

Unlocking subsurface potentials

Geosystem services for more informed and sustainable planning

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EGU 2026, Session

Under

The planning challenge: a rich but invisible subsurface

- The subsurface – not just risks, but also a multifunctional resource
- The subsurface is invisible (or at least less visible)
- The “first come, first served” principle is common
- Increasing demands and more potential conflicts
- Lack of a holistic perspective – the subsurface is managed in different sectors
- **Subsurface data is rarely translated into a form that connects to planning language**

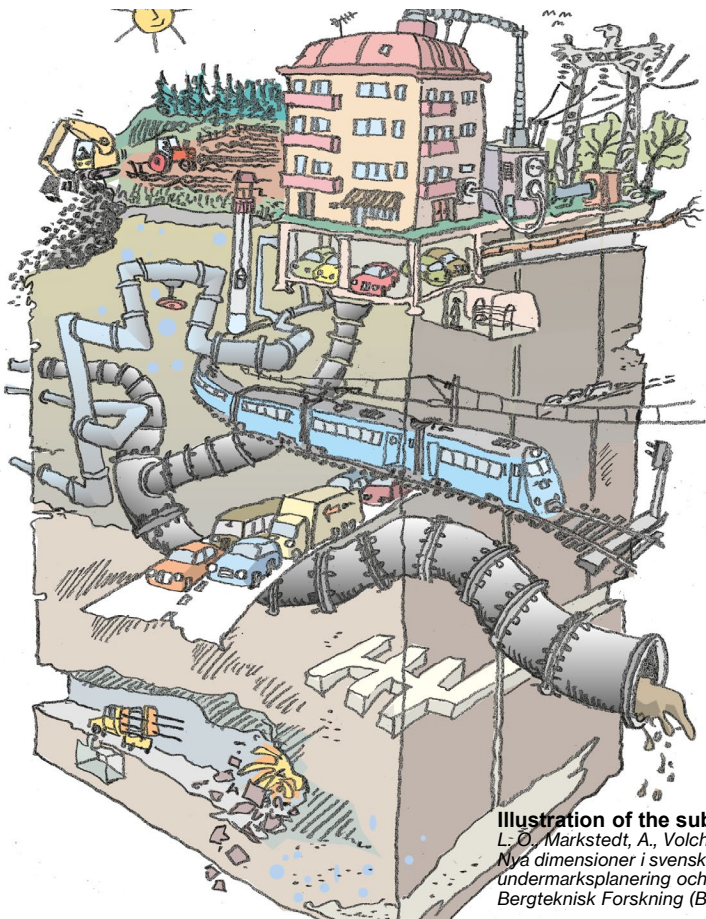
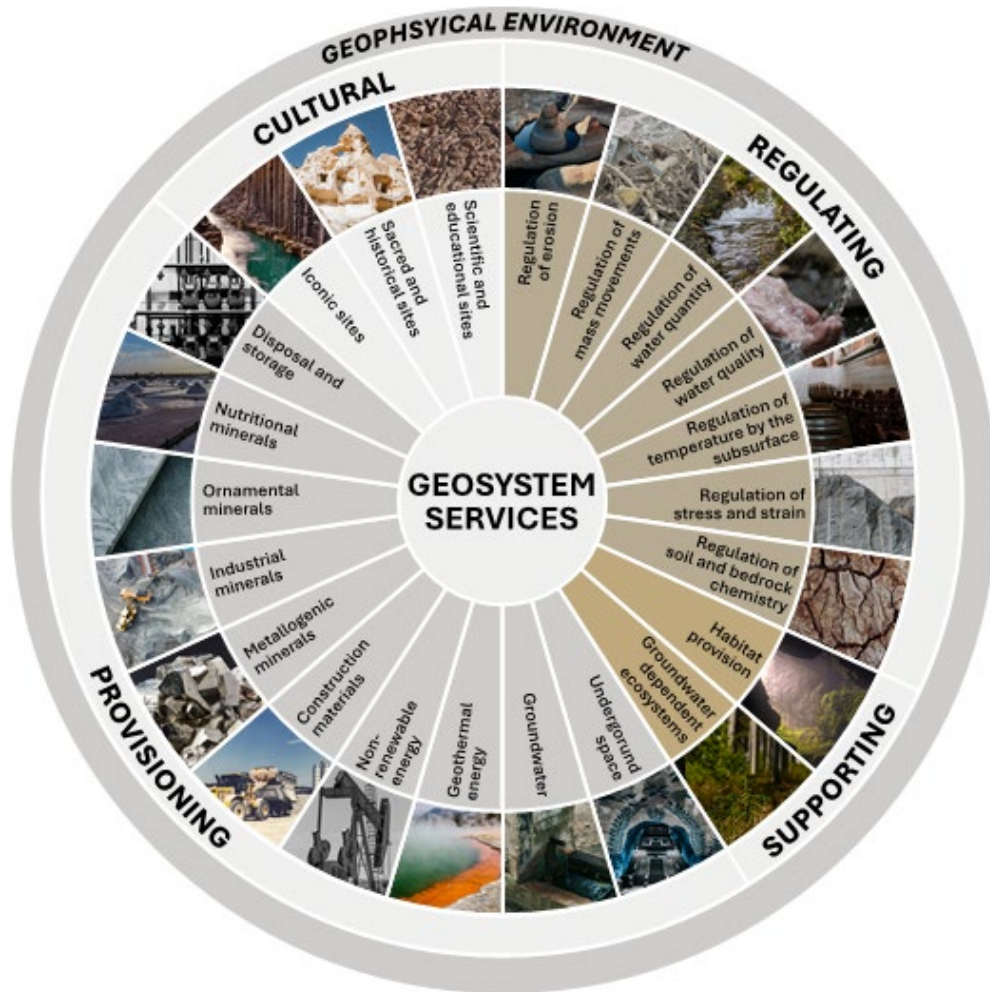


