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Data Article

A dataset on the geographical distribution, bounds, and reed cover of Hungarian fishponds

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ABSTRACT

This paper presents geospatial datasets, figures, and tables illustrating i) the location and total area of fish farms under cultivation; and ii) the spatiotemporal dynamics of reed cover in Hungarian fishponds generated from the published study of Sharma et al., [1]. Preliminary data for fish farm locations were obtained from the Institute of Agricultural Economics (AKI), followed by significant refinement based on high-resolution Google Earth Pro-imagery. The fishpond area dataset was validated against the values reported in annual statistical reports on aquaculture. In order to map reed vegetation freely available Sentinel-2 imagery (between 2017 and 2021) was accessed from the Copernicus Open Access Hub [2] and emergent macrophyte cover was classified using the NDVI-based threshold values [1]. Scientists, policymakers, and fish farmers can all benefit from such geospatial datasets. It could be used to monitor the extent of fishponds in Hungary and to design farm-level reed management plans to optimize the provision of ecological and production services.

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Specifications Table

Subject	Agricultural Sciences, Earth and Planetary Sciences, Environmental Science
Specific subject area	Aquaculture, Geographical Information System
Type of data	Geospatial data Table Maps
How the data were acquired	i. Raw data on the location of freshwater fish farms in Hungary was obtained from the Institute of Agricultural Economics (AKI) on request. This dataset is managed by AKI within the framework of the Fisheries Information System (HALir) project [3]. ii. A polygon shapefile dataset on stagnant surface water bodies (including lakes, reservoirs, and ponds) in Hungary was obtained from the General Directorate of Water Management (OVF), upon request. iii. Sentinel-2 imagery (between 2017 and 2021) was freely acquired from the Copernicus Open Access Hub [2] and processed for spatial analysis in ArcGIS Pro-v 3.1 and the cloud-based Google Earth Engine. iv. Statistical data on the fish farm area and the regional average reed cover were obtained from the open-access annual statistical reports published by AKI [4–8].
Data format	Analyzed fish farm points and boundaries maps (figure, shapefile, excel sheet) Analyzed reed cover maps (figure, GeoTIFF)
Description of data collection	i. Data on fish farm locations was received from AKI in .jpeg format which was visually interpreted into geo-coordinates using high-resolution Google Earth Pro-imagery, followed by the generation of a point-type shapefile. ii. Fish pond polygon-type data were extracted from the OVF dataset. Several discrepancies such as missing boundaries and incorrectly marked fish farms were also corrected. iii. Sentinel-2 Level-1C (L1C) and Level-2A (L2A) imagery at 10 m resolution were found to be most suitable in terms of availability for extracting reed cover within fishponds. iv. In addition, statistical data on region-wise fishpond areas were used to validate the fishpond area calculated using the generated shapefiles, by matching the reported and mapped area of fishpond in each region.
Data source location	Country: Hungary Latitude: 45°48′N to 48°35′N Longitude: 16°05′E to 22°58′E Primary data sources: Sentinel-2 products: https://scihub.copernicus.eu/ Locations of fish farms: Institute of Agricultural Economics (AKI), Hungary Geospatial data on surface water bodies in Hungary: General Directorate of Water Management (OVF), Hungary Statistical data: Institute of Agricultural Economics (AKI), Hungary [3–7]
Data accessibility	Repository name: Mendeley Data Data identification number: 10.17632/dh6n2zfkn4.1 Direct URL to data: https://data.mendeley.com/datasets/dh6n2zfkn4/1
Related research article	Sharma P, Varga M, Kerezsi G, Kajári B, Halasi-Kovács B, Békefi E, Gaál M, Gyalog G. Estimating Reed Bed Cover in Hungarian Fish Ponds Using NDVI-Based Remote Sensing Technique, *Water* 2023; 15,1554. https://doi.org/10.3390/w15081554

