



Impact analysis

Living on Soft Soils

Assessment of physical and economic impacts of land subsidence



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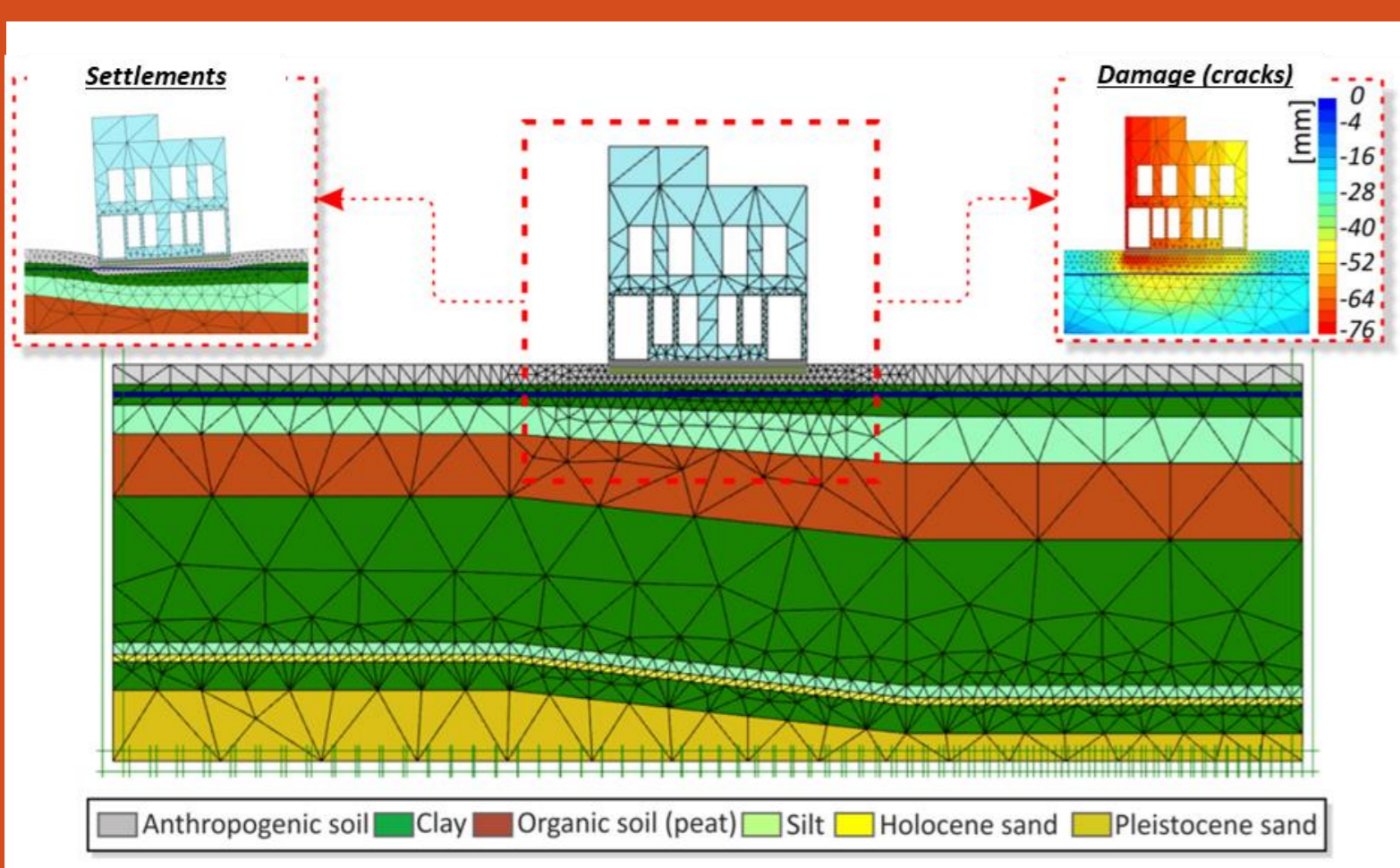


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Assessment of subsidence induced damage on masonry buildings

