FFI Forsvarets forskningsinstitutt

Norwegian University of Life Sciences

Bærekraftig massehåndtering i forurenset grunn ved bruk av livssyklusanalyser (LCA) -forurensning i skytefelt

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Foto: AdobeStock

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Assessing the life cycle impacts of the remediation of shooting ranges in peatland environments

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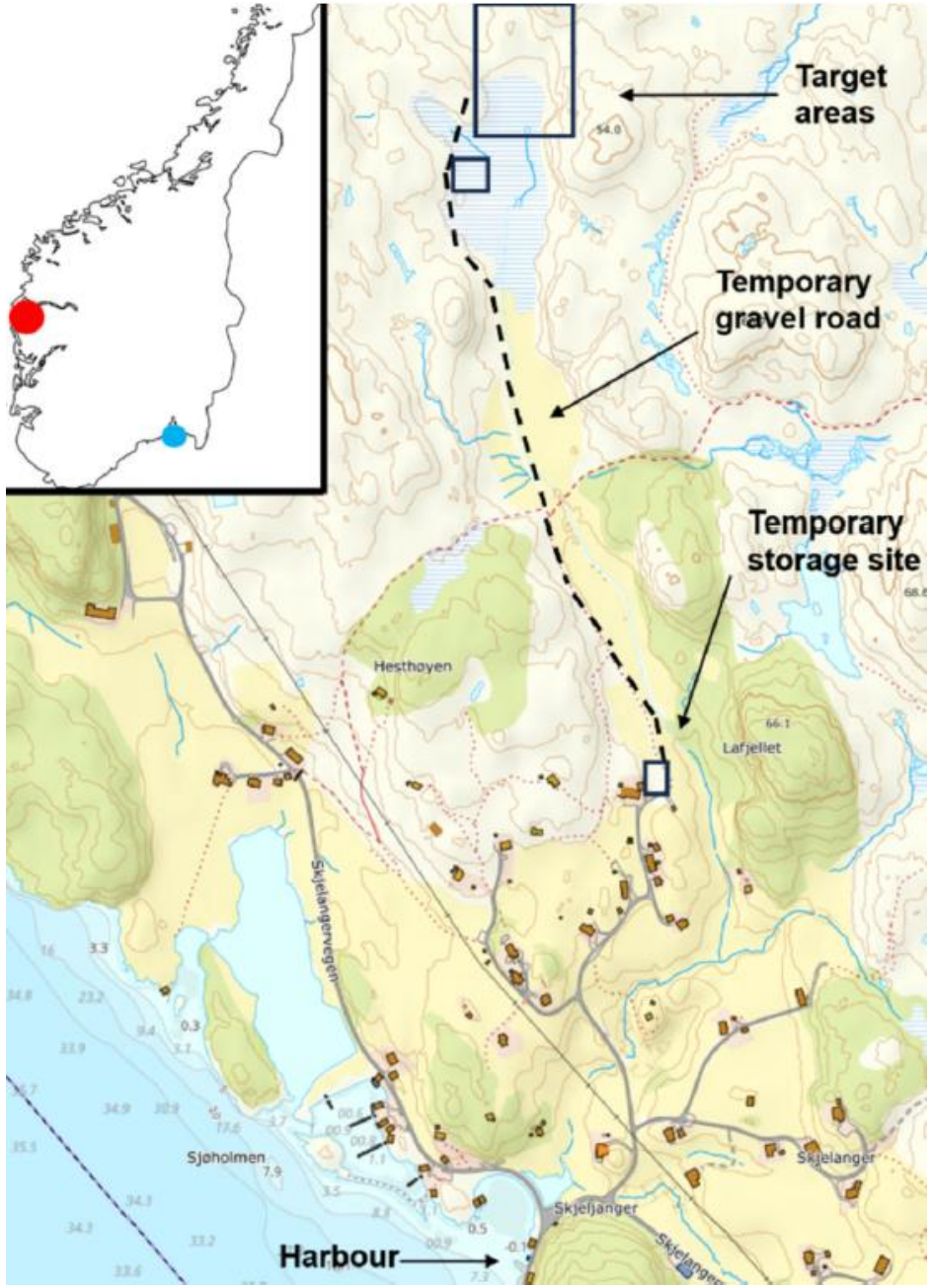

