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Data Article

Dataset of physical properties of histosols topsoils effected by wildfire in Indonesia

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A R T I C L E I N F O

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A B S T R A C T

Physical properties of peat are widely applied to detect the quality of peatland ecosystem. A comprehensive dataset on the peat properties is the foundation for the development tool and model of peat ecosystem, especially in region with frequent wildfire. Here we established a tabular dataset for physical properties of lowland tropical peatland in Indonesia. The data were obtained in dry season 2019 and 2023, respectively, at Jambi and Central Kalimantan peatlands. The dataset comprises of 66 peat samples from two land-uses namely secondary forest and ex-burned lowly vegetation. The physical properties are bulk density, porosity, water retention at four pressures (-1, -10, -25, and -1500 kPa), and water holding capacity. In addition, a set parameter of van Genuchten for water retention curve is available. The field-observed dataset provides a solid base for a better understanding of physical peat properties and can be used as a first step to develop peat water retention database in lowland tropical peatlands.

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Specifications Table

Subject	Environmental Sciences, Earth and Planetary Sciences
Specific subject area	Hydrology, Soil Science.
Data format	Raw and process data
Type of data	Table
Data collection	• Peat samples were obtained from 16 plots in two peatland provinces in Indonesia collected using Kopecky ring. • The samples represent two layers of peat depth at 0–30 and 30–50 cm. • In laboratory, each sample was analyzed to obtain the physical peat properties
Data source location	There are four districts in Indonesia, where peat samples were collected: • East Tanjung Jabung, Jambi (103°23′–104°31′ E, 0°53′–1°41′ S) • Savvmpit, Katingan, Central Kalimantan (113,^{0}19′ – 113,^{0}31 E, 3°2′– 3°13′S) • Palangkaraya, Central Kalimantan (113°30′–114°04′ E, 1°30′–2°30′ S) • Pulang Pisau, Central Kalimantan (113,^{0}30′ - 120,^{0}00′ E, 1°32′ - 3°28′ S) GPS location for each sampling point is listed within the dataset.
Data accessibility	Repository name: Mendeley Data Data identification number: 10.17632/2wcm6362y8.1 Direct URL to data: https://data.mendeley.com/datasets/2wcm6362y8/1

1. Value of the Data

- The data provide the peat physical characteristics of lowland tropical peatland associated to wildfire. Database on peat properties from topical peatland is limited, and it is mostly inaccessible for public.
- Researchers working on tropical peatland may benefit from this dataset as a benchmark in modelling peat hydrology. Researchers can use the characteristics of peat properties in this dataset to understand the water retention differences of their fire regimes.
- Researchers, program managers, and policymakers working on tropical peatland may benefit from this dataset to improve restoration project activity. By integrating climate and environmental data, information on physical peat properties can help to the study of peatland ecohydrology, ultimately helping to optimize peat restoration.
- Development of Indonesian database on peat properties will be supported by the dataset, especially the water retention.

2. Background

Indonesian peatlands with an area of 13.4 MHa [1] have a significant role in water and carbon cycles. Yet, land-use change and fires have transformed them into degraded condition, which decline their hydrological functions. Studies on peatland hydrology require information on soil physical properties, especially the water retention for various layers in the peat profile. In Indonesian peatlands, a database on the peat properties is still lacking especially related to fire occurrence. Therefore, development of a publicly accessible database of peat properties will find many grateful end users studying for instance, peat restoration, and drainage and optimization of peat water management.

3. Data Description

We provide an *in-situ* peat properties dataset from two lowland tropical peatlands in Indonesia, at a field level. This dataset contains information on physical properties (bulk density and porosity), water retention at four soil water pressure (namely −1, −10, −25, and −1500 kPa), coordinate, sampling depth, and location (file name: db_peatproperties_fire.csv). Detailed explanation of dataset is presented in Table 1. An overview of the variables (bulk density, porosity, and water holding capacity) for the sample peats is presented in Fig. 1. The collected dataset

Table 1
Description of the variables in the dataset.