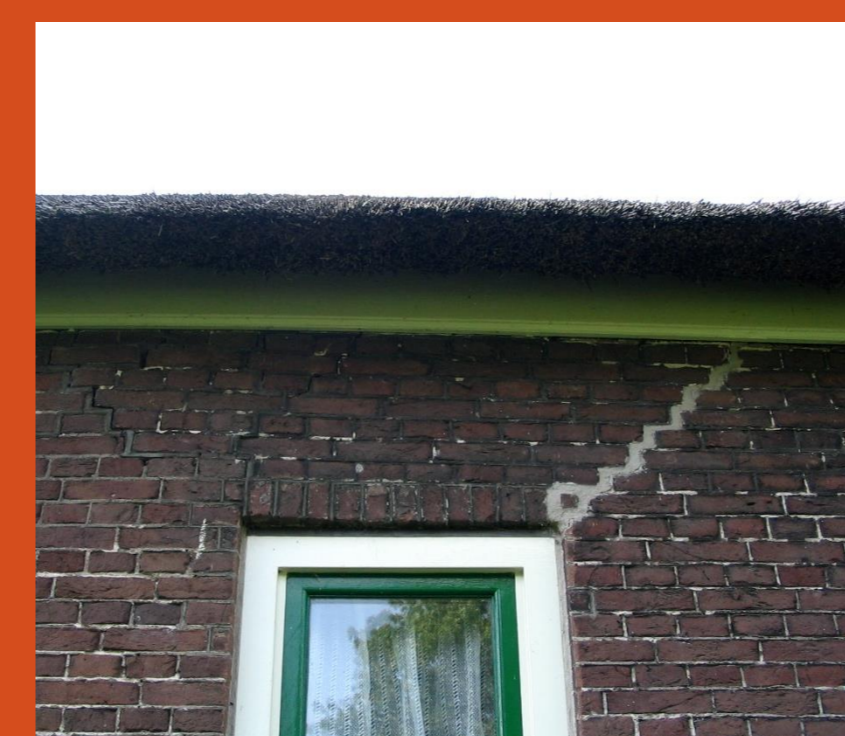
We aim to develop a reliable approach for the assessment of settlement-induced damage to the built environment due to land subsidence.



Modelling the influence of the soil variability on the damage of a house in subsiding conditions (Image: Prosperi, 2020).

Subsidence-related ground motions are significant in the Netherlands mainly due to the characteristics of the subsoil, characterized by the presence of peat and organic clay layers (soft soils). The settlements in a certain neighbourhood or area are highly influenced by the soil heterogeneities, the groundwater regime, and the loading conditions of the subsoil system, causing consolidation processes that can cause damage to houses and infrastructures. The purpose of this study is to improve the understanding of subsidence-related settlement occurrence and to be able to assess the influence of the variability in the soil system, the building characteristics and the groundwater regime.