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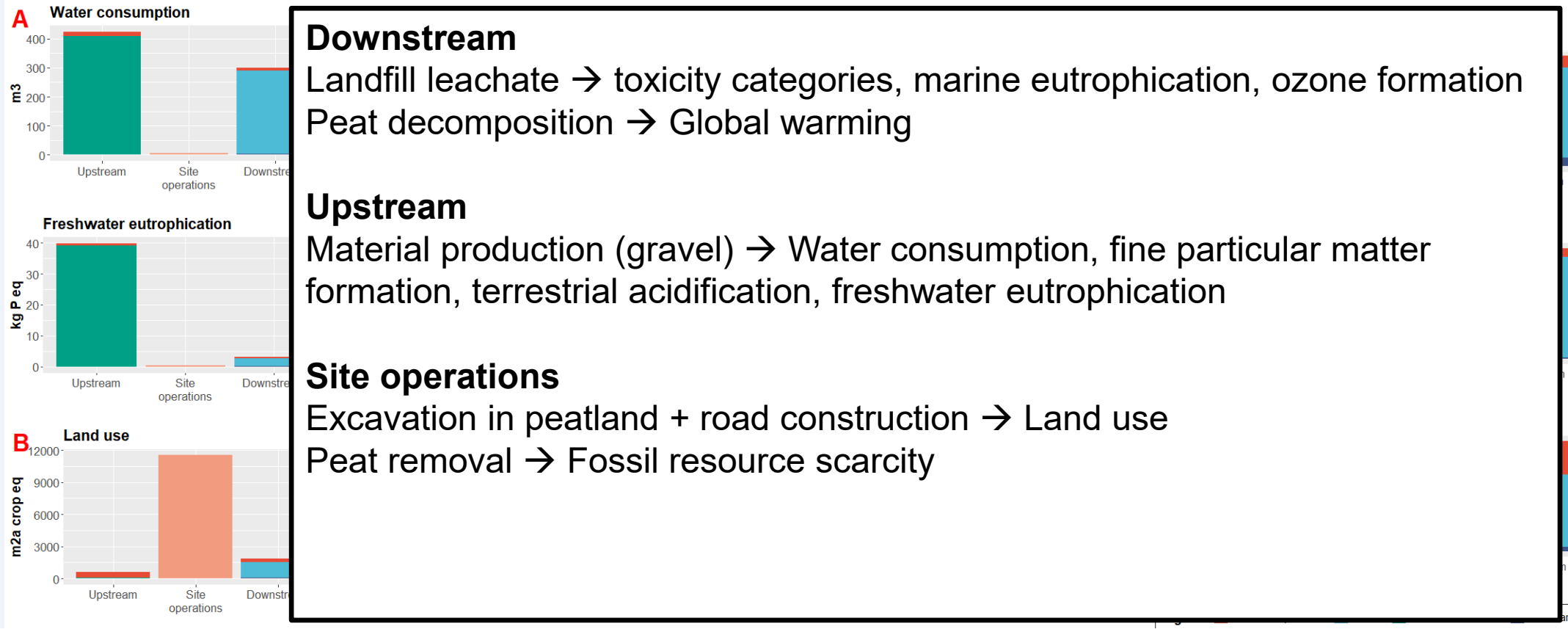


