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Research article

Explorative analysis of depth-to-water index in identifying rewettable agricultural peat soils

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ABSTRACT

Functional tools to implement peatland rewetting are essential to mitigate the negative environmental impacts of drained organic soils. Soil moisture indexes have been used to identify wet areas in forests but they have been applied to a lesser extent in agricultural areas. This research explores the potential of the depth-to-water index (DTW) to identify rewettable peat soils in agricultural areas and estimates the national rewetting potential of cultivated peat soils in Finland. We used water table level (WTL) measurements from five rewetted sites, combined with an analysis of the surrounding terrain, to assess the suitability of the index. The evaluation of DTW index maps in relation to observed WTL suggests that the DTW index has potential for predicting the suitability of specific field parcels for rewetting if the water flow can be modelled correctly. Using this approach, we identified 135,000 ha of Finnish cultivated peat soils that could be best suitable for rewetting. The method requires development particularly concerning input data. Lack of digital data on ditches in agricultural areas and their intersections with roads can lead to incorrect water flow modelling, resulting in over- or underestimation of mean DTW values for field parcels. Including the effects of existing agricultural drainage systems into the index calculation could improve accuracy, making it a more precise tool for authorities to target rewetting measures. Also, the position of the site within the watershed and the surrounding land use and drainage influence the rewetting success. Prioritising rewetting of large contiguous areas likely leads to better outcomes for biodiversity and climate mitigation, but rewetting single field parcels can also succeed if the surrounding terrain supports it.

1. Introduction

Peatlands and other organic soils are known as a globally significant carbon store (Frolking et al., 2011; Bonn et al., 2016). Draining them for human purposes predisposes the accumulated organic matter to oxygen leading to aerobic conditions, reduction of the carbon stock and gaseous emissions into the atmosphere. The gases formed and released are mainly carbon dioxide (CO_2) and nitrous oxide (N_2O) (Frolking et al., 2011; Kasimir-Klemedtsson et al., 1997), and agricultural practices like tillage and fertilisation intensify these emissions (Maljanen et al., 2010). Consequently, agricultural organic soils are known as a major greenhouse gas source in Northern Europe (Giersbergen et al., 2024; Statistics Finland, 2024). In Finland, like in many other European countries, the carbon sink of forests has diminished (Korosuo et al., 2023), and it is urgent to find ways to improve the carbon balance of the land use sector. About one tenth of the total agricultural land area of Finland are drained peatlands (Kekkonen et al., 2019) and according to Finland's National Inventory Document (Statistics Finland, 2024) this area emitted over 9 Mt carbon dioxide equivalents when both CO_2 emissions from the reporting sector Land Use, Land use Change and Forestry and N_2O from the sector Agriculture are counted for (Statistics Finland, 2024). Emissions from cultivated peat soils are much greater than the total emissions from the sector Agriculture in Finland and reducing their emissions would both strengthen the net sink of the land use sector and diminish the total emissions of Finland remarkably.

Rewetting restores the hydrological functioning of a peatland. As the purpose of rewetting is to reverse the effects caused by drainage, it will also have physical effects to peat (Dinesen and Hahn, 2019). Although rewetted ecosystems likely differ from natural peatlands (Kreyling et al., 2021) rewetting is an effective way to prevent CO_2 and N_2O emissions and to increase biodiversity (Bianchi et al., 2021; Schrier-Uijl et al.,

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2014; Renou-Wilson et al., 2019) especially of plants, birds and insects (Martens et al., 2023). Rewetting and restoration of peatlands can lead to them being a source of methane (Renou-Wilson et al., 2019), but methane emissions in general do not compromise the climate benefits obtained by reducing CO_2 and N_2O emissions (Günther et al., 2020). Current climate policies aim to mitigate greenhouse gas (GHG) emissions in all economic sectors, and in agriculture and land use sector peatlands and their rewetting are seen one of the most efficient mitigation measures (Freibauer et al., 2004). The need to set clear targets for policies and effective management practises for wetlands, and applying knowledge about location, size and type of peatland has been noted decades ago (Turner et al., 1998), and large-scale implementation is slowly proceeding. Also the Nature Restoration Regulation of the EU (EU 2024) has set clear targets for rewetting peat soils.

Hydrological conditions, largely defined by topography, as well as origin and volume of water control the water table level on pristine peat soils (Price et al., 2003), but in agricultural peat layered fields artificial drainage is the main controller of water table level. However, it has been found in practice that merely blocking the drains may not lead to successful rewetting as it may be hampered by insufficient or unstable supply of water resources (Price et al., 2003) or unfavourable position in relation to drained areas in the surrounding terrain (Kløve et al., 2017). Thus, targeting rewetting efficiently requires that the most suitable areas for rewetting are identified. Topography is an essential factor in determining wet areas, as water tends to move and accumulate as an outcome of gravitational potential energy (Murphy et al., 2009). Topographic attributes can be used to describe spatial variability of hydrological processes occurring in the landscape (Moore et al., 1991) and recent geographic information system (GIS) tools based on topography and hydrology might facilitate efficient allocation of rewetting measures.

