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Analysing the Geochemistry of Ireland's Peatlands using Tellus Geochemical Data

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1. Introduction

1.1 Background

Peatlands are defined as wetland ecosystems, consisting of at least 30% organic material (Creamer *et al.,* 2018). Peat forms under waterlogged conditions, where plant production exceeds plant decay, and have formed in Ireland within the last 10,000 years, following the retreat of the Late Midlandian British-Irish Ice Sheet (Ehlers & Gibbard, 2004). However, there is uncertainty as to how much of Ireland's landscape peatlands represent, with some researchers concluding 17.2% or Ireland's landscape is composed of peat (Bord Na Móna, 2017), whilst others conclude peat represents 25% of the Irish landscape (1.7 million Ha) (Soil Information System, 2014). Thus, there needs to be further research on mapping peatlands, to reach a consensus in the context of Ireland's landscape.

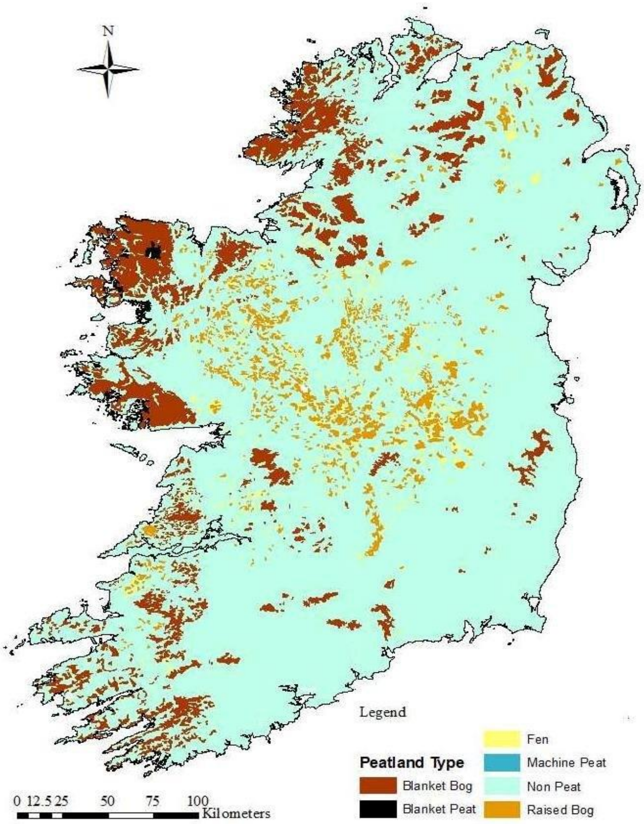


Figure 1 - Peatland Map of Ireland. Source: O'Connell, J., 2012. Monitoring Changes to Irish Peatlands using Satellite Remote Sensing (Doctoral dissertation, University College Dublin).

Peatlands mainly occur as blanket Bog, raised Bog and fen peat in Ireland. Bogs only receive nutrients from precipitation, whilst fens receive nutrients from both surface or groundwater and precipitation. Thus, fens tend to be more calcium and nutrient rich compared to bogs (Creamer *et al,* 2018). Blanket bogs account for c.774,360 ha and mainly occur along the western coast and on mountains throughout Ireland, predominantly overlying acidic mineral soil or bedrock (IPCC, 2017). Active raised bogs form on shallow lakes and account for <4000 ha due to drainage and turf cutting. They are mostly found in the midlands of Ireland, where rainfall is between 750-900mm per year. Their soil is acidic (pH = c.3.8-6.6 (Bord Na Móna, 2017)), but can overlie glacial alkaline soils of limestone origin (IPCC, 2017). Fen peats account for c.20,180 ha and are more alkaline. They are less prevalent compared to the other types of peatlands since approximately 97% of fens were drained for agriculture (Creamer *et al.,* 2018).

1.2 Context

1.2.1 The Importance of Peatlands

Peatlands act as a significant carbon store and sequester of CO_2 (Bullock *et al.,* 2012). However, over the centuries, peatlands have been subject to anthropogenic activities, including farming, afforestation and turf cutting for fuel (Joosten *et al.,*2014). This has converted peatlands from carbon stores to carbon emitters. It is hoped that restoration, such as rewetting will help to revert peatlands back to carbon dioxide sinks (Lee *et al.,* 2017). Thus, there is a renewed focus on peatlands with regards to climate change mitigation and efforts to reduce carbon emissions. Investigations into Ireland's peatlands is of growing importance, especially in the determination of carbon sink calculations and a commitment within the Climate Action Plan 2021 to rehabilitate 65,000 hectares of land (Government of Ireland, 2021), to assist in meeting the goals of the European Green Deal (European Commission, 2019). There are ongoing investigations by different groups and agencies studying Irish peat, to ultimately understand the status of current peatlands and to determine if they are carbon sinks or CO_2 emitters. Currently, there is limited research into geochemical variations within Irish peatlands. Thus, this research is hoped to assist in further understanding the geochemistry of peat and Irish peatlands.

1.2.2 Heavy Metals

The heavy metals content within a soil is not only influenced by the underlying geology but also by landcover and land-use. Heavy metals can be stored in the upper layers of some peats due to atmospheric and overland deposition from anthropogenic sources such as mining, agriculture, and industrial activities (Wuana & Okieimen, 2011). Heavy metals within peatlands can not only be toxic to human health (Chen *et al.,* 2015), but can pose threats to the environment, via contamination to water sources following erosion of the peat (Rothwell *et al.,* 2007). Thus, it is important to gauge heavy metal concentrations, to not only ensure peatlands are protected, but to also address whether peatlands are point sources of fluvial contamination following erosion.

1.2.3 Potassium

Potassium (K) is often associated with micas and feldspars (Hillel, 2008), which are principal constituents of granites, sandstones, greywackes, and schists. In addition, potassium salts (potash) are commonly added to fertiliser (Fertilizer Association of Ireland, 2020). Therefore, K content can be influenced both by anthropogenic and geogenic factors. However, peat naturally contains less K compared to mineral soil due to lesser amounts of clay particles. Furthermore, K is relatively mobile, thus does not tend to stay in the soil for long periods of time. Therefore, it may be expected that cut over raised peats close to agricultural areas will exhibit higher K concentrations.

