PEATLANDS

National peatland database

There is a national effort underway to capture information on South Africa's peatlands in the National Peatland Database. Althea Grundling, Piet-Louis Grundling and Lulu van Rooyen explain how contributors can add their information.

Peatlands accumulate and store dead organic matter from wetland vegetation under permanent water saturated conditions and low oxygen content, making it an important resource for a variety of ecosystem services – most notably carbon sequestration and as a source of fresh water.

It is important for us to recognise the spatial distribution of peatlands in South Africa in order to understand the key processes in their formation, as well as their contribution to South African wetland ecological infrastructure.Furthermore, knowing where peatlands occur (i.e. an inventory of peatlands) will allow us to make informed decisions on managing, using and conserving these sensitive ecosystems.

Researchers are calling on all relevant communities (e.g. wetland, soil or aquatic scientists, or the agriculture sector) to submit information of known peatland sites that could be included in the National Peatland Database. All contributors will be acknowledged within the database. The peatland database will be available to the public upon request.

The National Peatland Database recording spreadsheet (MS Excel document) lists the most important attributes per sample site. There are also columns for additional scientific information, should you have it available. Please contact Dr Althea Grundling (Althea@arc.agric.za) to obtain the spreadsheet.

The list of attributes is as follows (numbers 1 to 7 being the most crucial should you have no other confirmed information available):

1. Wetland Name.
2. Contact / Project Details (e.g. Wetlands Consulting, ARC).
3. Surveyor Name and registration (e.g. SACNASP registration).
4. Acquisition Date (when site/sample/profile was recorded).
5. X-Coordinate (Decimal deg. / DD/MM/SS all WGS84).
6. Y-Coordinate (Decimal deg. / DD/MM/SS all WGS84).
7. Possible Peat site (site still needs to be confirmed).
8. Peat Thickness (m).
9. Peat Area (ha).
10. Hydrogeomorphic (HGM) Wetland Type (e.g. seep, depression, valley bottom).
11. Vegetation Cover Type (dominant sp.).
12. Red Data Species (presence).
13. Land-use in Wetlands.
14. Land-use in Catchment.
15. Other Impacts (e.g. drains, erosion).
16. Landownership.
17. Photo of Wetland (indicate copyright holder of photo).
18. Photo of Peat at the site (indicate copyright holder of photo).
19. Comments.
20. Scientific Information (if available):
    - Peat Profile Description.
    - Photo of layers/horizons (indicate copyright holder of photo).
    - % Carbon (Organic Carbon) (should be >20% organic carbon or >30% organic matter).
    - Analytical Method used to determine % C.
    - Water Level.
    - pH (this is the porewater pH that one measures in the field with a pH meter).
    - Water Quality (e.g. Electrical Conductivity / Sodium Absorption Ratio (SAR) / Exchangeable/Extractable cations/anions / Heavy metals).
    - Palynological studies (pollen).
    - Carbon Dating.
    - Present Ecological State (PES) (e.g. WET-Health; Macfarlane et al., 2009) or River EcoClassification: Index of Habitat Integrity (IHI) (Kleynhans et al., 2008).

Sampling methods

How many samples should one take for analysis? Firstly, what do you want to know? Is the wetland a peatland or not? Secondly, how much funds do you have for analysis? For the peatland database, we need % Carbon found in the top 300 mm of the profile. During soil surveys a minimum of three samples is recommended to be statistically viable.

How should one take the sample? It is important that the sample is an accurate representation. Carbon pools are typically greater in the permanent wetland zones. Avoid unusual spots (e.g. bioturbation). It is advisable that a separate sample is taken from

each layer, with descriptions of the colour and texture of the sample. The Von Post (1922) classification system can also be used to describe the **organic matter** decomposition scale (i.e. H1 to H10). A peat profile can have different layers that represent different deposition environments (e.g. sand layer indicates higher energy; ash layer indicates desiccation and peat fire). In thicker peat layers, Carbon content also tends to increase with depth in a profile.

A peat auger is the best tool for obtaining a peat sample. If a peat auger is not available, a shovel or a spade can work satisfactorily. Take a slice of peat (about 50x50x20 mm thick) from each layer and place it in a sample bag. Mark the sample bag clearly on the outside. Use a permanent marker pen or attach a sticker or piece of paper onto the bag. Record all relevant data on the sample submission sheet. The laboratory sample should be approximately 500 grams or 250 ml. The lab does not need a large sample but 500 g will allow repeat analyses, if required.

How should one preserve the sample? It is important to keep the moisture inside. You can use plastic sample bags and seal them with a cable tie, or use large plastic zip-lock bags. You can also use a plastic sample bottle with wide mouth and lid. Keep the samples in a cool, dry place (e.g. cooler box) to prevent rotting and for transporting to the laboratory for analysis.