Moisture indexes, such as soil wetness index (SWI) or depth-to-water index (DTW) (Murphy et al., 2007, 2009) have been developed to predict terrain soil moisture variability. The indexes can be used to locate areas where water accumulates due to elevation variability and the stream network. Low DTW index values indicate areas which have higher possibilities to receive surface water throughout most time of the year. Wetness indexes based on topography generally vary in their ability to predict soil moisture both spatially and temporally. Murphy et al. (2009) evaluated the suitability of SWI and DTW indexes for soil moisture determination and concluded that the DTW model can have potential in agricultural and forestry applications. Ågren et al. (2014) also compared different indexes and concluded that DTW index is currently the most useful tool for mapping wet areas. DTW index indicates the differences of calculated water level in stream network defined based on certain flow accumulation threshold and expresses this for each location as depth to water below soil surface in meters (Murphy et al., 2007). Areas with the DTW index values less than 1 m can generally be considered wet (Ring et al., 2020; White et al., 2012). In small scale studies, the index can be optimized to the focused area, but challenges may occur when it is used at the scale of country or other large area. Methodological development may be needed as the of DTW have so far mainly focused on pristine lands, whereas its use in intensively managed systems such as drained agricultural peat fields may require modifications of the calculation method (Murphy et al., 2007, 2009; Kemppinen et al., 2018; Riihimäki et al., 2021; Hoffmann et al., 2022; Heppelmann et al., 2022).

The objectives of this study were 1) to investigate if DTW could be used to identify field parcels suitable for rewetting and 2) to quantify the rewetting potential of Finnish agricultural peatlands. We connected DTW index with the field plot register and Finnish soil database and evaluated the hydrological rewetting potential of each field plot based on the average value of its DTW index. We examined DTW results together with actual continuous measurements of water table level (WTL) at five rewetted sites and discuss ways to improve the calculation of DTW index to make it more suitable for agricultural peatlands.

2. Material and methods

2.1. Country scale application of DTW index for identifying rewetting potential

To locate agricultural areas most suitable for rewetting, we connected the DTW index representing average end-of-summer conditions (Ågren et al., 2014) calculated with a 4 ha flow accumulation threshold with Finnish Soil Database and field plot register which is a register that contains the spatial information of cultivated field areas (Table 1). We calculated mean DTW index value for each field parcel and used field plot area and spatial information for determining surface areas of peat soils on agricultural land. An area was classified peat if the soil type was Dystric Histosol or Sapric Histosol and if the peat layer was ≥30 cm in the Soil database. We included all peat soil areas located on field plots even if the whole plot was not peat. We chose to use the 4 ha threshold value for mean DTW calculation (Salmivaara, 2020) to ensure that the selected areas would be wet also during the drier conditions of mid-summer with limited water reservoirs. We used mean DTW value of ≤0.5 m as the criterion of rewettability. We identified field plots which potentially contained rewettable peat and defined the distribution of such like field parcels nationally, as well as the total area of agricultural peat soils with DTW ≤0.5 m. The 0.5 m threshold is stricter compared to previous studies as generally DTW index values up to 1 m are considered to represent wet circumstances (Murphy et al., 2007; Salmivaara, 2020). We chose to use a stricter value as the criterion of rewettability than suggested by the published studies on forest areas as rewetting of agricultural areas is more challenging in Finnish conditions due to the surrounding activities like forest drainage. to ensure that the areas are most likely the wettest areas with most potential water sources and their conditions would be most favourable for rewetting.

2.2. Evaluation of the DTW index for identifying rewetting potential

In order to evaluate whether the calculated mean DTW index is able to predict areas where it is easy to raise the WTL, we gathered WTL data from five field sites which were recently rewetted. We rated the success of the rewetting based on the latest available yearly WTL measurements and compared the rewetting outcome to the mean DTW index of the field plot. In this study we considered that rewetting was succeeded if it resulted to most likely too poor bearing capacity for conventional agricultural machines to operate on field and the aerial conditions of topsoil layer would not be optimal for conventional agricultural crops.

Table 1
Overview of the data used and its availability.

Name of used data	Year	Data availability
Field parcel register[a]	2022	Open
Depth-to-Water index of Finland (4 ha threshold)[b]	2019	Open
Finnish Soil Database (sediment polygons)[c]	2010	Open
Background map of Finland[d]	2022	Open
The Finnish River basin system: Level 5 data of catchment areas[e]	2023	Open
Topographic Database: Water area boundary line[f]	2023	Open

[a] Finnish Food Authority; https://www.ruokavirasto.fi/en/about-us/published-datasets/spatial-data-sets/; CC BY 4.0.
[b] Natural Resources Institute Finland; https://paituli.csc.fi/download.html?data_id=luke_dtw040_2m_2019_tif_euref; CC BY 4.0.
[c] Natural Resources Institute Finland; http://paikkatiedot.fi/so/1000236.
[d] National land survey of Finland; https://www.maanmittauslaitos.fi/en/maps-and-spatial-data/datasets-and-interfaces/product-descriptions/background-map-series-raster; CC BY 4.0
[e] Finnish Environment Institute; https://ckan.ymparisto.fi/dataset/valuma-aluejako ; CC BY 4.0.
[f] National Land Survey of Finland; https://asiointi.maanmittauslaitos.fi/karttapaikka/tiedostopalvelu?lang=en ; CC BY 4.0.