Downstream

Landfill leachate → toxicity categories, marine eutrophication, ozone formation

Peat decomposition → Global warming

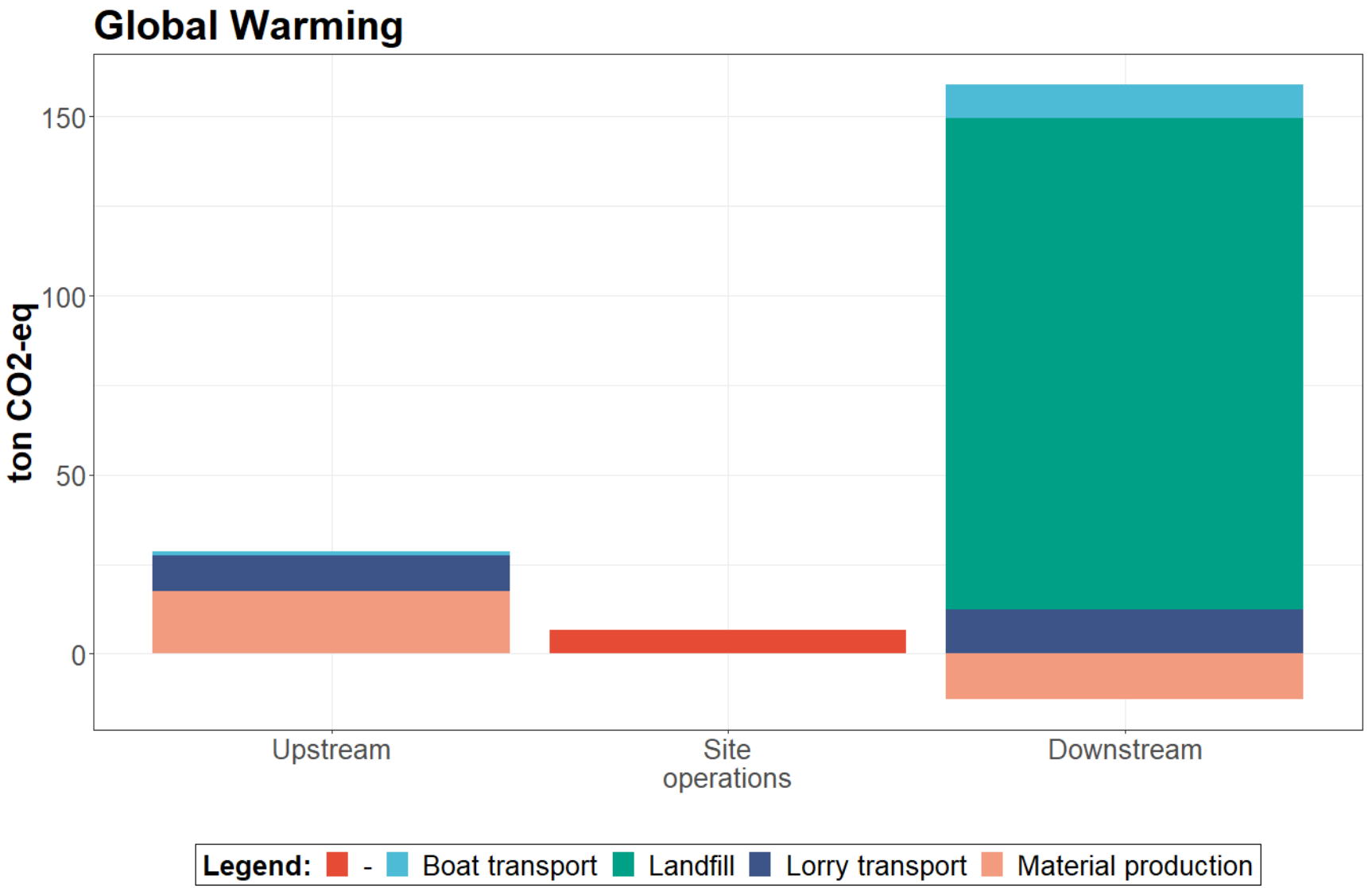
Upstream

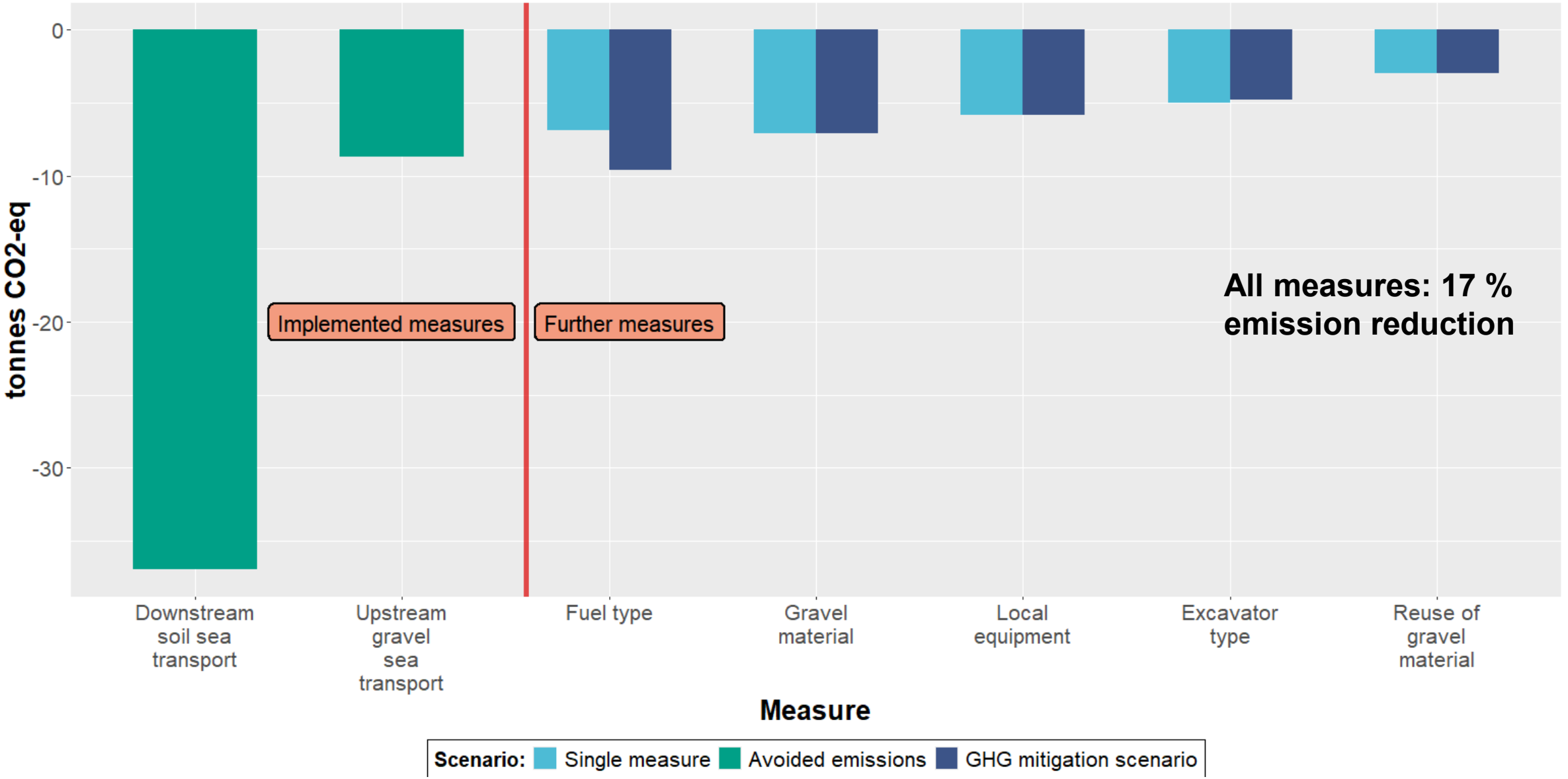
Material production (gravel) → Water consumption, fine particular matter formation, terrestrial acidification, freshwater eutrophication