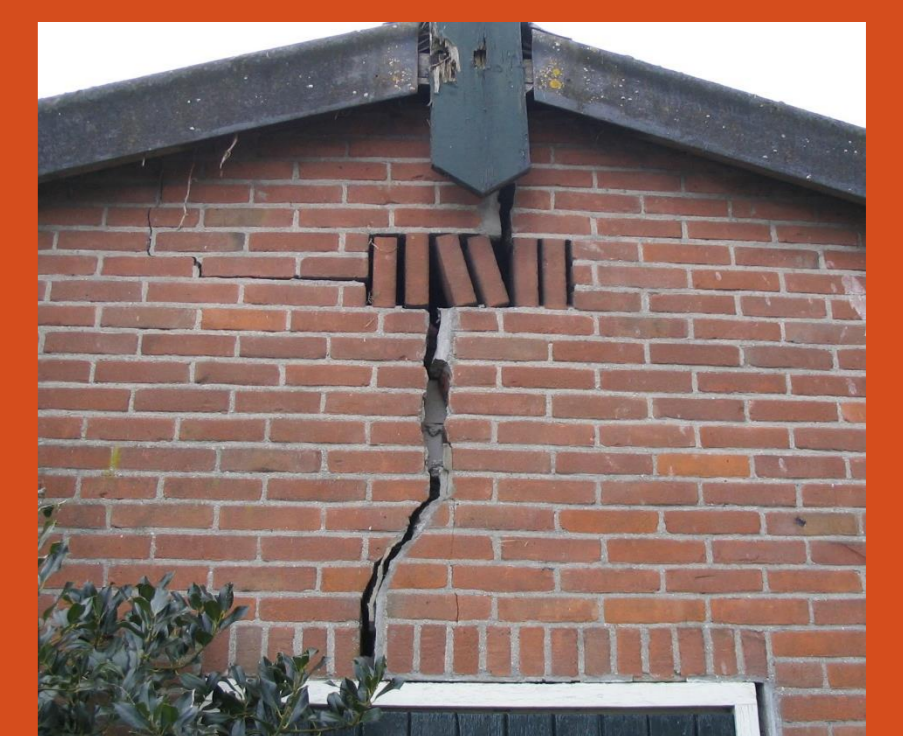
Types of damage on masonry structures



Aesthetic damage: cracks can be easily treated during maintenance works.



Functional damage: the functionality of doors, windows and underground service lines are affected.

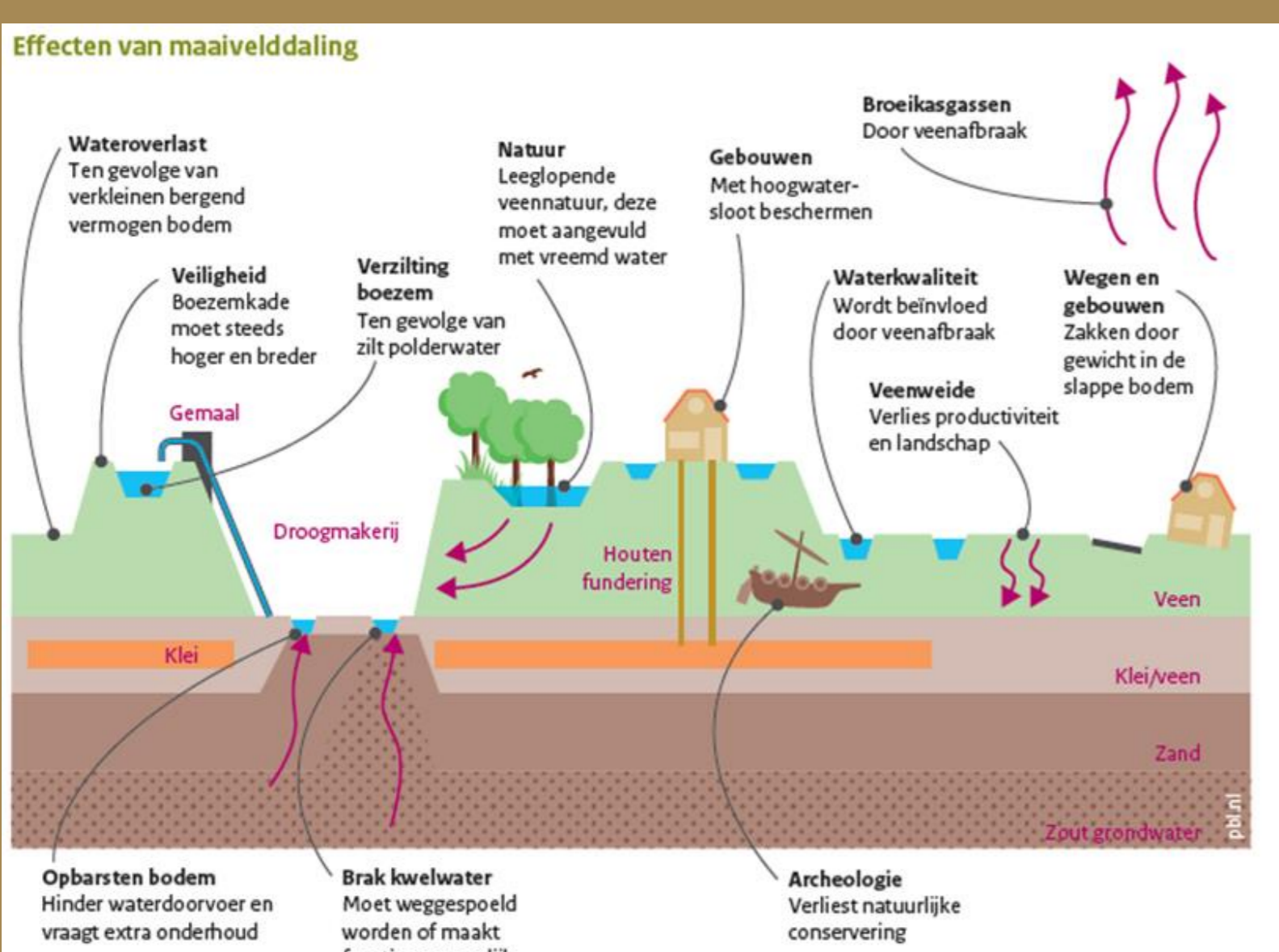


Structural damage: associated with a risk for the structural safety.