The rewetted field sites were located throughout Finland (Table 2, Fig. 1). The landowners determined their suitability for rewetting with drainage specialists, and DTW index was not considered when these sites were selected for rewetting. Some sites were established only on a small part of the field plot, especially if the original plot was large. All rewetted areas were shifted from conventional agriculture to paludiculture (Ziegler, 2020). Only one site (Field 1) had a sub-surface drainage system and there the water outflow was restricted by adjustable control wells. All other sites had open ditches and rewetting was carried out with pipe dams.

The WTL was measured with HOBO Water Level data loggers (Onset Computer Corp., Bourne, MA, United States). One logger was installed in a monitoring pipe (depth 100 cm) at each site for continuous water level monitoring with a sampling rate of half an hour. Location of the pipe at the site was selected to be as representative as possible from rewetted area if whole field plot was not rewetted. Also, one data logger was set to measure air pressure close to the WTL monitoring pipe to exclude air pressure effect on water level measurements as the logger in the monitoring pipe measures the total pressure including water and air pressure.

Hourly timeseries of WTL were constructed by linear interpolation for each monitoring pipe. Gaps resulting from the logger being out of the monitoring pipe due to logger reading or cultivation practices were filled with linear interpolation. Some of the observations were clearly erroneous, most likely due to freezing or random error source in air pressure measurements. This effect is not typical, but for example dirt can interfere the sensors, so disturbing effect of ice cannot be ruled out. Unexpected variations in water level were investigated and data removed if a change more than 10 cm in 1 h was observed. This led to removal of 0–4 datapoints from the annual dataset of each rewetted site. Annual mean WTL was calculated as a mean of the hourly values.

The five rewetted field plots were explored at catchment level to identify factors influencing the prediction of rewetting potential with DTW index. Finnish river basin system data and Topographic Database (Table 1) were utilised for exploration of surrounding areas of the rewetted sites the damming plans and neighbouring field plots to understand local differences between the sites. The river basin system was used to determine where the field was located relative to catchment area, whereas the Topographic database was used mainly to explore ditches.

3. Results and discussion

3.1. Country scale application: rewetting potential across Finland

Using the criterion of less or equal to 0.5 m mean DTW index of field plot, we found ca. 135,000 ha of agricultural peatland area best suitable for rewetting (Fig. 2). This is about half of the current 281,000 ha of cultivated organic soils in Finland (Statistics Finland, 2024). On average the mean DTW index per peat field plot was 0.62 m (median 0.48 m) (Fig. 3). The mean for peat soils was clearly lower than the mean for all field plots including minerals soils (1.11 m).

Municipalities with the largest areas of potentially rewettable agricultural fields were located mainly in western Finland (Fig. 2), coinciding with the areas of high density of cultivated peat soils that are located mostly in western and northern Finland (Kekkonen et al., 2019). We did not consider the current crop or cultivation intensity on these fields but as potential field areas for rewetting seem to concentrate on certain areas, the regional profile of agricultural practices is also worth of considering when targeting actions. We used relatively strict criteria in this exploration, but it is possible to change these criteria with evident implications on the results.

It has been recognised that rewetting is a more efficient measure to reduce GHG emissions or increase biodiversity than for example afforestation or grass cultivation of peat soils (Jurasinski et al., 2024; Kekkonen et al., 2025). These results offer an opportunity for planning rewetting locally, e.g. in the framework of the Nature Restoration Regulation of the EU that requires rewetting of more than 40,000 ha of cultivated peat soils in Finland by 2050 (EU 2024). Not only the Restoration Regulation but also national policies such as the Climate Act (Ministry of the Environment, 2022) outline climate reductions and rewetting of peat soils is mentioned in national climate plans (Silfver et al., 2024).

3.2. Evaluation of the identification of rewetting potential and exploration development needs by site

Of the five research field plots, Fields 1, 3 and 4 had mean DTW value below 0.5 m (Table 2). Two of those plots were successful in rewetting as their measured WTLs were 0.12 m (Field 3) and 0.14 m (Field 4), corresponding to their low mean DTW values of 0.20 m and 0.18 m, respectively. Rainwater was the supposed main source of water on all plots, and the WTL varied largely within the year (Fig. 4). Seasonal variation can be even greater in the future, as evapotranspiration is predicted to increase during the growing seasons due to climate change (Peltonen-Sainio et al., 2021) but yearly precipitation can increase (Ylhäisi et al., 2010) especially during winter (Ylhäisi et al., 2010; Jylhä et al., 2009). Thus, it may be more difficult to avoid lowering of the WTL in summertime but potentially easier to retain rainwater and meltwater from snow in the future.

Both successfully rewetted field plots had open ditches, but they were not deep or recently maintained. Furthermore, the surrounding areas included natural peatland or forest land, and favourable topography and position in the catchment ensured sufficient water reserves for rewetting (Fig. 5). Accumulation of water to specific area is related to position of the site in the catchment as the size of the above drainage area influences the amount of available water that can accumulate to the site (Pinhati et al., 2020).

