not remain stable under future climatic conditions.

Climate-related changes can change the risk profile of contaminated land

- Increase contaminant mobility
- Enhance leaching to groundwater and surface water
- Alter contaminant transport and exposure pathways
- Higher risk of stormwater-related contamination events
- Existing mitigation measures may become less effective
- Increase exposure risks to humans and ecosystems

Physical and Geochemical Stability May Shift

Physical processes

- Erosion
- Subsidence
- Settlement
- Slope instability
- Reduced soil quality

Geochemical processes

- Changes in redox conditions
- Changes in pH
- Changes in ionic strength
- Salinity effects
- Altered organic matter dynamics

Risk consequences

- Increased dissolved contaminant concentrations
- Greater particle-bound transport
- Failure of current containment assumptions
- New exposure pathways
- Increased uncertainty



**WILL CLIMATE RISK BECOME
CONTAMINATED LAND RISK
OR
WILL CONTAMINATED LAND RISK BECOME
CLIMATE RISK ?**

Photo: WSP Global

I think both



Key takeaways

Climate change affects both soil stability and contaminant behaviour

Flooding, erosion, groundwater fluctuations, and sea-level rise can increase contaminant mobility and exposure

Contaminated sites are becoming more vulnerable to climate-related hazards

Climate risk and contaminated land risk must be assessed together

Understanding the interaction between climate hazards and contamination risks is essential to make sustainable and resilient decisions for the future.



THANK YOU!

Contact:

Ida Kristine Buraas Aasgaard – idakristine.buraas@wsp.com

wsp.com



Photo: Microsoft stock images