Value of the Data

- The geocoordinates and digitized boundaries of fish pond farming sites in Hungary are contributed as new information by this database. In addition, maps of changes in reed cover inside fishponds at the regional level and related statistics (from 2017 to 2021) are provided.
- These pioneering national-level datasets, compatible with user-friendly GIS programs, enable users to effectively organize, visualize, and analyze fishpond-related data, fostering enhanced understanding and insights in this field.
- This dataset will bring significant benefits and valuable insights to scientists, policymakers, and a wide range of stakeholders involved in fish farms, including owners, managers, and engineers.
- Fish farm-related GIS data (i.e., point and polygon type) can be reused to monitor their distribution, status (if functional or non-functional), and area under production to get an overall picture of freshwater aquaculture in Hungary.
- Regulators and fish farm managers can better understand the dynamics of vegetation change using inter-annual data on reed cover change in fishponds. This will enable them to develop better management strategies at the farm level to improve the provision of a range of ecosystem services.

1. Objective

Pond farming is considered to be one of the most important aspects of fish production in Central and Eastern Europe [9]. Numerous elements of fishponds, including water surface area, and emerged macrophyte vegetation (commonly known as reed cover), provide a variety of ecological services [10]. It is critical for all stakeholders involved in the aquaculture industry to have correct knowledge of the spatio-temporal dynamics of cultivated ponds given the influence of fishponds and reed vegetation on the overall condition of production infrastructure. The Institute of Agricultural Economics (AKI), Hungary, publishes annually regional data on fishpond area (ha), reed cover (%) and other information such as production (by species), input use (feed, water, labor, veterinary products) and quarterly farm-gate prices. However, the reports are based on self-reported data from farmers and do not include geospatial information, which limits their potential for further use in environmental studies. Therefore, during the study [1], this dataset was created with the intention of providing an open, usable, and high-quality geospatial dataset of the location and extent of fish farms in Hungary and the reed cover inside them.

2. Data Description

Several remote sensing techniques have proven to be an efficient and cost-effective method to obtain information on a larger scale, and their ability to archive time-series data provides a critical understanding of vegetation dynamics through space and time [11–13]. Using this approach, the novel dataset generated for this article on nationwide fishpond distribution and reed cover dynamics between 2017 and 2021 will provide important baseline data for decision-making in the planning and development of the Hungarian aquaculture sector. The datasets are as follows:

- The longitude and latitude coordinates of the fishponds distributed throughout Hungary are listed as FP_HU.xlsx in the “Fishpond_points_HU” folder of the Mendeley database [14]. Furthermore, in Table 1, we list the number of ponds present in each county of 8 NUTS 2 [15] regions of Hungary. Due to the data protection policies of AKI, the name of the fish farm company or owner cannot be disclosed.
- Ready-to-use, editable point-type geometry ESRI shapefile on the fish farm locations in Hungary can be found as FP_HU.shp in the “Fishpond_points_HU” folder of the Mendeley database. In addition, the associated map showing the fish farm location is presented in

Table 1
Distribution of fish farms in Hungary.

NUTS 2 region	County (NUTS 3 region)	Number of fish farms
Central Transdanubia (CTD)	Fejér	16
	Komárom-Esztergom	8
	Veszprém	5
Budapest	Budapest	0
Pest	Pest	9
Western Transdanubia (WTD)	Vas	5
	Zala	8
	Győr-Moson-Sopron	3
Southern Transdanubia (STD)	Baranya county	29
	Somogy	50
	Tolna	21
Northern Hungary (NH)	Borsod-Abaúj-Zemplén	4
	Heves	1
	Nógrád	0
Northern Great Plain (NGP)	Hajdú-Bihar	15
	Jász-Nagykun-Szolnok	27
	Szabolcs-Szatmár-Bereg	8
Southern Great Plain (SGP)	Bács-Kiskun	11
	Békés	13
	Csongrád-Csanád	10
Total		243

Table 2
Structure of the attribute table in the FP_HU.shp file.

Field	Name	Comment
FID	Identifier of point-feature	This field includes a unique identifier for the point-feature
NUTS 2	Identifier of point-feature	This field specifies the code for planning and statistical regions located in Hungary
NUTS 3	NUTS 3-level code	This field specifies the code for the counties in Hungary

Fig. 1. This shapefile is developed in a GCS_WGS_1984/VCS: EGM96_Geoid. In total, 243-point features with three data fields (as presented in Table 2) are included in this database.