Rewetting of the southernmost plot, Field 1 (Fig. 5, left), failed even though the DTW index was low (0.23 m) and spatial variation of DTW within the plot was moderate (Table 2, Fig. 5, left). Reaching the target WTL of −20 cm turned out to be impossible, although this field plot was problematic due to wetness even before rewetting. Closer examination of Field 1 revealed that its location in the catchment should have been favourable (Fig. 1) as it located in the lower part of the 14,800-ha catchment. However, the rewetted plot was surrounded by large collector drains and other well-drained field plots (Fig. 5) and a deep ditch was dug to the south-west side of the rewetted site to protect the adjacent plot from rewetting. As the surrounding areas were efficiently drained, mere rainwater gathering to the site was not enough to raise water table levels. Water flow direction of this area was towards the northern corner of the field plot (Fig. 5). As there were several factors restricting water accumulation, rewetting several field plots would

Table 2
Characteristics of the rewetted sites and success of rewetting as related to the DTW index.

Field	Site name	Field area (ha)	Rewetted (ha)	Mean DTW (m)	WTL follow-up time	Mean WTL (m)	DTW vs. WTL
1	Konnunsuo	14	7.2	0.23	Oct22-Sep23	0.51	Low DTW; not successful
2	Inganneva	28	10	0.87	Oct21-Sep22	0.56	High DTW; not successful
3	Veneheitto	24	1.2	0.20	Sep22-Aug23	0.12	Low DTW; successful
4	Särkelä	1.3	0.5	0.18	Jun22-May23	0.14	Low DTW; successful
5	Alavieska	3.3	3.3	1.04	Jun23-Sep23	0.35	High DTW; successful

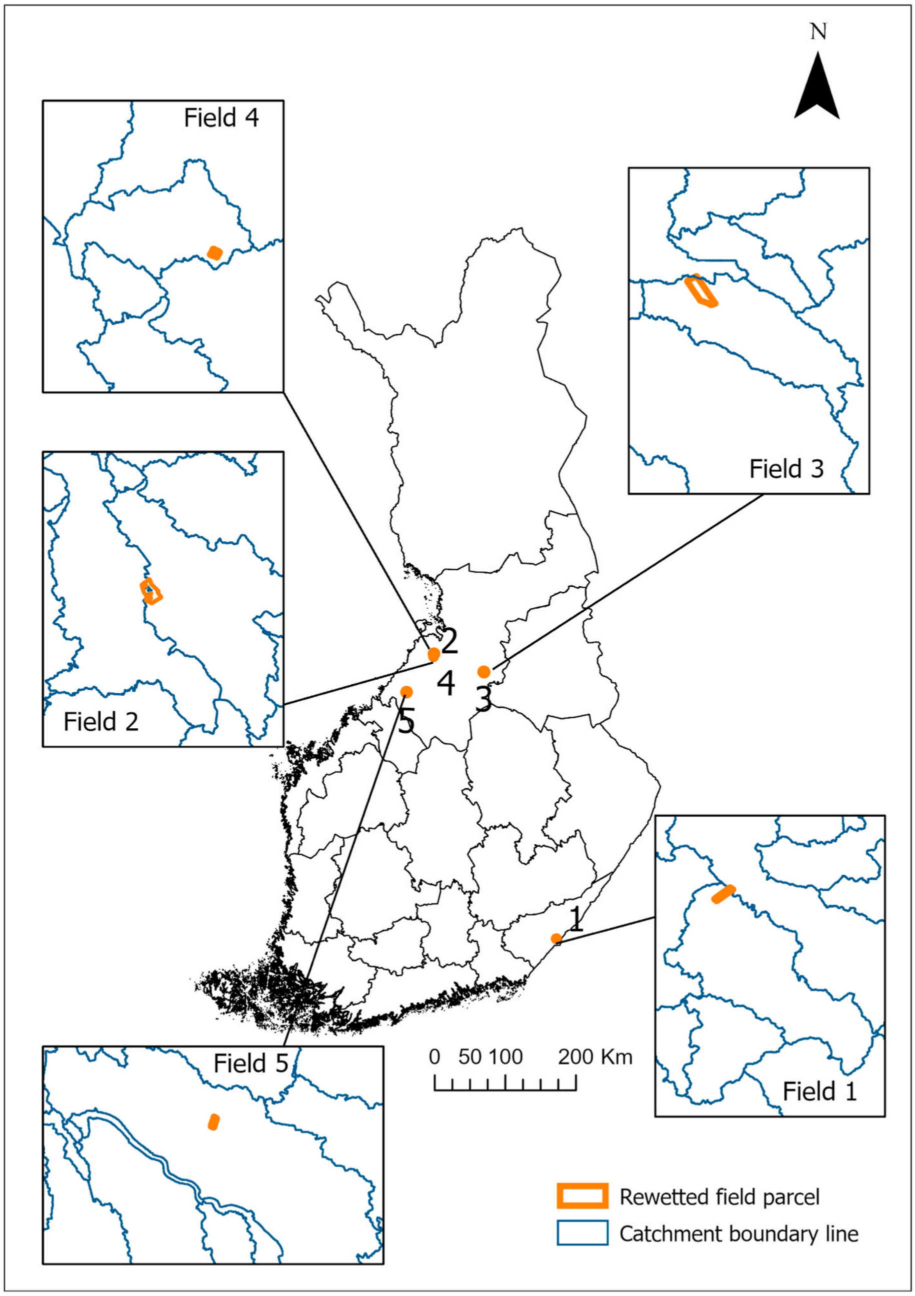

Fig. 1. Location of rewetted sites across Finland and their positions at local catchment (Level 5 catchment, see Table 1).

probably have led to a better outcome and the best result would likely have been reached by damming all collecting ditches in this area.