Illustration of the subsurface. From: Norrman, J., Ericsson, L., Ö. Markstedt, A., Volchko, Y., Nilsson, K. L., & Sjöholm, J. (2020). *Nya dimensioner i svensk planering: en utredning om undermarksplanering och geosystemtjänster*. Stiftelsen Bergteknisk Forskning (BeFo).



Geosystem services – a bridging concept between geology and planning

One definition...

“goods and services provided by the subsurface that contribute to human well-being”

Picture by Emrik Lundin Frisk. Vidareutveckling av figur från Lundin-Frisk, Emrik (2023). Geosystem services to support decisions on subsurface use (Chalmers University of Technology: 2023:1) [Licentiate thesis, Chalmers University of Technology]. Chalmers University Publications Electronic Archive

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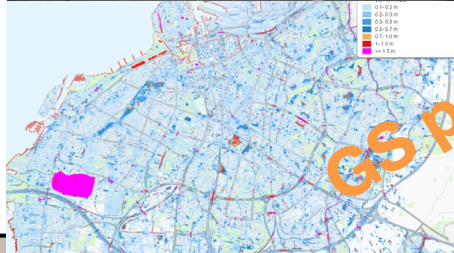
Geosystem services underneath for sustainable communities and improved spatial planning practices

Towards implementation

Same concept, different planning contexts, different applications

Malmö

Climate adaptation
planning



GS potential maps

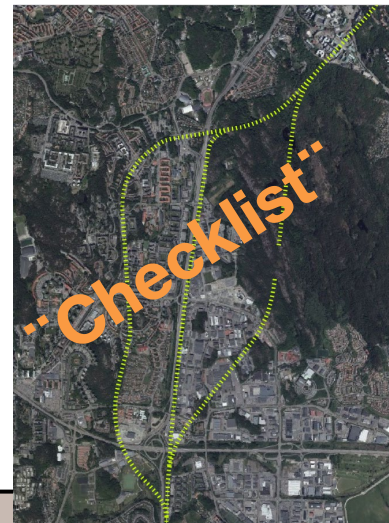
Askersund

Comprehensive
planning



Gothenburg

Future tunnel corridor
selection

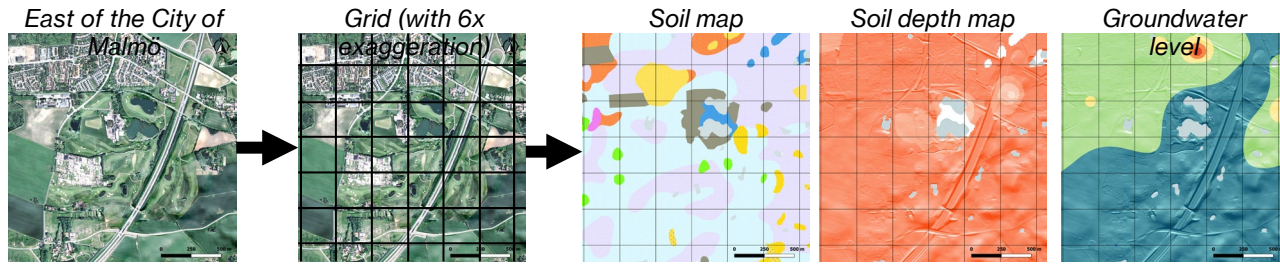


„checklist“



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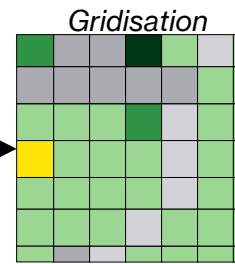
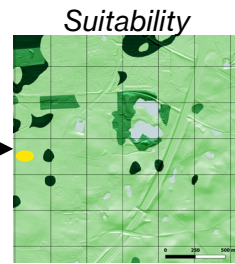
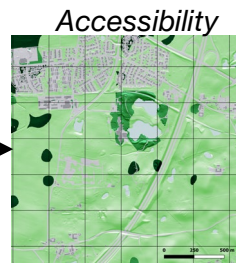
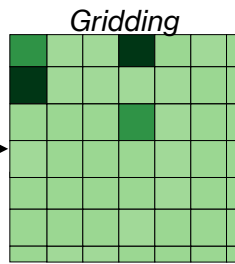
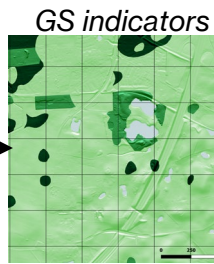
Development of indicators and GS potential maps



Study site selection

Superimposing grid

'Geophysical environment'