- The dataset contains the digitized shapefiles for each pond in the fish farming systems of Hungary. These vector polygons are available as "Fishpond_poly_HU.shp" in the Mendeley database folder "Fishpond_poly_HU". These polygon features cover a total area of around 292 km^2 in Hungary. Table 4 shows the fishpond area in Hungary by region. The shapefile has a GCS_WGS_1984/VCS: EGM96_Geoid and three data fields (details provided in Table 3). As an example, Fig. 2. shows the digitized shapefiles of fishponds typical for certain NUTS 2 regions.
- Table 5 provides information on the change in reed cover in Hungary's fishponds from 2017 to 2021. The numbers in AKI's statistical books come from reports by fish farm companies and owners, but they don't include geospatial information about the reed cover in Hungary's fishponds. The data derived from Sentinel 2 imagery in this study, provide a more accurate understanding of the distribution of vegetation over the ponds, as well as the change in area over the last five years. The Google Earth Engine (GEE) java script developed to extract the

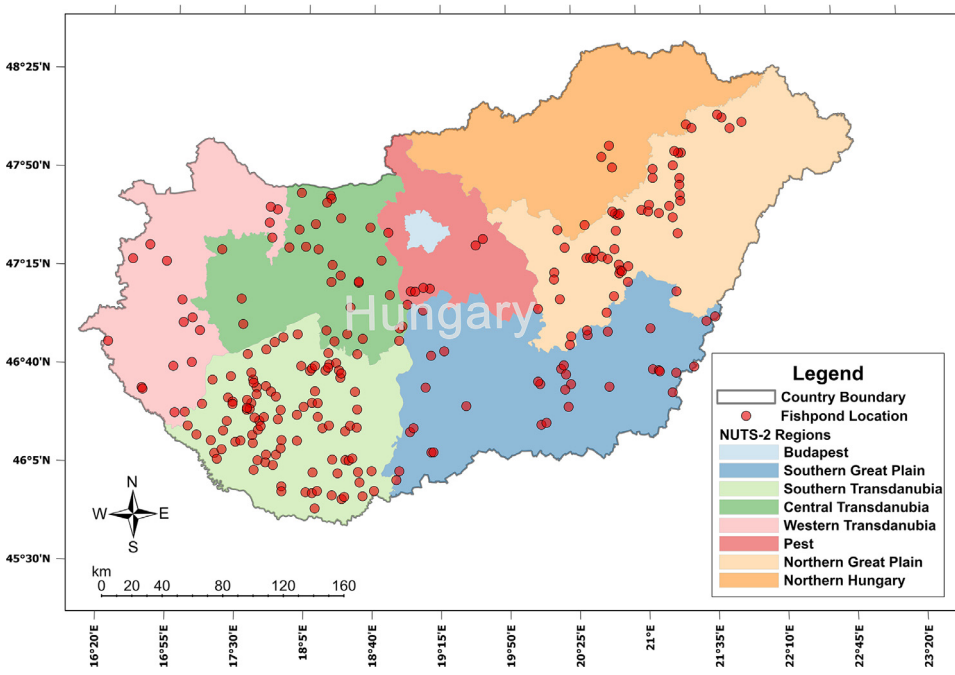

Fig. 1. Fishpond farm sites in Hungary.

Table 3
Structure of the attribute table in the FP_HU_poly.shp file.

Field	Name	Comment
FID	Identifier of point-feature	This field includes a unique identifier for the point-feature
NUTS 2	NUTS 2-level code	This field specifies the code for planning and statistical regions located in Hungary
Pond_area	Area of the polygon feature	This field includes the calculated area of each fish farm in hectares

Table 4
Region-wise fishpond area in Hungary.