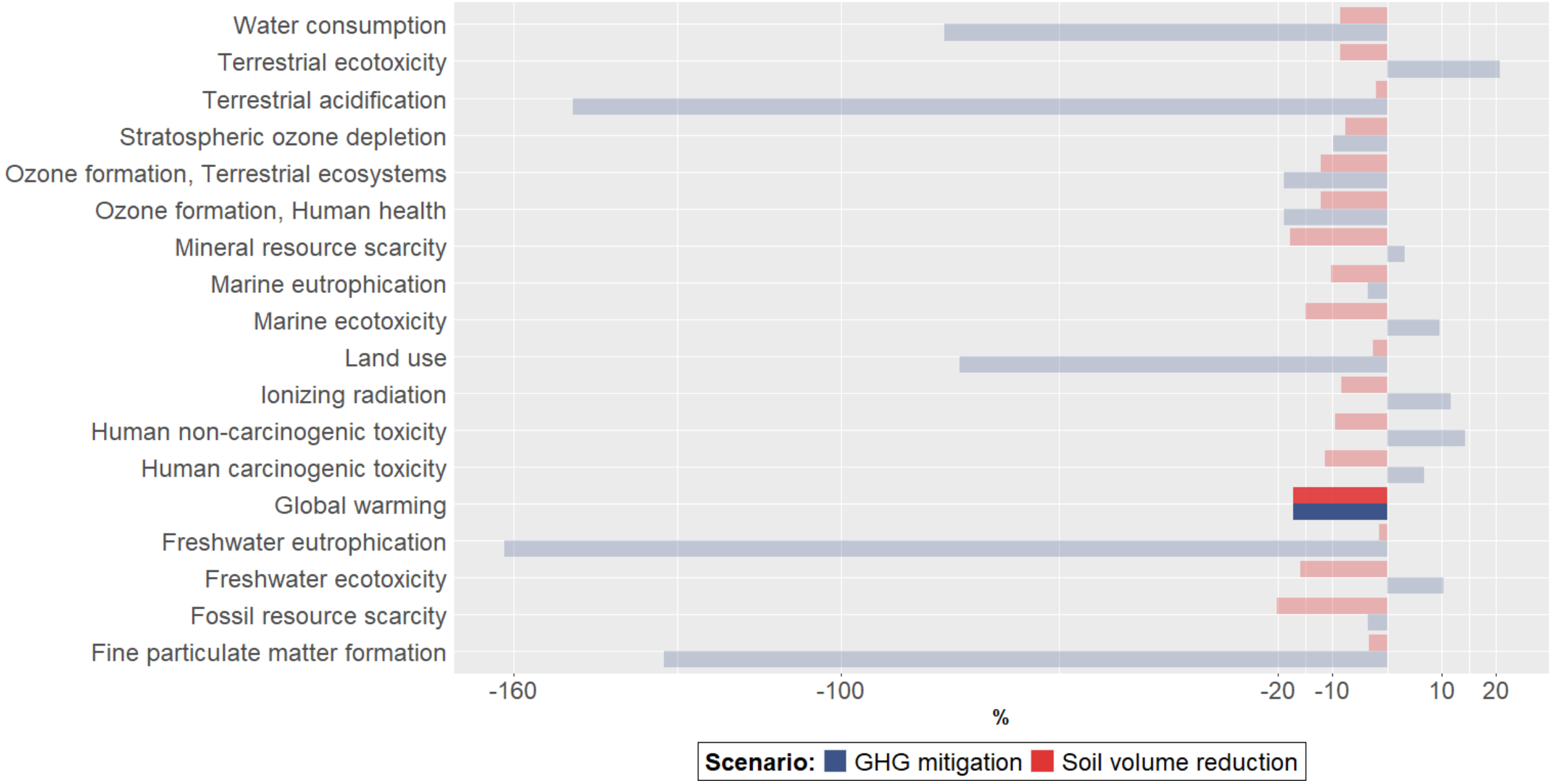
Site operations

Excavation in peatland + road construction → Land use

Peat removal → Fossil resource scarcity


Global Warming
ton CO2-eq
150
100
50
0
Upstream
Site operations
Downstream
Legend: - Boat transport Landfill Lorry transport Material production


0
-10
-20
-30
tonnes CO2-eq
Implemented measures
Further measures
All measures: 17 % emission reduction
Downstream soil sea transport
Upstream gravel sea transport
Fuel type
Gravel material
Local equipment
Excavator type
Reuse of gravel material
Measure
Scenario: Single measure Avoided emissions GHG mitigation scenario


Water consumption
Terrestrial ecotoxicity
Terrestrial acidification
Stratospheric ozone depletion
Ozone formation, Terrestrial ecosystems
Ozone formation, Human health
Mineral resource scarcity