Translation to potential via indicators

Accessibility assessment

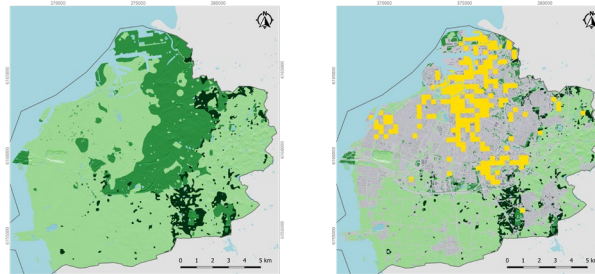
Suitability assessment

Aggregated assessment



Use of the subsurface to infiltrate and retain stormwater

Geosystem service potential



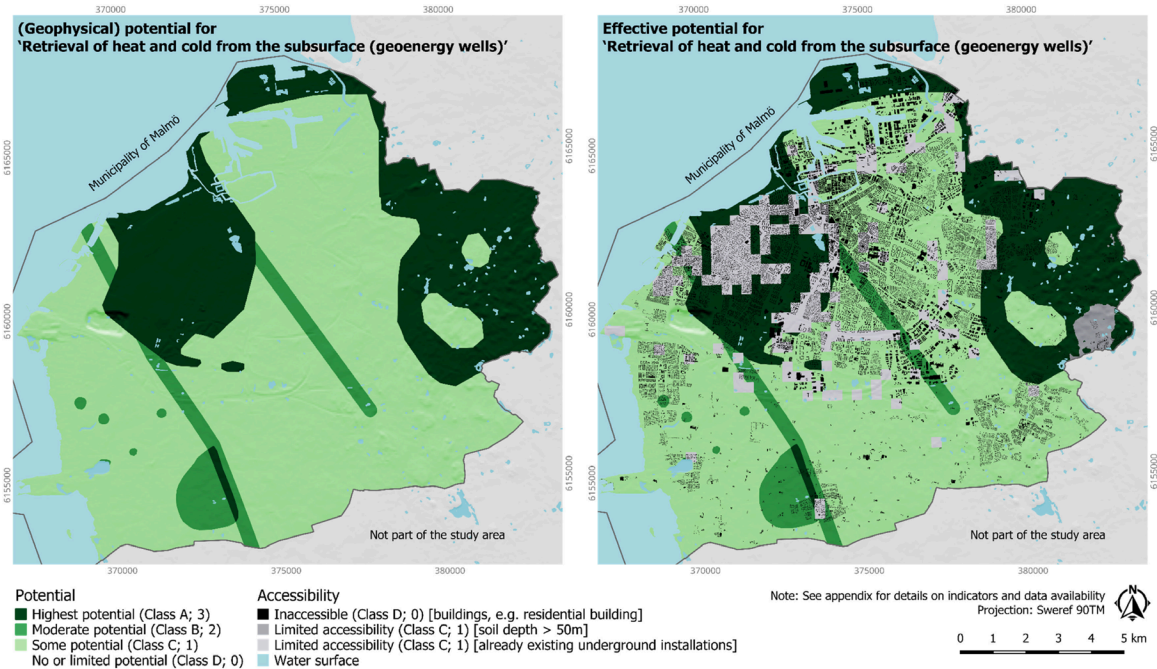
Effective potential

- Highest potential (3)
- Moderate potential (2)
- Some potential (1)
- No or limited potential
- Potentially contaminated site (0)
- No accessibility (0) [e.g. residential building]
- Limited accessibility (1) [e.g. impervious surfaces]

Malmö: revealing hidden subsurface capacity for climate adaptation

Selected GS

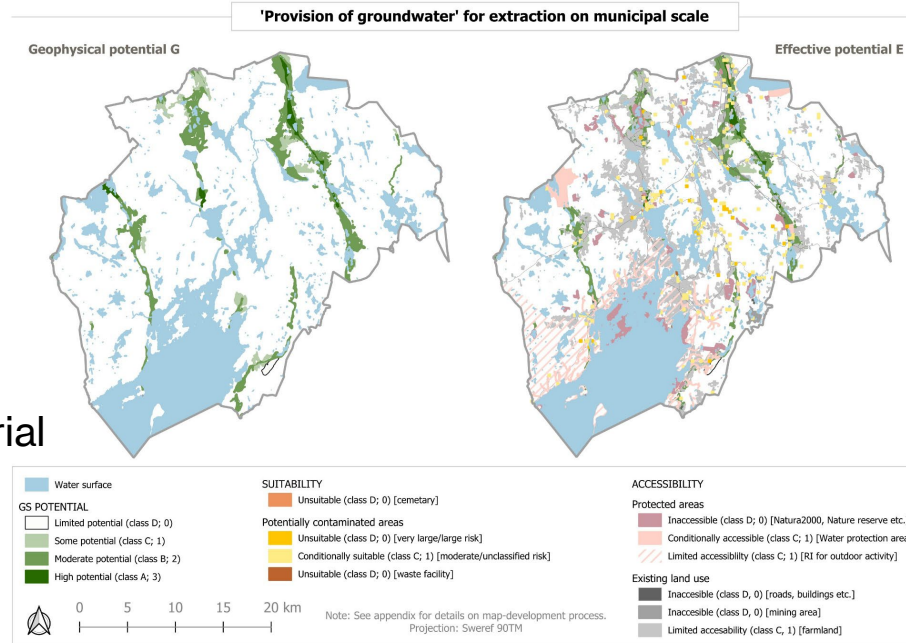
- Stormwater infiltration & retention
- Shallow and deep underground space
- Resistance to coastal erosion
- Access to construction material
- **Access to geo-energy**