NUTS 2 region	Area (ha)
Central Transdanubia	3617.92
Budapest	0
Pest	1064.64
Western Transdanubia	1381.14
Southern Transdanubia	7117.39
Northern Hungary	300.86
Northern Great Plain	9711.81
Southern Great Plain	6064.47

reed cover within the fishpond areas is contained in the file 'Reed_GEE.txt' in the data repository. Fig. 3 depicts several examples of mapping reed cover and its change from 2017 to 2021. The folder "Reed_Cover_FP_HU" in the Mendeley Database contains GeoTIFF images for the reed cover present inside the fishponds. The year-wise classified reed cover images can be found in the sub-folders namely: "CH" – Central Hungary, "NH" – Northern Hungary, "CTD" –

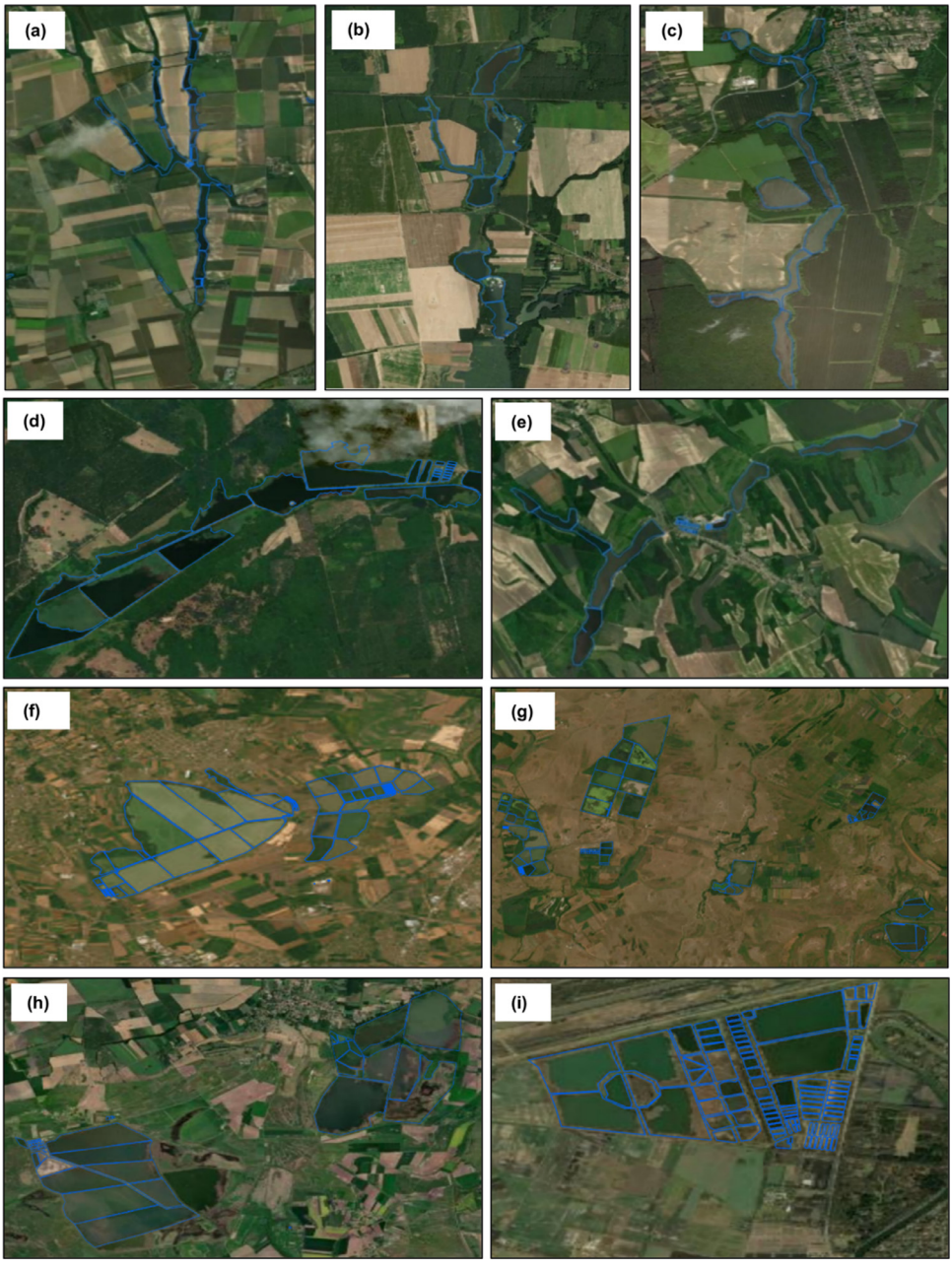

Fig. 2. Fishponds from different NUTS 2 regions of Hungary: (a-e) fishponds typical for Transdanubia (i.e., STD, WTD, CTD), and (f-i) fishponds typical for the Hungarian Plain (i.e., SGP, NGP, and NH).