Marine eutrophication
Marine ecotoxicity
Land use
Ionizing radiation
Human non-carcinogenic toxicity
Human carcinogenic toxicity
Global warming
Freshwater eutrophication
Freshwater ecotoxicity
Fossil resource scarcity
Fine particulate matter formation
-160
-100
-20
-10
10
20
%
Scenario: GHG mitigation Soil volume reduction

Take home

- Soil carbon emissions inevitable and substantial
  - Relevant for all high TOC-soils but also large volume remediation
  - Uncertainty high
- Optimization potential limited
- Infrastructure needs at remote sites
- Long transportation distance
- Ecological destruction of areas high in ecosystem services

- → more holistic assessments!
  - With new legislation, x 2-3 times the impacts

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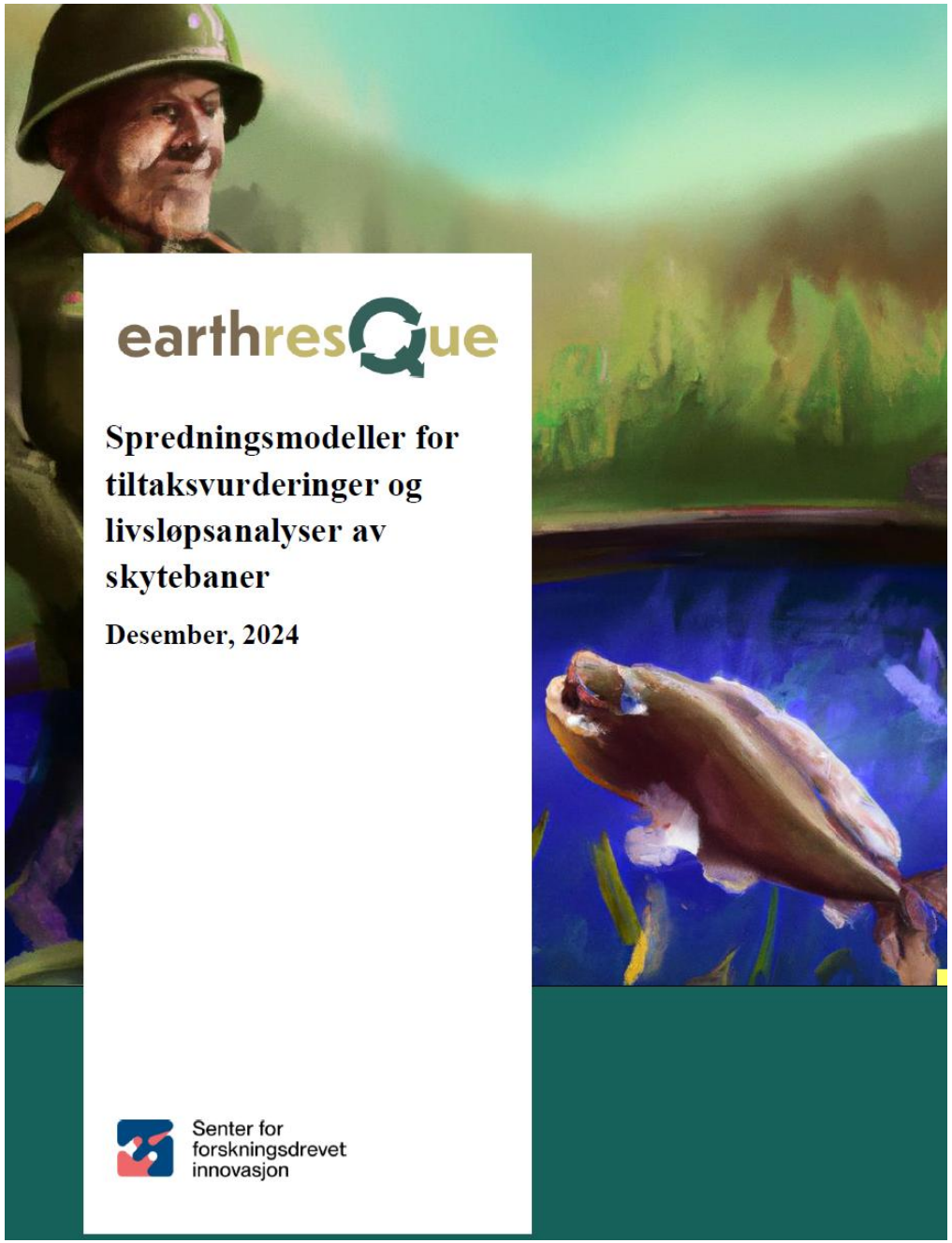
Videre arbeid