1.2.4 Loss-on-ignition and pH

Loss-on-ignition (LOI) analysis can be used to indicate how much organic material is contained within a substance (Bensharada *et al.,* 2022). It is therefore a useful peat indicator and assists in understanding the soil characteristics further. pH is another geochemical parameter which implies how acidic/alkaline the soil is (Trick *et al.,* 2008). pH can also influence the absorption of heavy metals and other elements, for example, decreased soil pH can lead to increased metal uptake (Fässler *et al.,* 2010). Investigating pH can assist in understanding the geochemical nature of peat and possible interactions.

1.3 Aims and Objectives

The aim of this project was to investigate the geochemical signature of peatlands and the different peatland types in Ireland, and to identify the potential factors which might account for these signatures. To achieve this, the following objectives were delivered:

- Identify average heavy metal and potassium concentrations, per peat type.
- Identify average pH and LOI, per peat type.
- Investigate the influence of additional parameters, such as bedrock geology and landcover.
- Create maps of elemental concentrations on bedrock geology.
- Assess landcover types in areas of higher elemental concentrations.

2. Materials and Methods

2.1 Data Used

The geochemical data for this investigation was made available by the Tellus programme of Geological Survey Ireland, a division of the Department of the Environment, Climate and Communications, whereby topsoil samples were taken at two depths (shallow 'A' topsoil (5-20cm Below ground level) and deeper 'S' topsoil (35-50cm Below ground level), from survey blocks G1, G3, G5 and G6 corresponding to the northern half of Ireland. These topsoil samples have been analysed for pH, loss-on-ignition (LOI) and elemental concentrations. The elemental analysis was conducted via Inductively-Coupled Plasma Mass-Spectroscopy (ICP-MS) and X-Ray Fluorescence Spectroscopy (XRFS). The samples were analysed using ICP-MS, following *Aqua Regia* digestion techniques. This is a 3:1 mixture of hydrochloric acid and nitric acid, dissolving part of the sample. XRFS does not require dissolution and instead involves X-rays passing over the sample, causing particles to become excited, and producing fluorescence (Lillburn *et al.,* 2022) Further details on the methodology can be found within the technical reports that accompany the freely available geochemical data available from the Geological Survey Ireland website https://www.gsi.ie/en-ie/data-and-maps/Pages/Geochemistry.aspx. Since the ICP-MS involves acid dissolution, it would therefore be expected that the XRFS values of the soil samples will tend to exhibit higher values to ICP-MS samples.

The Tellus Geochemical data used were:

1) 'A' Soils: 5-20 cm

   a) ICPar:

      - GSI | 58xxxxA-65xxxxA_Shallow_Topsoil_Download_v1.1
      - 6117xxA-6174xxA_Shallow_Topsoil_Download_v1.0

   b) pH & LOI:

      - GSI | 58xxxxA-65xxxxA_Shallow_Topsoil_Download_v1.1
      - 6117xxA-6174xxA_Shallow_Topsoil_Download_v1.0

c) XRFS:

- GSI | 58xxxxA-65xxxxA_Shallow_Topsoil_Download_v1.1

2) 'S' Soils: 35-50 cm

a) ICPar:

- GSI | 58xxxxS-65xxxxS_Deeper_Topsoil_Download_v2_1
- 6117xxS-6174xxS_Deeper_Topsoil_Download

b) pH & LOI:

- GSI | 58xxxxS-65xxxxS_Deeper_Topsoil_Download_v2_1
- 6117xxS-6174xxS_Deeper_Topsoil_Download

c) XRFS:

- GSI | 58xxxxS-65xxxxS_Deeper_Topsoil_Download_v2_1

In addition to Tellus Geochemical data, the following datasets were used:

- GSI 1:1M Bedrock Geology (IE_GSI_Bedrock_Geology_Datasets_1M_IE32_ITM)
- GSI 1:50K Quaternary Geology (IE_GSI_Quaternary_Sediments_50K_IE26_ITM)
- Corine Landcover 2018 (CLC18_IE_ITM) (EPA Map Services)

2.2 Research Methods

All analyses were carried out using Esri ArcGIS Pro, v. 3.0.2 and Microsoft Excel, v. 2212.

ArcGIS was utilised to compile the datasets. Spatial joins were used to classify the topsoil geochemistry data with the Quaternary sediments. The ‘Lithology’ Field within Quaternary sediments was the Field used to identify the different types of peat. Any lithologies which did not contain ‘peat’, were removed, as the primary focus was the geochemical signature of peatlands. This resulted in 2,573 peat ICP sampling points per soil depth, and 1,625 XRFS samples per soil depth. One ICP sampling point fell under the ‘Raised (in-tact)’ lithology group; however, this was discarded due to the unreliable sample size, resulting in 2,572 peat ICP sampling points, per soil depth. The breakdown of these samples into peat categories can be seen in Figure 2.