Variables	type	Description	Unit or category
no	numeric	Data numeric record	Sequential number
province	character	Province where the sampling was performed	e.g. Jambi or Central Kalimantan
plotID	character	Unique code associated with each sampling site	G4P101
lu	character	Condition of land-use	e.g. ex-burned
depth	character	Range of peat sampling depth	cm
lon	numeric	Longitude coordinate of the plotID	Decimal format
lat	numeric	Latitude coordinate of the plotID	Decimal format
samplingDate	date	Date when sampling was carried out in plotID	Day/month/year
vegetation	character	Type of vegetation of the plotID	e.g. lowly vegetation
region	character	Peatland region	e.g. Sampit
Observation			
BD	numeric	Bulk density for each sample	gr/cm^3
porosity	numeric	Porosity for each sample	%
pF1	numeric	Water retention at −1 kPa	%
pF2	numeric	Water retention at −10 kPa	%
pF2.54	numeric	Water retention at −25 kPa	%
pF4.2	numeric	Water retention at −1500 kPa	%
Calculated or modeled from measured variables			
whc	numeric	Water holding capacity	%
res	numeric	Residual water content of van Genuchten model	%
alpha	numeric	Parameter alpha of van Genuchten model	–
n	numeric	Parameter shape (n) of van Genuchten model	–
m	numeric	Parameter m of van Genuchten model	–

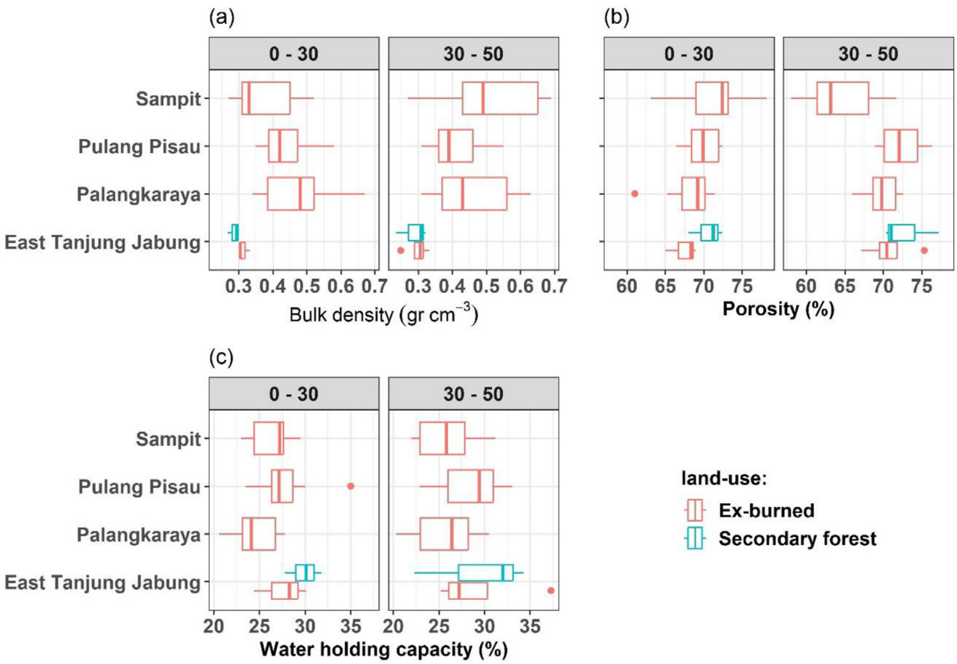

Fig. 1. Boxplot of: (a) bulk density; (b) porosity; and (c) water holding capacity from sampling peats in Jambi and Central Kalimantan. Soil layer comprises of two depths: 0 – 30 and 30 – 50 cm. The boxplot indicates the median (bold line), and the 25% (Q1) and 75% (Q3) quartiles. A whisker in boxplot represents the data within 1.5 times the interquartile range, whereas the dots indicate outliers.

runs from dry season 2019 for Jambi peatland and dry season 2023 for Central Kalimantan peatland, comprising of 66 samples.