Uneven settlements associated with land subsidence processes may induce observable damage of different severity levels on structures. If not repaired, the damage may cumulate and increase overtime, threatening the safety and the value of (historical) masonry buildings.

Social Cost-Benefit Analysis of land subsidence mitigation

We aim to provide economic assessments of management and policy responses to land subsidence.



Overview of societal effects of land subsidence in the Dutch context which need to be taken into account in cost-benefit analysis. (Image: Van den Born et al., 2016)

Next to physical damages there are many other impacts of subsidence. Possible policy responses will be evaluated through Social Cost-Benefit Analysis (SCBA). We will assess the effects of policy alternatives such as water level adjustments, construction improvements, changing land use and institutional design alternatives such as taxes and compensatory regimes.

Different effects of subsidence need to be quantified and monetized. These include implementation costs, damages to the built environment, agricultural yield impacts, social and health risks, flood risks and impacts on nature conservation and GHG emissions. This project will also analyse the distribution of these effects between stakeholders and regions.

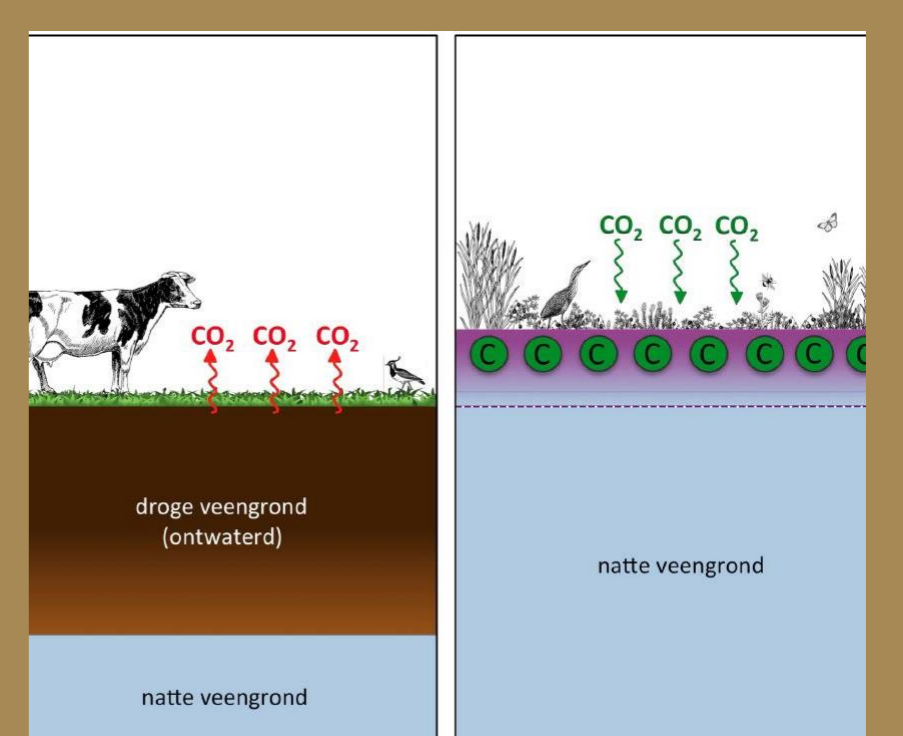
Quantifying and valuing societal damages of subsidence



Include both repair costs and loss of cultural heritage value (Image: iStock/Digital 21)



Include impact of measures on agricultural production levels (Image: Unie van waterschappen)



Monetize environmental effects such as carbon emission reductions (Image: van de Riet et al., 2014)

For proper comparison of alternatives, 4 types of effects need to be valued (Kok & Costa, 2021):

- Direct market effects, such as building repair costs
- Indirect market effects, such as loss of agricultural production
- Direct non-market effects, such as loss of cultural heritage
- Indirect non-market effects, such as health risks and biodiversity