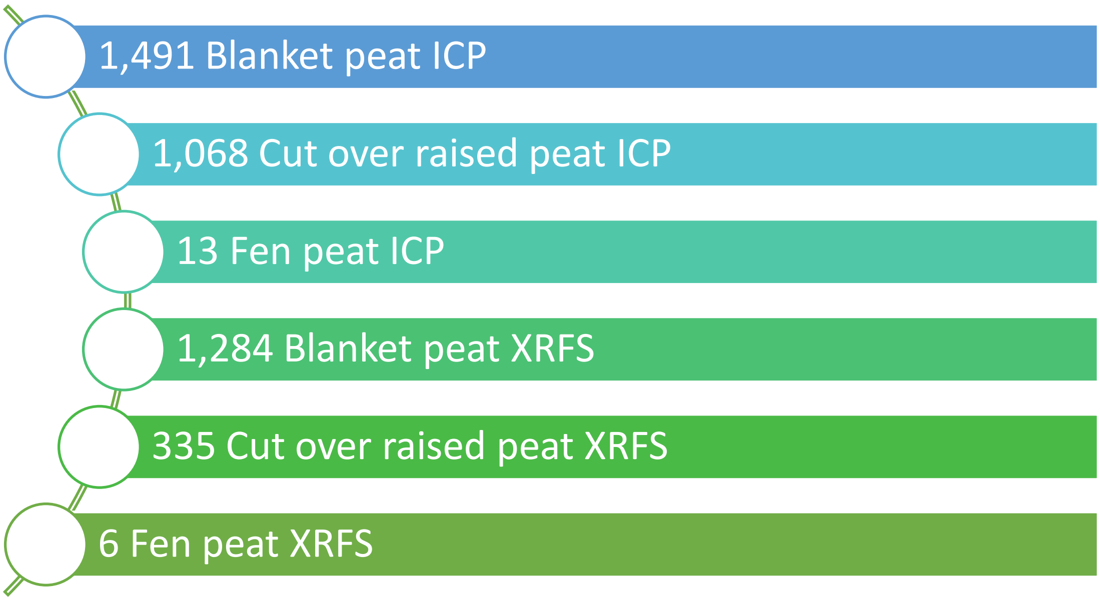


Figure 2 - The figure represents the number of peat samples per soil depth, for the ICP and XRFS analyses. It is also noted there was 1 raised (in-tact) peat sample but was disregarded due to the sample size.

The sampling point locations for the different types of peat, for both the ICP and XRFS data are shown in Figure 3.

The Geological Survey Ireland Bedrock Geology and Corine 2018 datasets were joined to the peat dataset to visualise and assess the influence of geology and land cover on the geochemical signatures of peat.

Summary statistics, including total count and mean values were completed in Excel. Graphs and tables for mean average potassium (K) and several heavy metals, including arsenic (As), cobalt (Co), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn) were produced. In addition, the mean average LOI and pH per peat type graphs and tables were also created. The graphs were then analysed to identify patterns and trends.

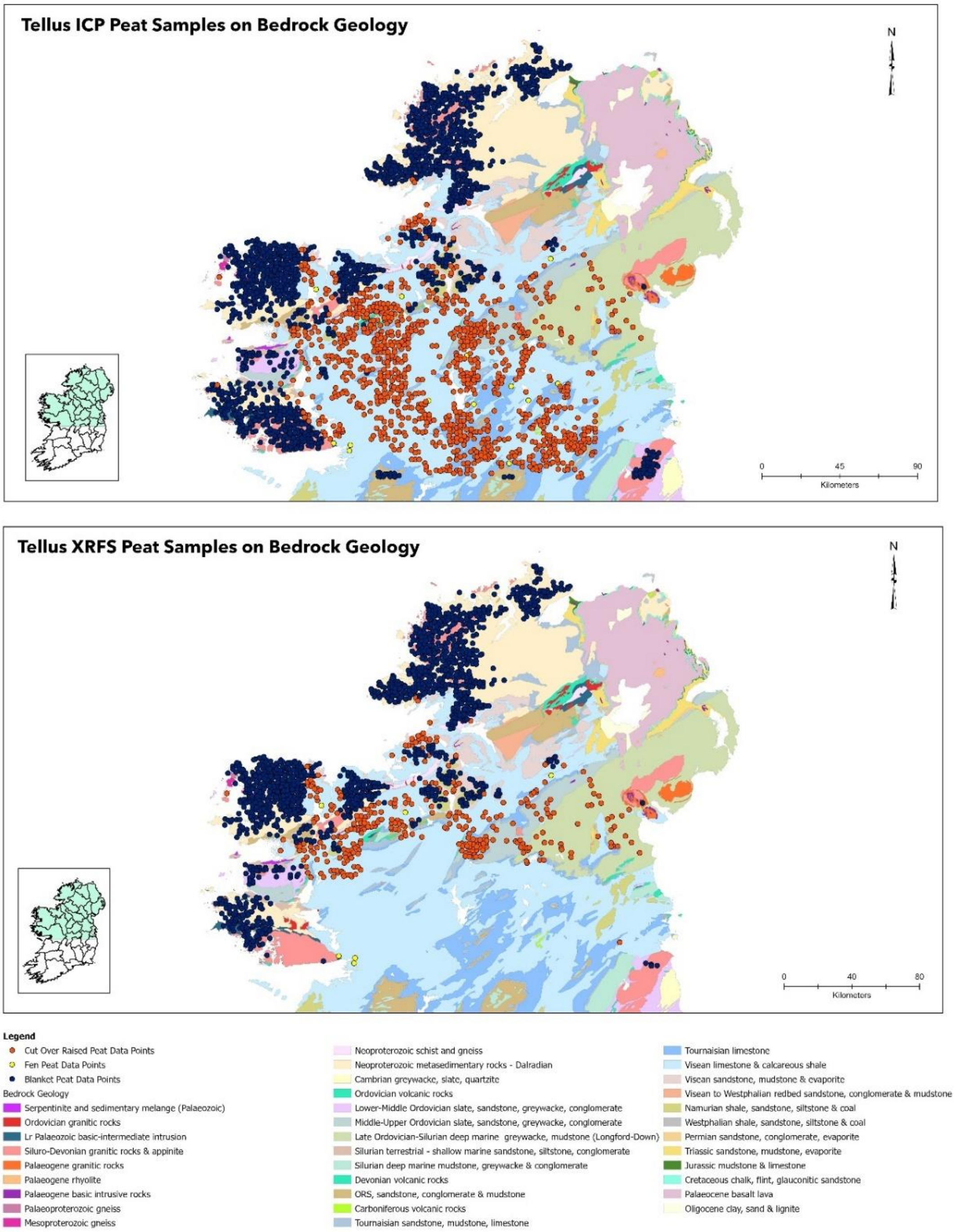


Figure 3 – Tellus ICP and XRFS peat sampling locations under study, overlaid on Bedrock Geology 1:1M map.