4. Experimental Design, Materials and Methods

4.1. Site description

The Jambi site is situated in the eastern part of Sumatra, Indonesia. We took samples from Sungai Buluh peatland, located in East Tanjung Jabung district. The site is mostly flat with peat thickness in range of 50 – 700 cm [1]. The rainfall seasonality in the site is an equatorial type with two dry seasons in February and July-September [2]. The annual rainfall is >2500 mm, which is similar to other equatorial regimes in Riau [3] and West Kalimantan [2]. For secondary forest in Jambi was dominated by *Shorea pauciflora* and *Dyera polyphylla* [4].

In Central Kalimantan, Indonesia, the sampling was located in three districts namely Palangkaraya, Pulang Pisau, and Sampit (Table 2, Fig. 2). Deep peat (300 – 700 cm) was found in Palangkara and Pulang Pisau, whereas shallower peat (<200 cm) was identified in Sampit

Table 2
Number of samples based on district and land-use characteristics.

District	Habitat ecosystem	n-plots	n-samples	samplingDate
Palangkaraya	Ex-burned	6	14	Jul-Aug 2023
Pulang Pisau	Ex-burned	5	21	Jul-Aug 2023
Sampit	Ex-burned	2	18	Mid Jul 2023
East Tanjung Jabung	Ex-burned	2	7	End Aug 2019
East Tanjung Jabung	Secondary forest	1	6	End Aug 2019

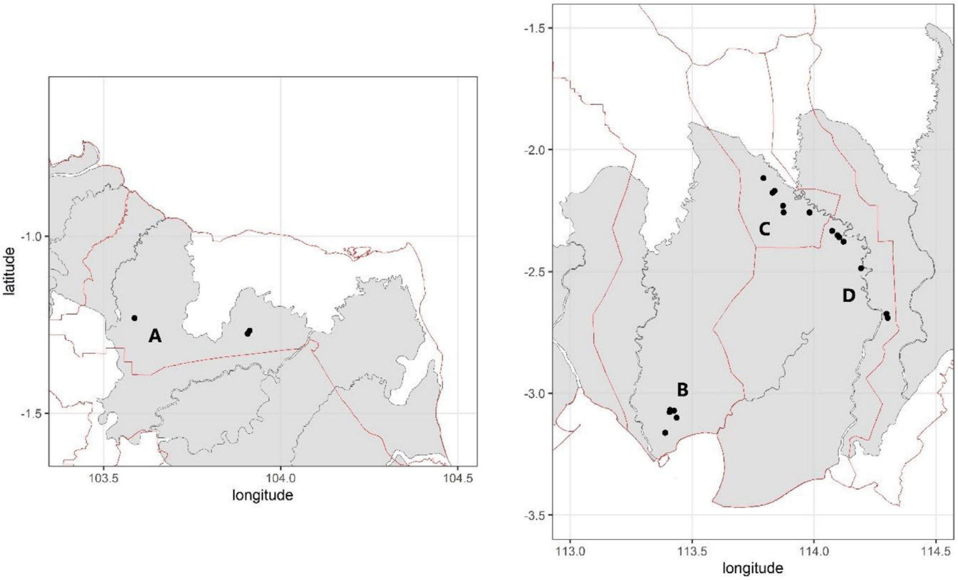

Fig. 2. Sampling sites in: A. East Tanjung Jabung; B. Sampit, Katingan; C. Palangkaraya; D. Pulang Pisau. Site A in Jambi, whereas B-D in Central Kalimantan. A red polygon indicates administrative boundary, whereas a grey color represents peatland area.

[1]. Strong seasonality of rainfall was observed in southern part of Central Kalimantan, with a peak dry season occurs at August-October [5]. The sampling was carried out in degraded peatland, which was one of the most fire-prone areas in Indonesia [6]. The plant community for ex-burned area was dominated by paku-pakuan (Selaginella wildenowii) and kelakai (Stenochlaena palustris).