Komparativ LCA-studie av ulike tiltaksløsninger
Hva er betydningen avnøkkelparametre mot satt opprydningsnivå?



Spredningsmodeller for tiltaksvurderinger og livsløpsanalyser av skytebaner earthresQue Report no. 14 ISBN: 978-82-575-2993-2

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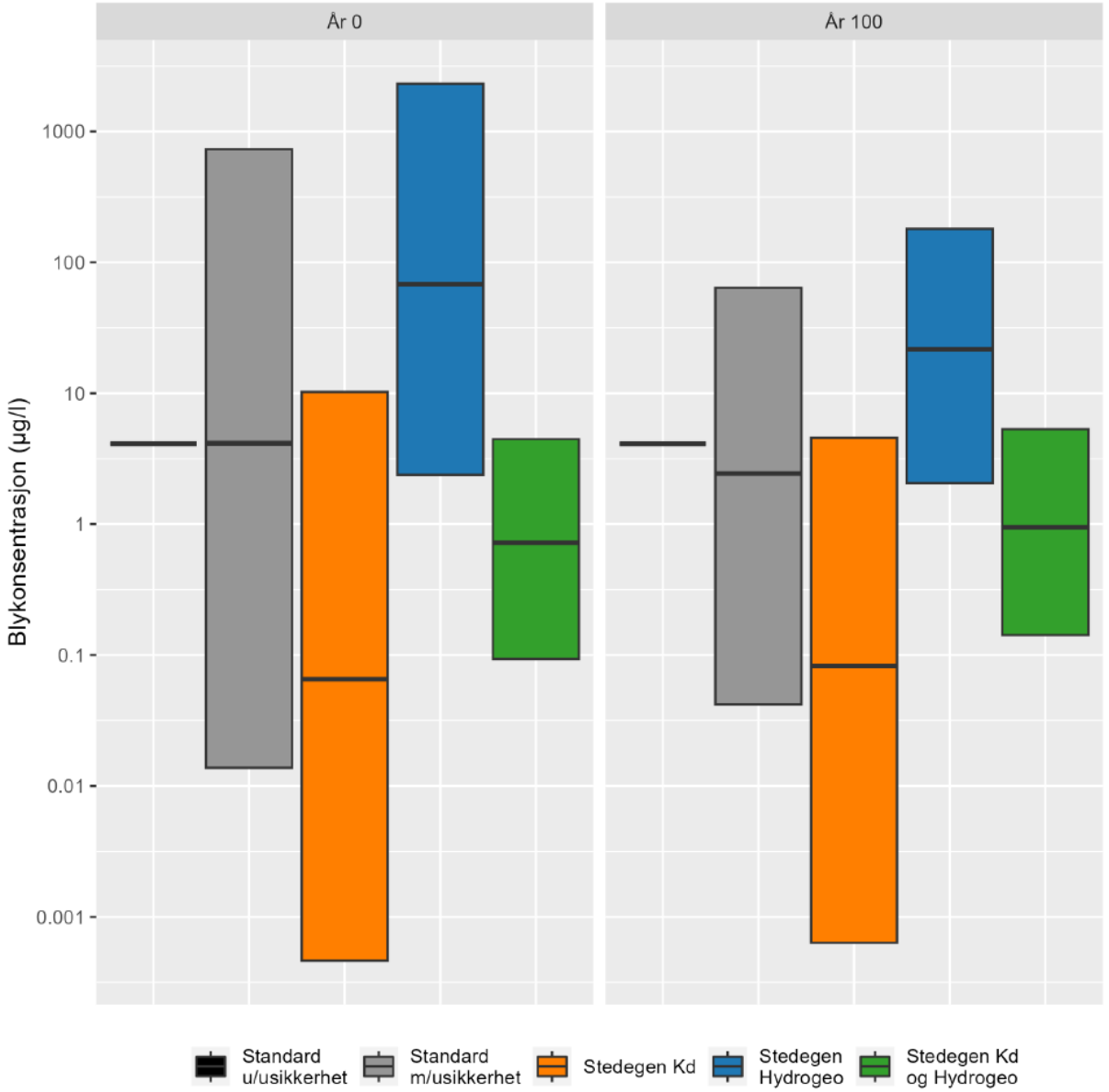
Betydning av spredningsmodell?