3. Results and Discussion

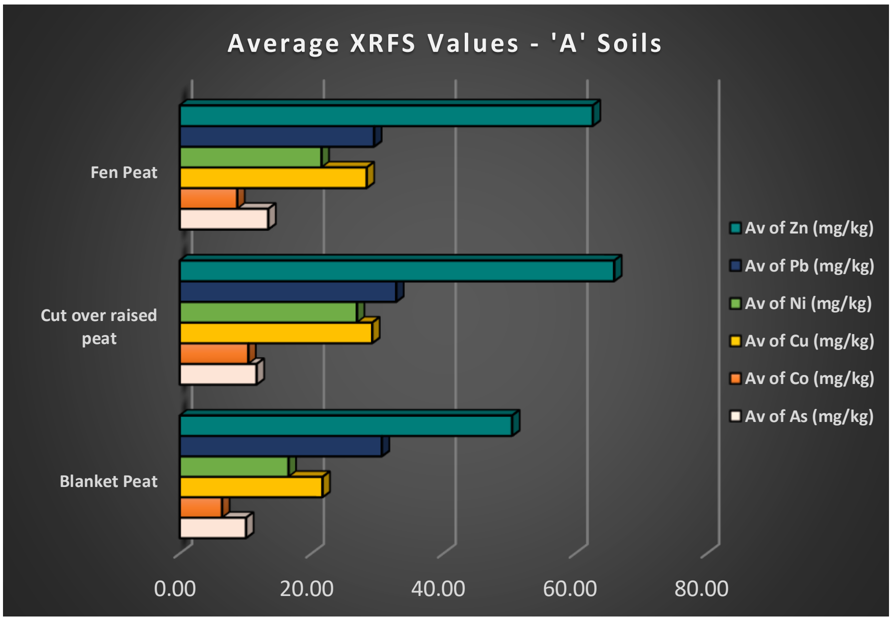
3.1 Heavy Metals

Table 1 and Figure 4 show the mean average elemental values for the 'A' soils and 'S' soils over the three peat types. Generally, 'A' soils display higher elemental levels than the 'S' soils.

Table 1 – Mean average XRFS and ICP elemental values for the 'A' and 'S' soils

	Blanket Peat				Cut Over Raised Peat				Fen Peat			
	XRFS 'A' Soils	**ICP 'A' Soils**	**XRFS 'S' Soils**	**ICP 'S' Soils**	**XRFS 'A' Soils**	**ICP 'A' Soils**	**XRFS 'S' Soils**	**ICP 'S' Soils**	**XRFS 'A' Soils**	**ICP 'A' Soils**	**XRFS 'S' Soils**	**ICP 'S' Soils**
As (mg/kg)	10.06	5.38	10.07	4.15	11.67	6.60	8.16	5.48	13.43	8.18	6.83	6.95
Co (mg/kg)	6.42	1.56	3.09	1.84	10.40	3.32	7.07	3.53	8.72	4.11	6.81	4.39
Cu (mg/kg)	21.66	7.18	8.64	6.25	29.21	15.56	19.94	11.42	28.37	21.22	24.58	19.99
Ni (mg/kg)	16.51	3.32	5.38	3.96	26.89	11.80	19.51	12.83	21.52	19.95	27.27	23.74
Pb (mg/kg)	30.67	26.44	16.92	15.07	32.85	27.85	23.68	17.80	29.49	26.36	24.15	17.60
Zn (mg/kg)	50.44	23.58	27.00	21.64	65.94	42.91	51.89	38.97	62.68	49.11	41.40	39.25
K20 (%)	1.06	-	0.58	-	1.39	-	1.01	-	1.59	-	1.05	-
K (%)	-	0.05	-	0.05	-	0.06	-	0.06	-	0.09	-	0.10

The results show that Zn generally has the highest mean average of the observed heavy metals, at both depths, with the highest average values occurring in fen and cut over raised peat.



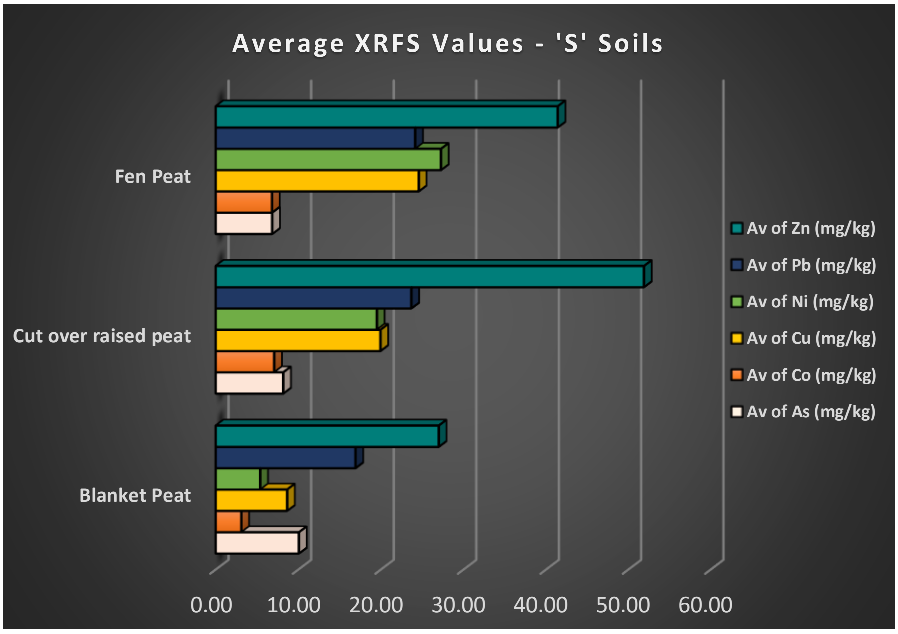


Figure 4 – The 'A' soils XRFS average heavy metal values per peat type is displayed, along with the 'S' soils XRFS average heavy metal values per peat type.

Zn was further investigated by assessing the ICP values of Zn (see Figure 5), which shows that fen peat contains the highest mean average values for Zn, followed by cut over raised peat. Blanket peat falls below the overall peat mean average of Zn (31.73mg/kg). However, it is also important to consider the difference in sample size of fen peat when making comparisons.