4.2. Peat sampling and analysis

In Jambi, we collected 13 samples from East Tanjung Jabung district, within a week during the dry season of August 2019. Two habitat ecosystems were identified namely secondary forest and ex-burned with lowly vegetation. For Central Kalimantan, fieldwork was carried out in 2023, within two weeks during a peak dry season from July to September 2023. A total of 53 samples from three districts (namely Palangkaraya, Sampit, and Pulang Pisau) was collected. Distribution of location for sampling in each district is shown in Table 2.

Peat sample was randomly obtained within 50×50 m plot. In each plot, we took samples from two depths using 167 cm^3 Kopecky ring, which represent the top layer (0 – 30 cm) and subsurface layer (30 – 50 cm). Before peat sampling, litter layer covering peat (Fig. 3) was removed first. The samples within Kopecky cores then were sealed to prevent drying for laboratory analysis.

The samples were analyzed for water retention and bulk density [7]. For measuring water retention, four water pressures were applied (−1, −10, −33, and −1500 kPa) based on the pressure plate method. For determining bulk density, the samples were dried in oven (at 105 °C) for 24 h. Then, porosity for each sample was derived from the measured bulk density.

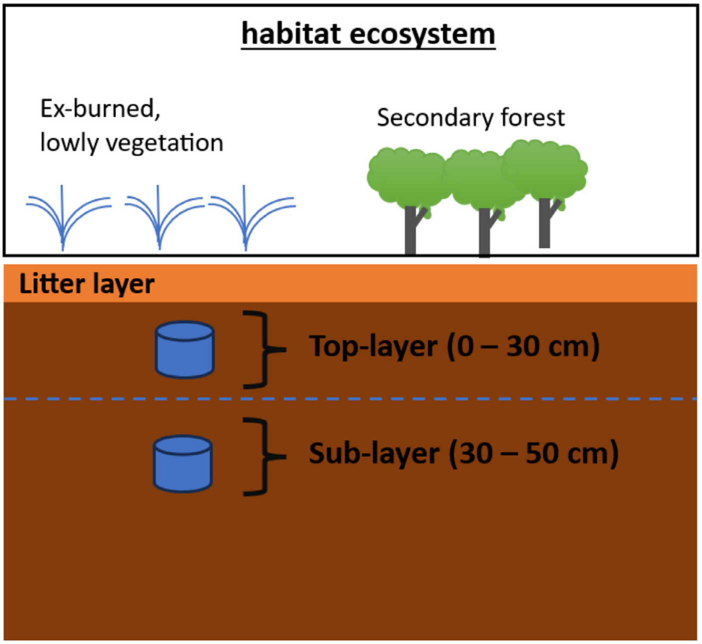

Fig. 3. Graphical overview of the habitat ecosystem and sample collection.

4.3. Parameters of water retention and water holding capacity

The relationship between soil water pressure and water retention was described using the van Genuchten approach [8] in Eq. (1). Three parameters of Genuchten (residual water content - θr, α, and n) were optimized using *nls* function in R language [9]. We assumed saturated water content (θs) was equal to porosity [10].

$$\theta = (\theta_s - \theta_r) \left[1 + \alpha h^n\right]^m \tag{1}$$

where θ is the volumetric peat water content (cm^3 cm^{-3}), h is water pressure (cm), and α (cm^{-1}) is the inverse of air entry point, n (unitless) is a shape parameter, and $m = 1–1/n$. Parameters α and n indicate the shape of water retention curve [11], namely its concave/convex and its tendency to a horizontal asymptote, respectively.

We calculated soil water holding capacity (WHC) as the difference between the water contents at −10 and −1500 kPa.

Limitations

Not applicable.

Ethics Statement

This work does not involve human subjects and animal experiments.

CRediT Author Statement

Muh Taufik: Funding acquisition, Conceptualization, Methodology, Writing – review & editing. **Mudrik Haikal:** field sampling, data preparation. **Marliana Tri Widyastuti**: field sampling, data preparation. **I Putu Santikayasa**: Funding acquisition, field sampling, Supervision. **Chusnul Arif**: Funding acquisition, field sampling, Supervision.

Data Availability

Physical peat properties of lowland tropical peatland subject to wildfire (Original data) (Mendeley Data).

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Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could be perceived to have influenced the work reported in this article.

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