Historical loss of groundwater-dependent terrestrial ecosystems in undrained and artificial drained landscapes in Denmark

Gasper L. Sechu[1], Bertel Nilsson[2], Bo V. Iversen[1], Mette B. Greve[1], and Mogens H. Greve[1]

[1]Aarhus Universitet Institut for Agrookologi
[2]De Nationale Geologiske Undersogelser for Danmark og Gronland

June 16, 2022

Abstract

Groundwater-dependent terrestrial ecosystems (GWDTE) have been increasingly under threat due to groundwater depletion globally. Within the past 200 years, there has been severe artificial drainage of low-lying areas in Denmark, leading to a gradual loss of GWDTE nature habitat areas. This study explores the spatial-temporal loss of Danish GWDTE using historically vectorized topographical maps. We carry out geographic information systems (GIS) overlap analysis between different historical topographic maps with signatures of GWDTE starting from the 19 th century up to a current river valley bottom map as a reference period. This is because farmworkers and monks have practiced drainage by ditching since the early middle ages (1100-1200). We then examine the changes in two protected GWDTE habitat types in different periods and different hydrologic spatial locations. Results reveal a decrease in the area of GWDTE over the last 200 years. We attribute this to different human interventions that through e.g., drainage, have impacted the low-lying landscape throughout history. We further conclude that downstream parts of the river network have been exposed to less GWDTE habitat loss than upstream ones. This indicates that upstream river valleys are more vulnerable to GWDTE decline. Therefore, as a management measure, caution should be exercised when designing these areas for agriculture activities using artificial drainage and groundwater abstraction since this may lead to further decline. In contrast, there is a higher potential for establishing constructed wetlands or rewetting peatlands to restore balance.

Hosted file

`Manuscript.docx` available at https://authorea.com/users/489533/articles/573219-historical-loss-of-groundwater-dependent-terrestrial-ecosystems-in-undrained-and-artificial-drained-landscapes-in-denmark