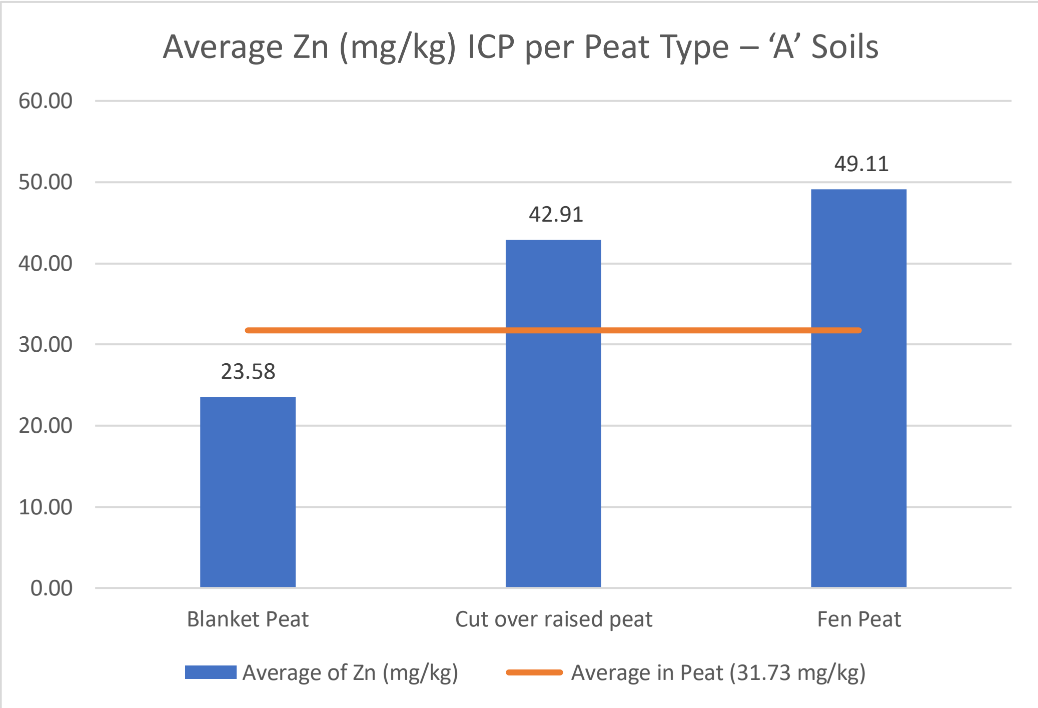


Figure 5 – Average Zn ICP values per peat type. The numbers above the bars represent the average Zn value in mg/kg.

To investigate the effect bedrock geology may have on Zn concentrations within peat, a bedrock geology map was created with the Zn XRFS 'A' soils data (Figure 6). The Zn XRFS values for 'A' soils range from 0-1,160.3mg/kg, with a 'peat' mean average of 56.94mg/kg. It is observed that the highest values here occur over Viséan (Carboniferous Period) limestone and calcareous shales (1,160.3 mg/kg, on Blanket peat) and Neoproterozoic metasedimentary rocks – Dalradian (1076.3mg/kg, on cut over raised peat). To validate the high value of these points, the ICP 'A' soils data for Zn was assessed and it disclosed that these two sampling points also exhibited the highest ICP values for Zn, at 978mg/kg and 855mg/kg, respectively, which are considerably higher than the overall mean average.

The Corine 2018 dataset displays that these two data points are situated in the vicinity of land use areas which may influence the Zn levels. The datapoint - 1,160.3mg/kg, on Blanket peat is situated c.12km NW of road and rail networks, whilst the datapoint -1076.3mg/kg, on cut over raised peat, is located c.14km north and south-west of mining and industrial sources. Since Zn, can be sourced from these land use areas, particularly in the form of airborne particulates, there may be a reason to believe that these industries may affect the

Zn concentrations. However, it also poses the question of why datapoints located closer to these land-uses do not exhibit higher values. The field notes from the sample collection noted at both locations that wire was located within c.40m of the sampling point, which may have an influence on the elevated Zn concentrations seen. However, it is hard to make a firm conclusion regarding the Zn source without further investigation.