Carbon analysis methods

There is a difference between analysing for organic material (matter) and organic carbon. To classify as peat, the sample should have >20% organic carbon or >30% organic matter, with profile depth at least 300 mm. The depth (300 mm) is an important criterion for the wetland to be classified as a peatland. According to Joosten and Clarke's publication of 2002, "peat is sedentarily accumulated material consisting of at least 30% (dry mass) of dead organic material". There are three laboratory methods listed in Table 1: Walkley-Black (W-B), Dry Combustion (Total C) and Loss on Ignition (LOI) (Grundling et al., 2010).

Table 1: Carbon analysis methods, cost per sample and short explanation

Method	Explanation	Cost Range (inc. VAT) per sample
Walkley-Black (W-B)	This is a rapid oxidation method. The W-B method is the most suitable to measure soil organic carbon. The method can underestimate the organic carbon content, and for this a conversion or correction factor is applied (Sleutel et al., 2006). The accuracy of this method tends to decrease with higher organic C levels (>8%) (Soil Survey Staff, 1999). The method makes use of chemicals, which are difficult to dispose of in an environmentally friendly manner.	R77.52 to R89.00
Dry Combustion (Total C)	Total C refers to both organic and inorganic carbon content in soils (Schumacher, 2002). The dry combustion method is based on the oxidation of organic C and thermal decomposition of carbonate minerals. For peat, this is the preferred method to determine organic carbon content because it measures directly and no conversion or correction factor is involved. However, the amount of carbon might be overestimated by this method in areas where carbonate minerals (lime, calcrete, etc.) are present in the profile or underlying parent materials.	R89.00 to R163.02
Loss on Ignition (LOI)	This method gives you the Organic Matter (Ash + Moisture). It is based on measuring the weight or percentage loss of organic matter when exposed to a high temperature (varying between 450 and 900°C). The weight loss that occurs is then correlated to oxidizable organic carbon (Sleutel et al., 2006). The LOI method can give an overestimation of the amount of carbon.	R94.62

The dry combustion method is regarded as a very accurate method to determine total C, but only when there are no carbonate minerals present in the peat. It is also the most costly of the three methods. Should cost be a factor, one can use LOI for peat samples, taking into account the limitations of the method.

A

B

Photos A & B: Two different peat profiles obtained using a peat auger. A) Peat profile from the Muzi System, Tembe Elephant Park, indicating different deposition environments (open-close water conditions). B) Peat profile (0-20 cm) from the Eastern Shores of Lake St. Lucia. [Photos by AT Grundling.]

Photo C: Peat profile on rock, obtained using a spade at the Kgaswane Mountain Reserve. [Photo by AT Grundling.]

References

Grundling AT, Pretorius ML and Beukes DJ. (2010) Comparison of three carbon analysis methods for wetland soils on the Maputaland coastal aquifer (north-eastern KwaZulu-Natal). WRC Project No. K5/1923 Deliverable 3 (Phase 1). ARC-ISCW Report No. GW/A/2010/33.

Grundling P-L, Grundling AT, Pretorius L, Mulders J and Mitchell S. (2017) South African Peatlands: Ecohydrological characteristics and socio-economic value. WRC Report No. 2346/1/17, Water Research Commission, Pretoria.

Joosten H and Clarke D. (2002) ***Wise use of mires and peatlands***. International Mire Conservation Group and International Peat Society, Jyväskylä, Finland.

Kleynhans CJ, Louw MD and Graham M. (2008) Module G: Ecoclassification and ecostatus determination in river ecoclassification: Index of habitat integrity (Section 1, Technical Manual). Joint Water Research Commission and Department of Water Affairs and Forestry Report. WRC Report No. TT 377/08, Water Research Commission, Pretoria.

Macfarlane DM, Kotze DC, Ellery WN, Walters D, Koopman V, Goodman P and Goge C. (2009) ***WET-Health: A technique for rapidly assessing wetland health***. WRC Report No. TT 340/08, Water Research Commission, Pretoria.

Schumacher BA. (2002) ***Methods for the determination of total organic carbon (TOC) in soils and sediments.*** United States Environmental Protection Agency, Environmental Sciences Division: National Exposure Research Laboratory.

Sleutel S, De Neve S, Singier B and Hofman G. (2006) Quantification of organic carbon in soils: a comparison of methodologies and assessment of the carbon content of organic matter. ***Communications in Soil Science and Plant Analysis*** 38: 2647-2657.

Soil Survey Staff. (1999) ***Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys*** (2nd ed.). Washington, DC: US Department of Agriculture Soil Conservation Service.

Von Post L. (1922) Sveriges gologiska undersöknings torvinventering och några av dess hittills vunna resultat. ***Sv. mosskulturför Tidskrift*** 1922: 1-27.