Fields 2 and 5 had high DTW values and would have been rated as unfit for rewetting. However, rewetting succeeded in Field 5, while the WTL did not raise sufficiently in Field 2. Both field plots had open ditches which were dammed to raise WTL to 15 cm below surface. On Field 2, the strips between the ditches were modified to dome shape when the field was cleared, and this caused high spatial variation in the water level. DTW values also varied greatly within Field 2 (Fig. 3, right); the mean value was 0.87 m and thus it did not a seem favourable location for rewetting according to our criterion (Table 2). It was possible to raise the WTL with the implemented dams but the target WTL of −15 cm was not reached (Table 2) although the landowner found this field too wet for conventional farming practises even before rewetting. Field 2 was surrounded by open ditches and forest in the northwestern edge, and the field was divided between two different catchment areas. Water in the upper catchment area collects to the ditch shown on the right-hand side of the picture. Water in this ditch flows to two different directions changing direction approximately in the middle of rewetted area (Fig. 6, left) and continues through the ditch network to Siikajoki river which is visible in the upper right corner of the picture. Closer exploration of Field 2 revealed that the lack of digital data of ditches in agricultural areas caused errors for DTW calculation, as wrong placement of a culvert under the road hampered modelling the water flow.

In Field 5, rewetting succeeded likely because it is positioned in the middle of the catchment, and the surrounding areas include forest which can increase water availability. The high DTW value of Field 5 was interpreted as erratic due to outdated data on former forest ditches that appear in the older version of Topographic Database. DTW index was calculated using older version of Topographic Database but the ditches had been removed since then and the field was cleared for agricultural use. Similarly, as in Field 2, the lack of digital data on agricultural

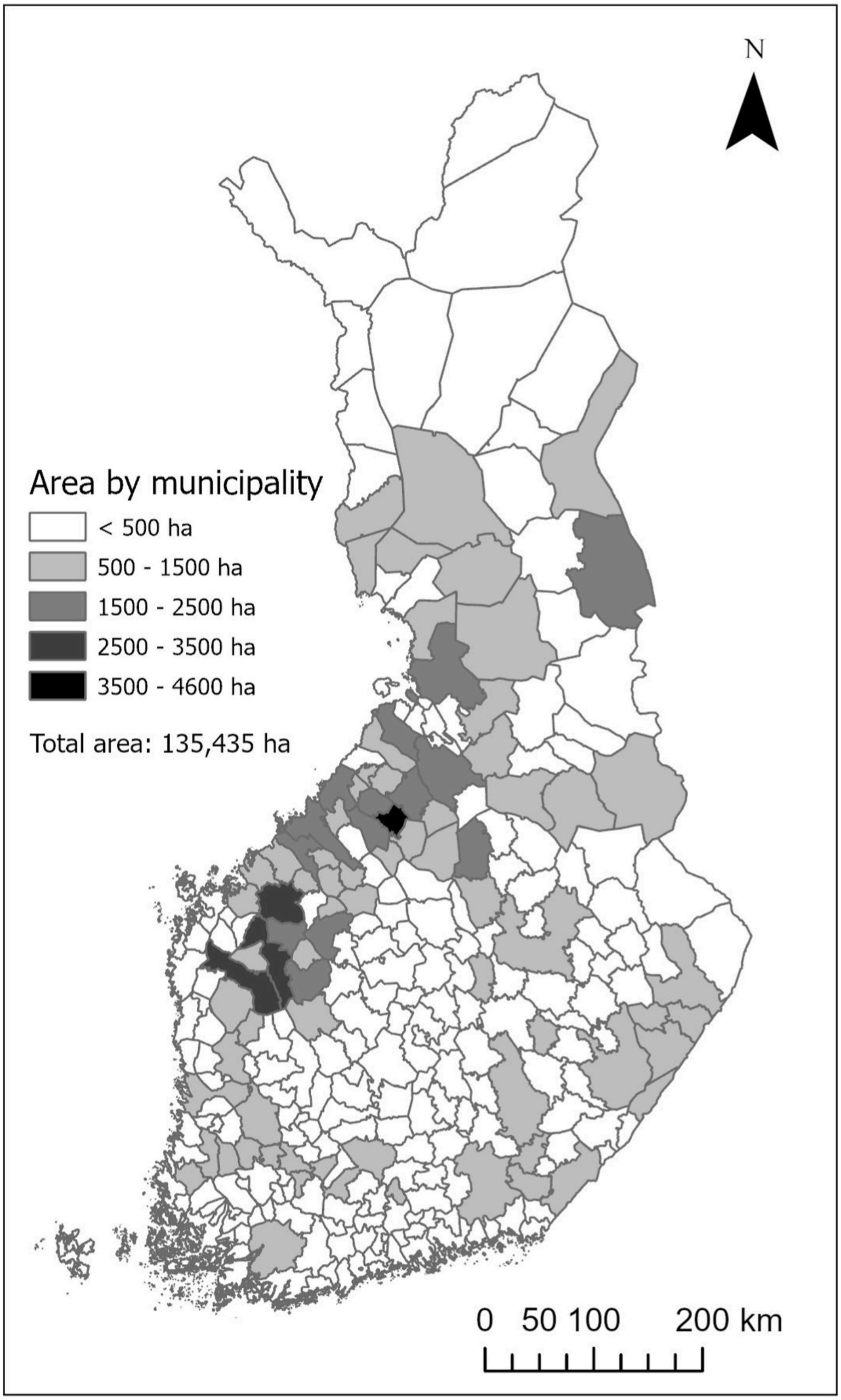

Fig. 2. Total agricultural peat soil area best suitable for rewetting by municipality (mean DTW index ≤0.5 m).

ditches caused that the ditch network was not continuous to the west of the field parcel and that further increased the DTW index values.