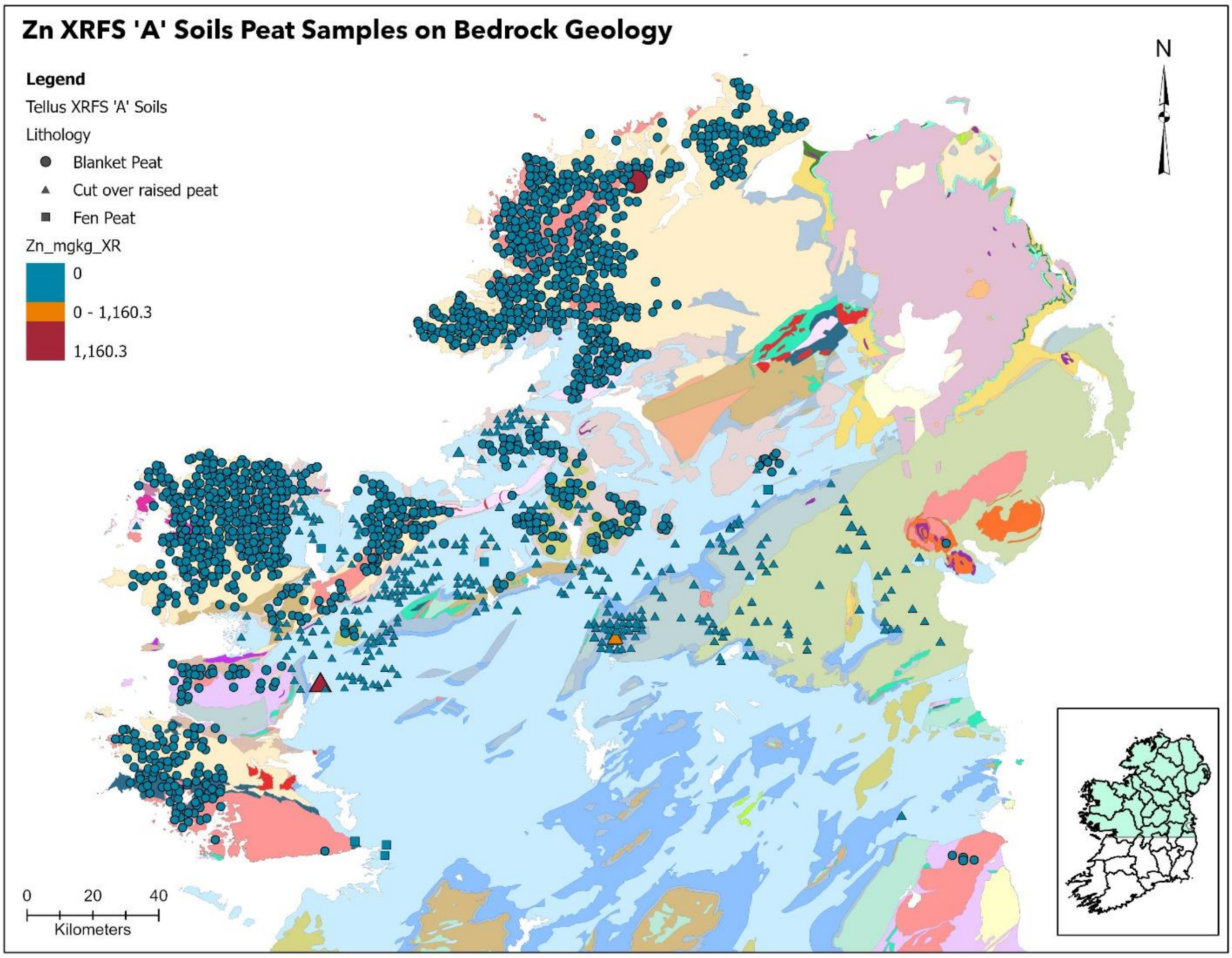


Figure 6 – The Zn XRFS 'A' soil data represented on Bedrock geology. The Zn data here increase in size with the larger values, and change colour, with blue representing lower Zn values, orange representing mid-range values and red representing high Zn values. Refer to Figure 2 for bedrock geology legend.

On comparing the Zn concentrations of the three peat types for both ICP and XRFS over different bedrock groups, the average concentrations tended to display the same pattern of higher values in fen and cut over raised peat and lower values in blanket peat. However, average Zn concentrations for samples overlying Viséan limestones and calcareous shales were observed showing the inverse. Carboniferous limestone is a typical host of Zn deposits in Ireland, and thus, is an interesting group to examine. The Viséan Limestone and Calcareous Shale bedrock group was therefore plotted against the average Zn XRFS ‘A’ soils values (see Figure 7). As Figure 7 shows, the Blanket peat over Viséan Limestone and Calcareous Shale exhibits the highest Zn average levels (80.29mg/kg, compared to 65.58mg/kg and 61.29mg/kg for cut over raised and fen peat, respectively), per peat type. This may imply that blanket peat samples could be located close to known Zn deposits or zones of mineralisation, although broader spatial XRFS coverage would be needed to test this hypothesis.

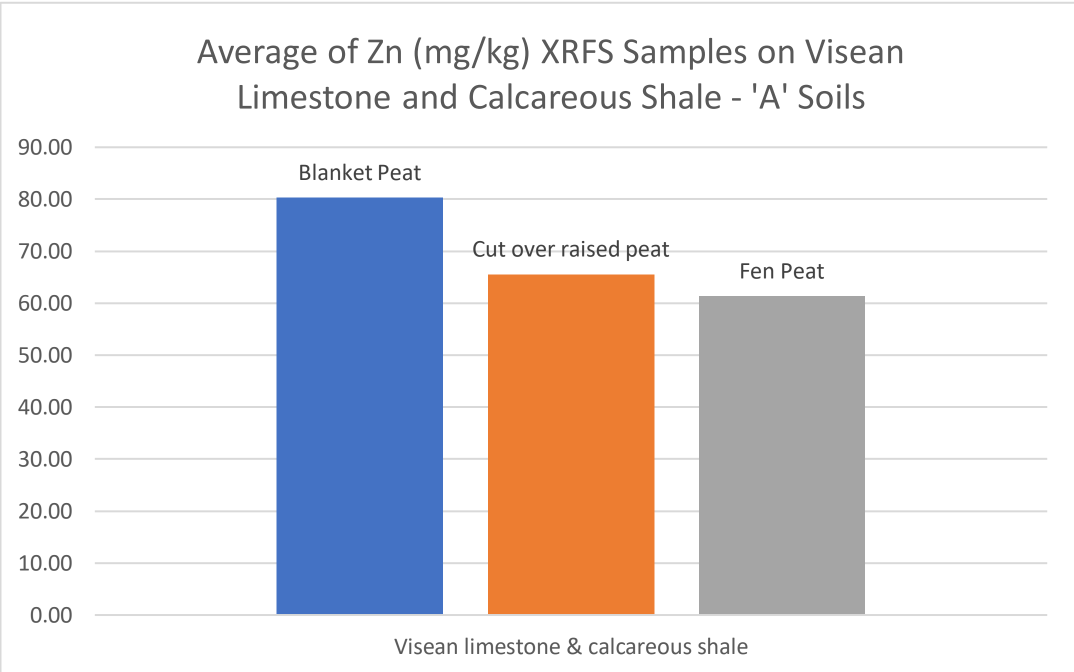


Figure 7 – The average Zn XRFS ‘A’ soils values for each peat type on Viséan Limestone and Calcareous Shale

It is also worth noting that Zn is a biogenic element, meaning this element is more readily accumulated in plants, compared to non-biogenic elements (Novosyolova *et al.,* 2011). Land cover and surrounding habitats may therefore play a role in biogenic elemental concentrations in peat. Furthermore, Zn can be sourced from anthropogenic sources, such as mining and farming (Noulas *et al.,* 2018). It is therefore hard to conclude what exactly leads to the higher values of Zn in certain areas, as there are multi-parameter factors at play. Thus, further investigations into land cover may be an important subject to study when conducting future research, to further understand geochemical signatures of peat.