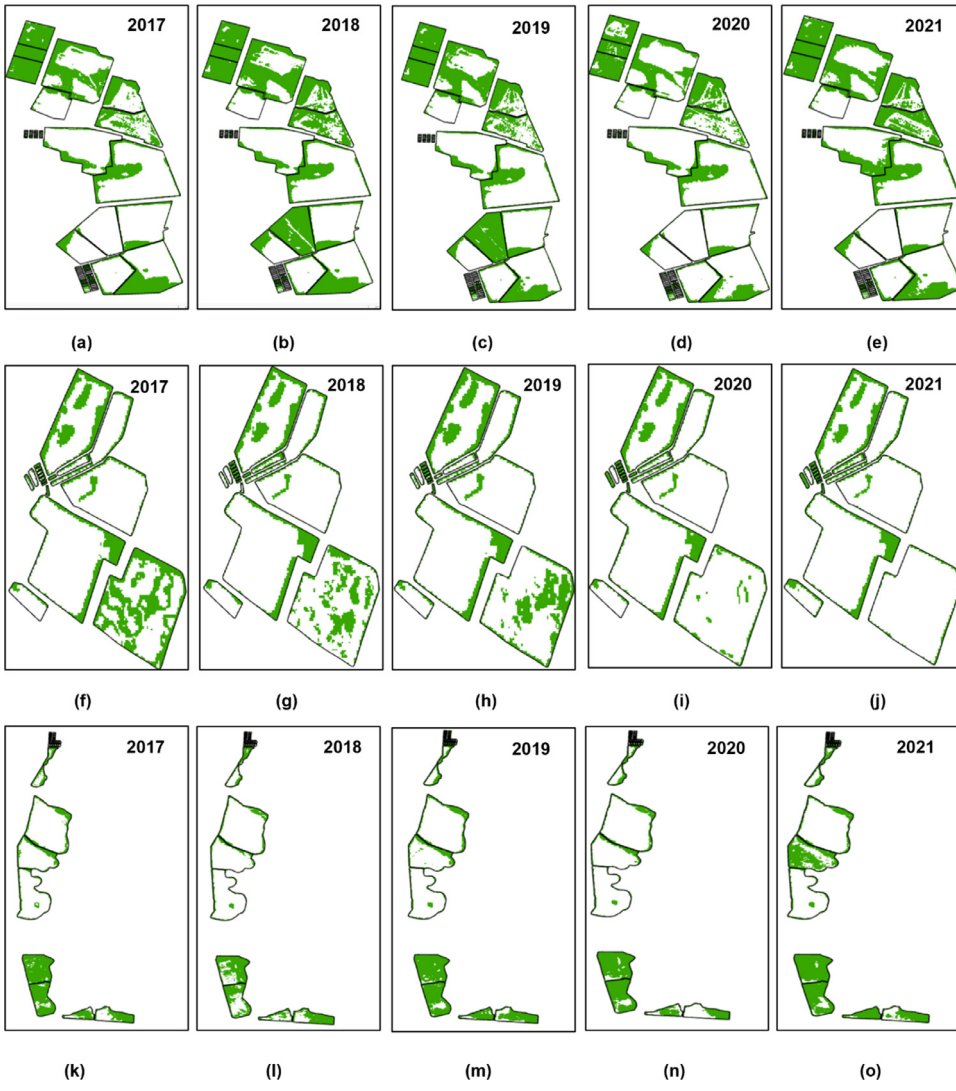

Fig. 3. Illustration of some examples showing the mapped reed cover and its change from the year 2017 to 2021 in the STD fishponds (a-e), the NGP fishponds (f-j), and the SGP fishponds (k-o).