3.3. Emerged development needs

3.3.1. Rewetting management

The case of Field 1 showed that rewetting may be impossible if the surrounding drainage is not blocked. As Field 1 located between other plots with active drainage systems, successful rewetting would likely require wetting several neighbouring fields at the same time which could have been feasible at least based on the mean DTW indexes (0–0.5 m) of the neighbouring plots. Similar problems in small scale rewetting projects due to practises affecting hydrology in the surroundings were also discussed in (Mitsch and Wilson, 1996). Accordingly, some other studies (Laine et al., 2016; Pasquet et al., 2015) concluded that pristine peatland ecosystems and restoration practises suffer from surrounding

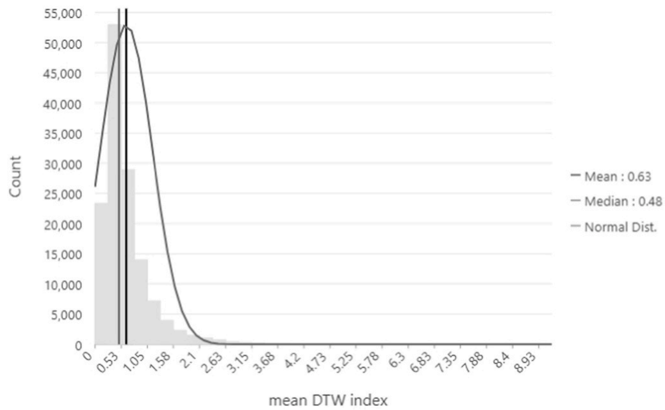

Fig. 3. Distribution of mean DTW indexes of field parcels which are partly or totally covered by peat. The black line denotes the national mean.

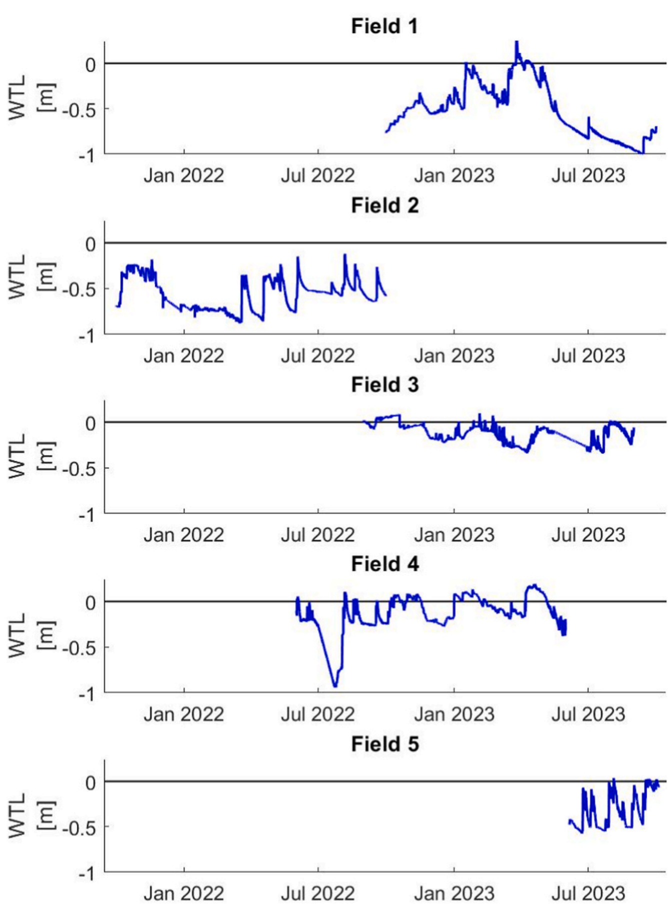

Fig. 4. Water table levels of rewetted field plots 1–5 during the follow up time.

drainage, and rewetting practices should be connected to peatland conservation and restoration on broader scale.

3.3.2. Drainage information

Open-ditched peatlands, particularly those with deep and steep ditches, can have a higher mean DTW value because the slopes of the ditches contribute to the calculated total slope of the field, and these areas could therefore be erroneously classified as poorly rewettable if the drainage network cannot be mapped realistically. The DTW model uses cost distance analysis which calculates the distance to the nearest source for each cell in the raster based on the least cost pathway over a cost surface. High slope variation at the point of ditches increases the cost and results to higher DTW value. Areas with relatively high DTW index at some water channels are seen as lighter colour (Figs. 5 and 6) whereas channels where ditches were correctly identified as water channels appear in the figure with darker colour, indicating low DTW index.