3.2 Potassium

Figure 8 displays the average K ICP values for the 'A' soils. Fen peat contains the highest average value, quite considerably, compared to cut over raised and blanket peats. However, it is also important to consider both the difference in sample size of fen peats, and the sampling collection locations, when making comparisons. It can be observed that the average of K across all peat categories is 0.06%, however, the K values range from 0.05% to 0.56% across the 2,572 sampling points.

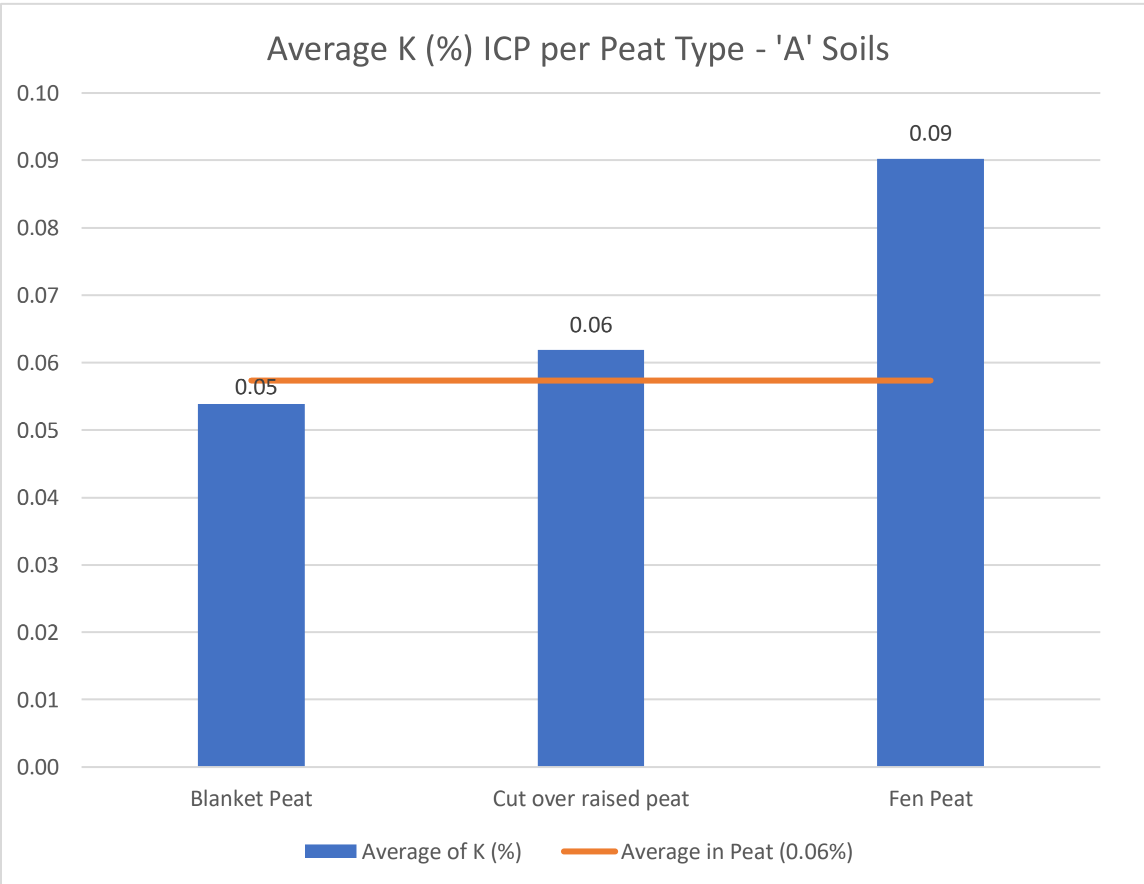


Figure 8 – Mean average K ICP 'A' soils values per peat type. The numbers above the bars represent the average K

To gauge a better understanding of the K signature, the ICP data for the 'A' soils was plotted on the bedrock geology map (See Figure 9). The highest three values relate to cut over raised peat on slate, sandstone, greywacke, conglomerate *(0.56%)*, blanket peat on gneiss *(0.37%)*, and blanket peat on meta-sedimentary rocks *(0.35%)*. These bedrock types are typical of containing clay minerals and/or potassium-bearing orthoclase feldspar (Fertilizer Association of Ireland, 2020), and thus assist in explaining the higher values of K at these locations. Furthermore, these three samples are all situated at pastures/agricultural areas, according to the Corine 2018 dataset, which may also elucidate the higher K values, due to the presence of potassium-containing fertilizer.