Table 5
The total area of reed beds in Hungarian fishponds (in hectares).

NUTS 2 region	2017	2018	2019	2020	2021
Central Transdanubia	1300.68	1048.16	1052.45	1023.28	1084.24
Budapest	–	–	–	–	–
Pest	268.20	273.26	274.11	236.82	260.20
Western Transdanubia	430.68	416.21	398.99	355.18	424.79
Southern Transdanubia	2123.07	1982.38	2109.29	2095.02	2332.07
Northern Hungary	100.12	96.38	94.95	86.42	92.11
Northern Great Plain	2622.56	2581.01	2633.80	2154.43	2651.76
Southern Great Plain	1524.74	1449.25	1442.44	1340.61	1412.13

Table 6
Classes of reed cover maps.

No.	Value	Description	Color Code
1	1	Reed cover	Green
2	0	No reed (all the other classes)	No color

Central Transdanubia, "STD" - Southern Transdanubia, "WTD"- Western Transdanubia, "SGP" – Southern Great Plain and "NGP" – Northern Great Plain. Table 6 provides information on the classes of reed cover.

3. Experimental Design, Materials and Methods

We obtained the raw data on the locations of different types of ponds in Hungary used for fishing, industrial use, recreation, and fish production from AKI. This data is not suitable for processing in a geographic information system (GIS) because it was uncategorized and in .jpeg format, which is not machine-readable. Therefore, the replicability and reproducibility of this data is scarce. We used high-resolution Google Earth Pro-imagery to visually inspect this baseline data and label the geo-coordinates of commercial fish ponds. It was followed by the creation of a shapefile containing point features and an attribute table for the locations of the fishponds.

The spatial data for the fishpond boundaries corresponding to the geocoordinates were extracted from another dataset containing all surface water bodies in Hungary. These boundaries in their original form were inconsistent, misplaced, and incomplete polygons, so we repaired, digitized, and corrected them. Finally, we coded the fields in an attribute table and calculated the area in ArcGIS Pro-for these vector polygons. To validate the 'FP_poly.shp' datasets, we used the area statistics data from the AKI annual fisheries statistics reports [16].

Sentinel 2 Level 1C and 2A imagery was processed for reed mapping within the fish ponds. The composites of the images collected from 2017 to 2021 were used in the generation of this dataset. We calculated the Normalised Difference Vegetation Index (NDVI) (Eq. (1)) for the collected images, followed by the application of NDVI thresholds to define and extract the reed vegetation inside the fishponds. This analysis was performed using the web-based Earth Engine JavaScript API and the associated code is also provided in a .txt file in the Mendeley database. Finally, the resulting raster images in GeoTIFF format were processed using ArcGIS Pro-to generate two classes, (i) reed cover and (ii) all other classes (as mentioned in Table 6). A more detailed description of the methods applied, accuracy assessment, and other inferences could be referred from Sharma et al. [1].

$$NDVI = \frac{NIR - RED}{NIR + RED} \tag{1}$$

Where NIR is the near-infrared band (band 8) and RED is the red band (band 4) of the Sentinel 2 multispectral bands.

Ethics Statement

The authors comply with the ethical guidelines of the journal. Humans, animals, or data from social media are not involved in this research

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

Geographical distribution and reed cover of Hungarian fishponds (Original data) (Mendeley Data).

CRediT Author Statement

Priya Sharma: Conceptualization, Methodology, Software, Validation, Writing – original draft; **Mónika Varga:** Data curation, Writing – review & editing, Supervision; **György Kerezsi:** Conceptualization, Visualization, Software, Validation; **Balázs Kajári:** Conceptualization, Methodology; **Béla Halasi-Kovács:** Data curation, Writing – review & editing, Funding acquisition; **Emese Békefi:** Data curation, Writing – review & editing, Funding acquisition; **Márta Gaál:** Data curation, Writing – review & editing; **Gergő Gyalog:** Conceptualization, Methodology, Supervision, Data curation, Writing – review & editing.

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