Askersund: geosystem services in rural comprehensive planning

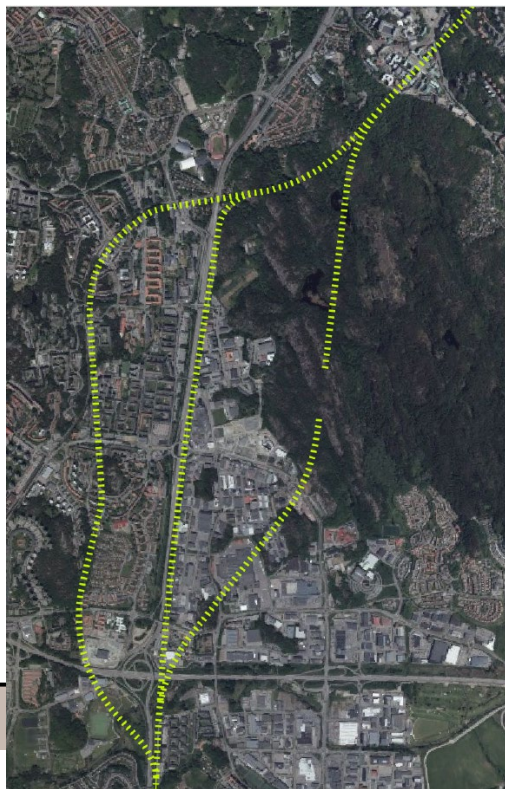
Selected GS:

- Infiltration & retention of stormwater
- Bearing capacity
- Resistance to erosion
- Provision of aggregate material
- **Provision of groundwater**
(on municipal scale)



Gustafsson, 2026

Gothenburg: avoiding unintended subsurface trade-offs



SUBSURFACE ASPECTS:

- Available space underground
- Available space on the ground
- Technical solutions / Construction methods
- Rock quality
- Working environment
- Energy wells
- Consequence of groundwater disturbance
- Stormwater management
- Historic geological locations

Bilaga 1 – Sammanställning av beaktade aspekter

ASPEKT	STRÄCKNING	Västra	Mitten	Östra	Geosystemjämnt
Framkomlighet för tunnelsträckning					UTRYMME
Framkomlighet för tunnelsträckning (fördyring, hinder som avhjälp)					
Framkomlighet söder om tunnelpåslag (fördyring, ej alternativskiljande)					
Framkomlighet i yttiga tunnellägen		ej aktuell		ej aktuell	
Teknisk byggbarhet under mark					BYGGBARHET & MILJÖ
Entreprenadberg/Entreprenadjord (avsättning/deponi)					
Arbetsmiljö (fördyring pga radon mm)					
Störning av befintliga energibrunnar			ej aktuell		RISK FÖR ÖMGIVNINGSPÅVERKAN
Störning av grundvattenmagasin som används för dricksvatten			ej aktuell		
Störningar av grundvattennivåer i undre akvifären med skada för ovanliggande grundläggning			ej aktuell		
Störning av grundvattenmagasin som leder till försämrade ekosystem					
Störning av grundvattenmagasin som i framtiden kan användas för dricksvatten			ej aktuell		FÖRSÄMRING AV FRAMTIDA POTENTIALER
Störning av möjlighet till storskaliga bergrum för exempelvis lagring			ej aktuell		
Grundvattenbildning					
Förnybar energi för enskilda hushåll			ej aktuell		GEOLOGISKT ARV
Reglering av dagvattenflöden		ej aktuell		ej aktuell	
Historiska platser av geologisk betydelse					



Under

What geosystem services add to spatial planning



GS provides

- A shared language
- Early identification of conflicts and opportunities
- Visibility of long-term subsurface potential

Works across

- Urban ↔ rural
- Strategy ↔ project level



Under



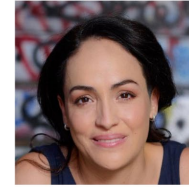
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Links:

[About the project & selected publications](#)

[Gustafsson's Master thesis](#)



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The UNDER team

Under

Geosystem services underneath for sustainable communities and improved spatial planning practices