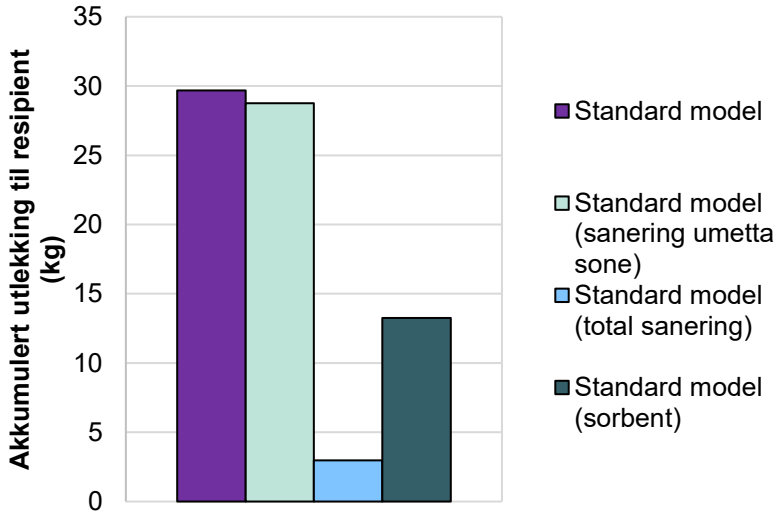


For å kunne vurdere spredning av bly fra skytebaner anlagt på myr ble hydrogeologi og bindingsestimater (K_d-verdier) i Miljødirektoratets spredningsmodell tilpasset. Figuren viser estimert resipientkonsentrasjon nedstrøms en skytebane. Størrelsen på boksene viser variasjonen mellom de 50% midtre estimatene (interkvartil avstanden) fra Monte Carlo simuleringer.

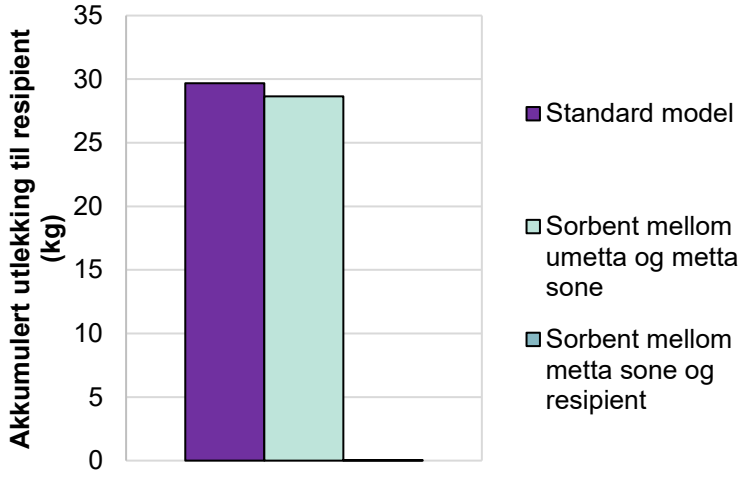
Tiltaksrettet kartlegging av jord og vann ved Skyte-og øvingsfelt. Tiltaks-og Risikovurderinger av Forurenset Grunn og Vann ved Skytebaner. Norges geotekniske instiutt. DOK.NR.20200360-01-R