The ditch network of forest areas, natural streams and rivers are included In the Topographic Database. However, agricultural ditches less than 2 m wide are largely missing, except for some bordering ditches which meet the width and network continuity criteria of the database, which means that only ditches and water channels from 2 to 5 m wide are included in the agricultural areas. Some agricultural open ditches are included in the database, but most are not since ditches wider than 3 m including the verge are excluded from the area receiving agricultural subsidies and hence the width of ditches is often less than 2 m. The lack of ditches in the Topographic Database was found to cause errors to the calculation of the DTW by disabling correct pre-processing of elevation model and further modelling the flow routes of water. On Fields 2 and 5 the high DTW index seemed erratic and we found that the flow of water was not modelled correctly in the DTW index calculation due to missing continuous ditch network and also due to use of outdated ditch data in Field 5. Where there are deep open ditches not part of the modelled drainage network, the DTW value will get high values indicating dryer conditions. The lack of ditches in agricultural areas concerns roughly half of the peatland fields since the area of open-ditched field plots on peat soils has been estimated to cover 136,000 ha[35]. Thus, lack of precise drainage data likely influences the DTW index values remarkably. It is important to have up-to-date information on the ditches and on the active parts of drainage network to model the flow of water correctly, for which recently developed methods could be applied using machine learning and high-accuracy point cloud data (Lidberg et al., 2023; Busarello et al., 2025).

There are also challenges in predicting the effect of drainage in field plots with subsurface drainage. The ground surface of subsurface drained field plots is flatter and does not affect the DTW calculation the same way as open ditches but it is difficult or impossible to estimate in which direction water is directed without knowing the drainage plan. Subsurface drainage can alter flow pathways significantly (Sloan et al., 2016) and they can hinder restoration practices after long period of time (Krejčová et al., 2021). Identifying subsurface drained field areas can play a major role in terms of targeting rewetting measures.

3.3.3. Other uncertainties and development needs

There were shortcomings in the rewetting plans and ground water table monitoring which was not performed comprehensively from the whole rewetted field plot area. As WTL was measured only at one point on the field plot, the results do not give a spatially representative picture of WTL after rewetting but a general overview of WTL behaviour. The used WTL data was quite short term, only one full year data from each site either one year after damming or the most recent available data. From one site (Field 5) the data did not cover a full year period, as the logger was collected from the field before winter harvesting of reed canary grass. Data of the damming year would not have been realistic, as water level typically remained low until snow melt in spring. Longer term data would provide a better picture of the true WTL, as growing seasons and local precipitation can vary greatly and rewetting as a project and raising WTL seems to require time especially if rainwater is only water source to the area (Lång et al., 2024; Joosten, 2021).

4. Conclusions

This study shows that the DTW index can be used for the preliminary estimation of rewettability and the identification of regions with relatively high possibility of successful rewetting. This information is important for national, regional and local planning and for implementing regional climate measures and could also encourage