Modellerte stoffmengder til resipient

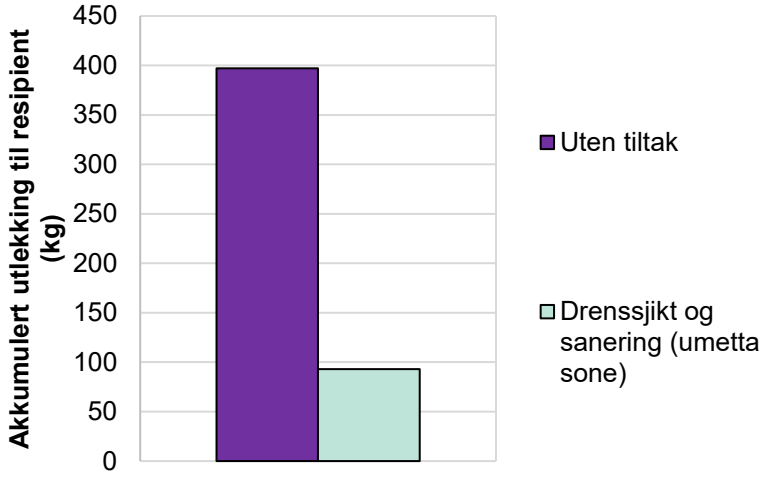
Oppgraving av kulefang + myra



Sorbentsjikt



Innkapsling av myr med grus



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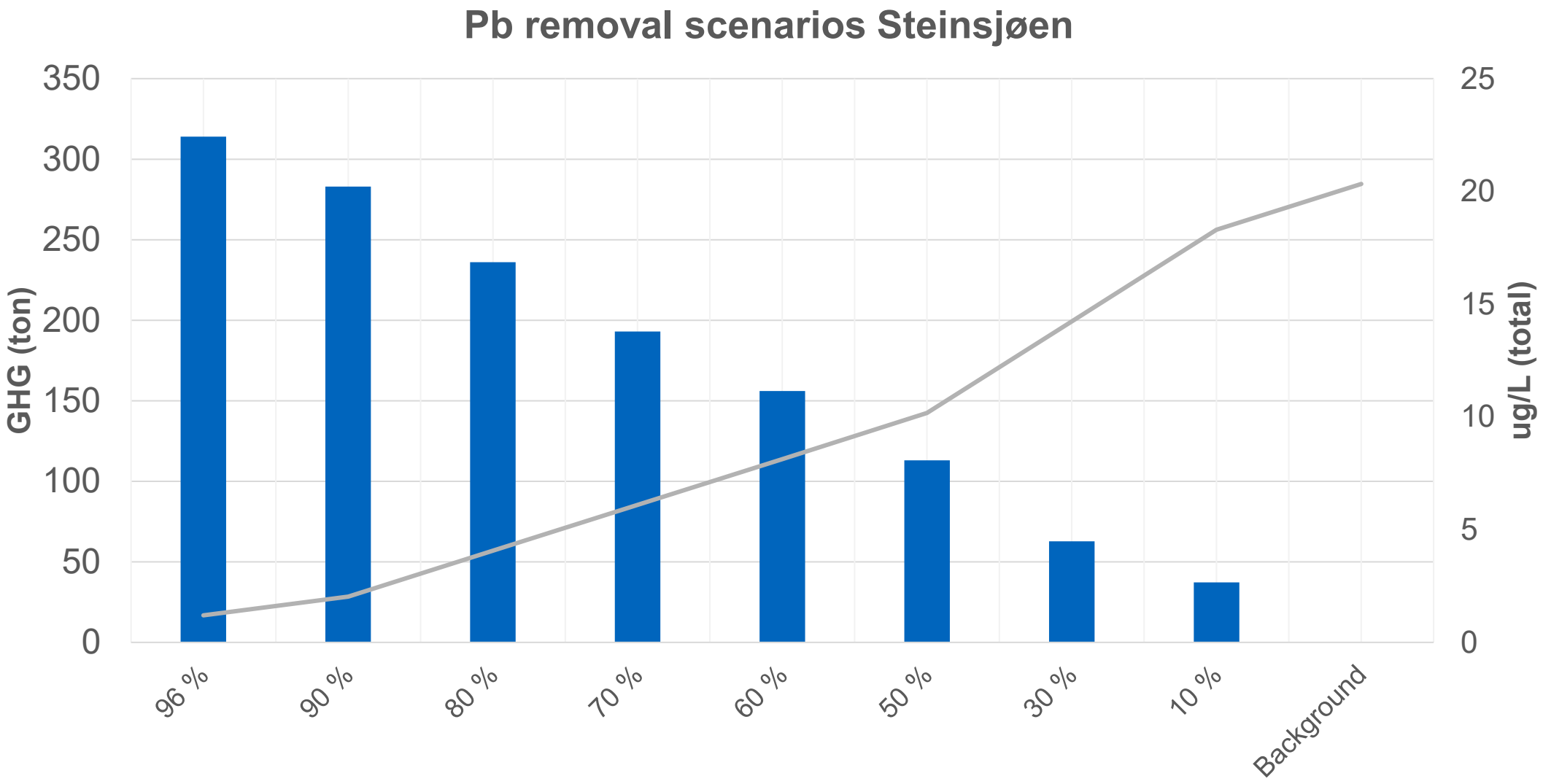
Pb removal scenarios Steinsjøen
GHG (ton)
ug/L (total)
350
300
250
200
150
100
50
0
25
20
15
10
5
0
96 %
90 %
80 %
70 %
60 %
50 %
30 %
10 %
Background

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Vi gjør kunnskap og ideer til et effektivt forsvar