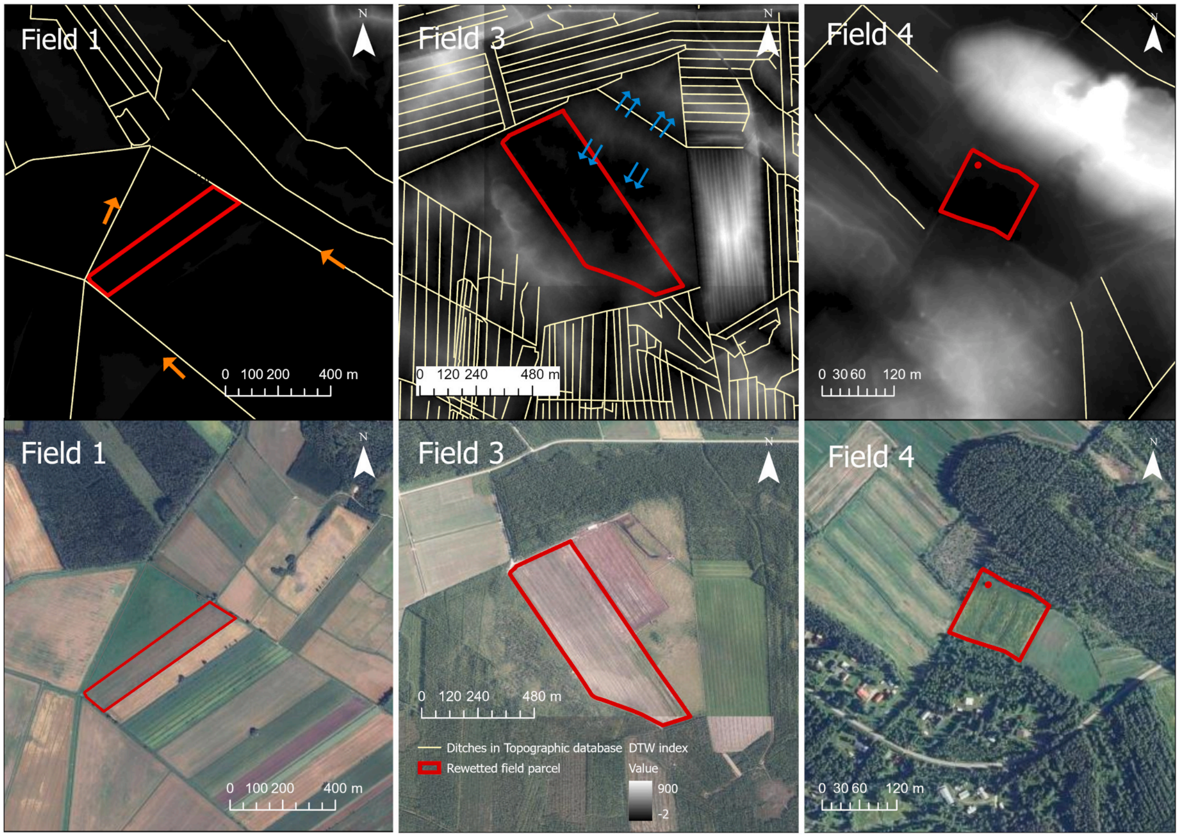

Fig. 5. Rewetted field plots (red border lines) which had mean DTW index favourable for rewetting. Upper row images show the DTW index of sites. Ditches shown in the Topographic Database are represented with yellow lines. Orange arrows show the direction of water in collector drains around Field 1. Field 3 is divided between two different catchments. Blue arrows show the direction of water flow at the border of the catchments. Lower row images are aerial photographs of the sites and their surrounding terrain.

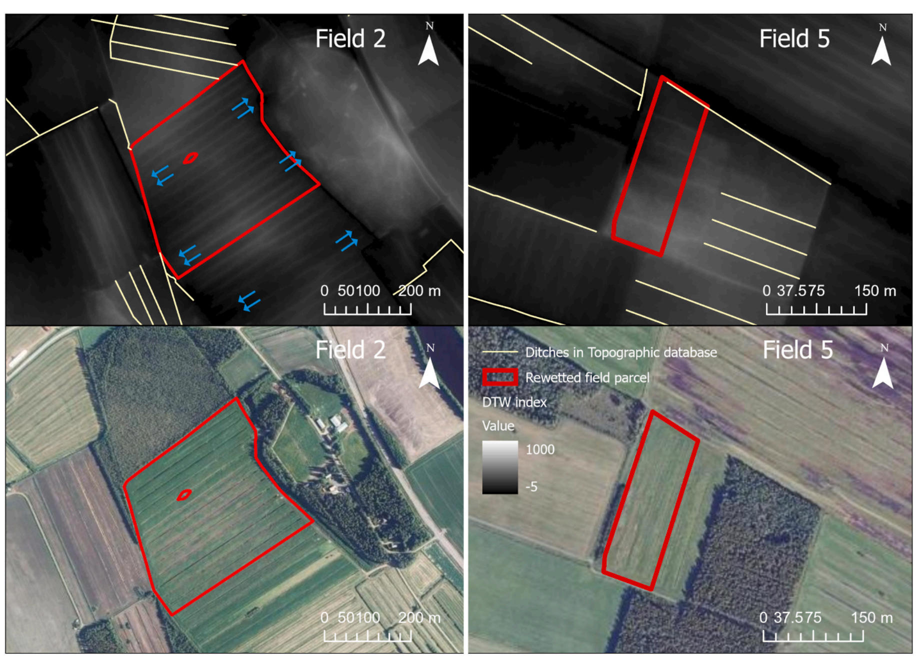

Fig. 6. Rewetted field plots which were not potential for rewetting according to the mean DTW index. Upper row images show the DTW index of sites. Field 2 is divided from the middle into two different catchment areas and the blue arrows show the direction of water in the catchments. Lower row images are aerial photographs of the sites and their surrounding terrain.

landowners to self-initiated measures. Further development of the DTW method and long-term WTL measurements are needed to improve prediction of the suitability of an individual field plot for rewetting.

In Finland, the absence of or outdated ditch information on agricultural land area causes error in modelling flow of water and the calculation of the flow accumulation. For a more precise outcome, non-existing ditches should be removed from the maps and the DTW index calculation could be improved to better account the effects of agricultural drainage systems; agricultural ditch network with ditches less than 2 m wide need to be mapped and included to the ditch network data. To improve the identification of potential rewetting sites, we recommend that the position of the target area in the catchment, the surrounding terrain and past and current land use are considered in the assessment. In addition, research is needed to enable including the effect of subsurface drainage in the assessment of rewetting potential.

As a policy recommendation we conclude that targeting resources to large rewetting areas should be prioritized and especially areas where surrounding drainage hinders the possibilities of rewetting practices should be avoided. Although experiences of this study and available literature indicate that rewetting a single field plot can in some cases be successful if the surrounding terrain supports water availability, rewetting larger areas would more likely ensure the availability of water and thus also better enhance co-benefits with biodiversity. Developing the presented method towards a catchment scale approach would support the implementation of the Restoration Regulation and improve targeting of rewetting activities if adopted by authorities.

CRediT authorship contribution statement

Hanna Kekkonen: Writing – original draft, Investigation. **Aura Salmivaara:** Writing – review & editing, Methodology, Investigation. **Henri Honkanen:** Writing – review & editing, Data curation. **Sanna Saarnio:** Data curation. **Aleksi Lehtonen:** Writing – review & editing. **Mikko Peltoniemi:** Writing – review & editing. **Hannu Ojanen:** Data curation. **Kristiina Lång:** Supervision, Funding acquisition.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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