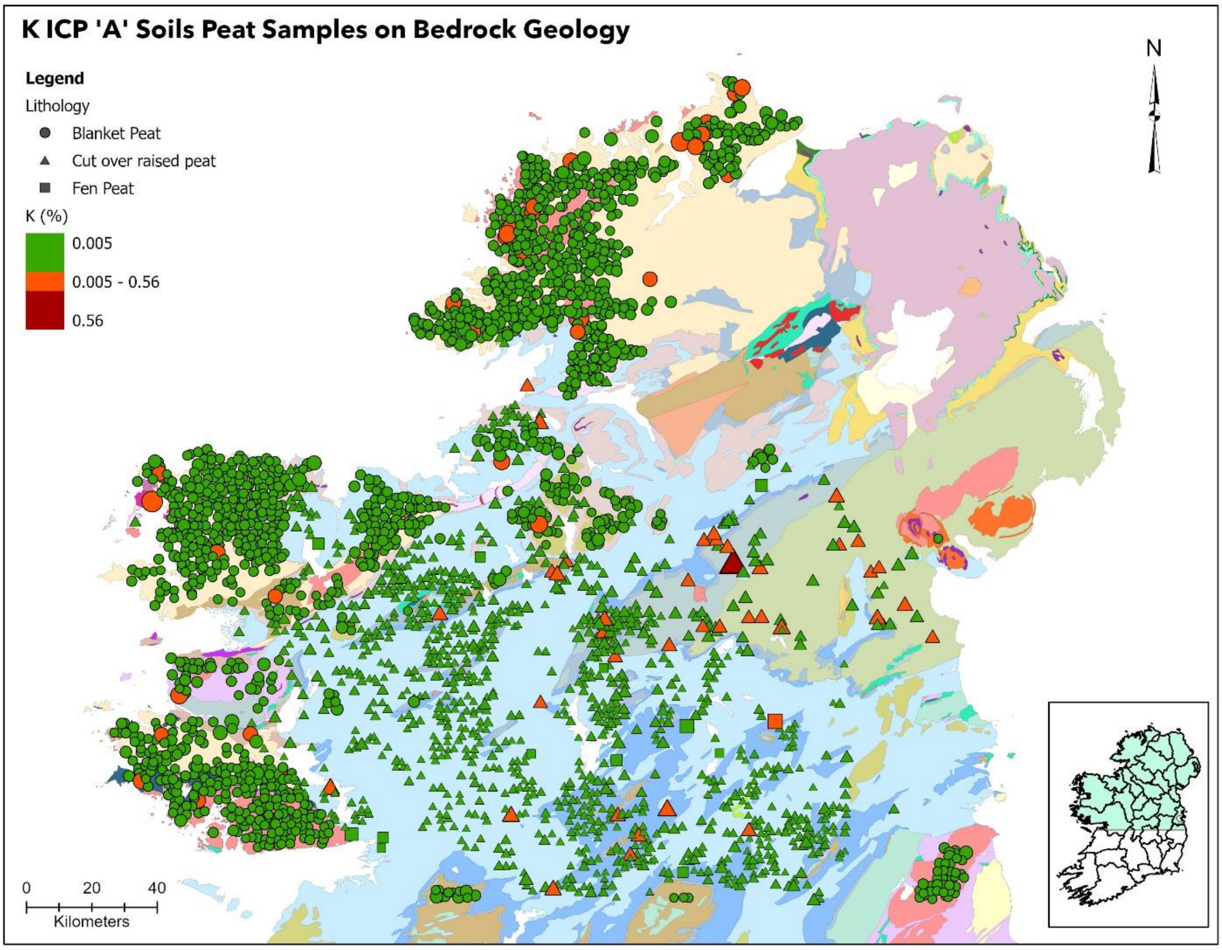


Figure 9 – The K ICP 'A' soils peat samples, represented on Bedrock Geology 1;1M map. The data point symbols increase in size with increasing K values. The 'traffic light' colour system also represents the K value – smaller values are green, mid-range values are orange and high values are red. Refer to Figure 2 for bedrock geology legend.

3.3 Loss-On-Ignition

The graphs below, in Figure 10 display the loss-on-ignition (LOI) results for the 'A' and 'S' soils. The two soil depths show similar trends between the different types of peat – blanket peat has the highest LOI (82.15% and 75.16%, for 'A' and 'S' soils, respectively). It can therefore be observed that the LOI reduces with soil depth. This may be because the peat layers are thin and overlie a mineral soil.

Overall, the LOI values are lower than expected, especially for the fen peat, considering peats are defined as LOI of >30% according to Creamer *et al* (2018). This may reflect sampling access issues, whereby some samples were collected at the edges of peatlands (which may contain more mineral soil matter), for ease of access or for health and safety reasons. Thus, further study could involve increased sampling points, particularly for the areas situated on fen peats, and to target sampling areas which are located more wholly within a peat area.

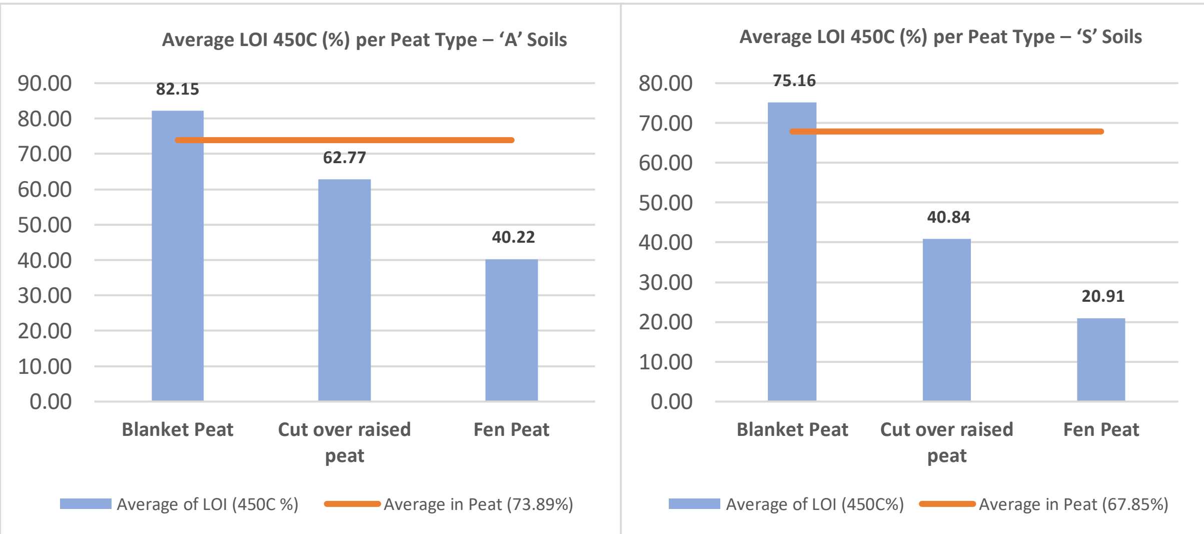


Figure 10 – The mean average LOI values per peat type for 'A' soils (seen left) and 'S' soils (seen right). The values above the bars represent the mean average LOI values for their respective peat type.

3.4 pH

Figure 11 shows the average pH results per peat type for the 'A' and 'S' soils. The overall average in peat is 3.89 for the 'A' soils and 3.71 for the 'S' soils. The two soil depths show similar trends between the different types of peat – fen peat has the highest pH (5.6 'A' soil, and 5.88 'S' soil). Since fen peats are typically more alkaline, whilst blanket and cut over raised peat are more acidic, these results are expected. The blanket peat is the only peat category to decrease in pH with depth ('A' soils – 3.56; 'S' soils – 3.52). This may be attributed to a range of factors such as the thickness of peat, stage of decomposition or original composition. Conversely, the increase in pH with thickness for Fen peat might be explained by the potential influence of groundwater.

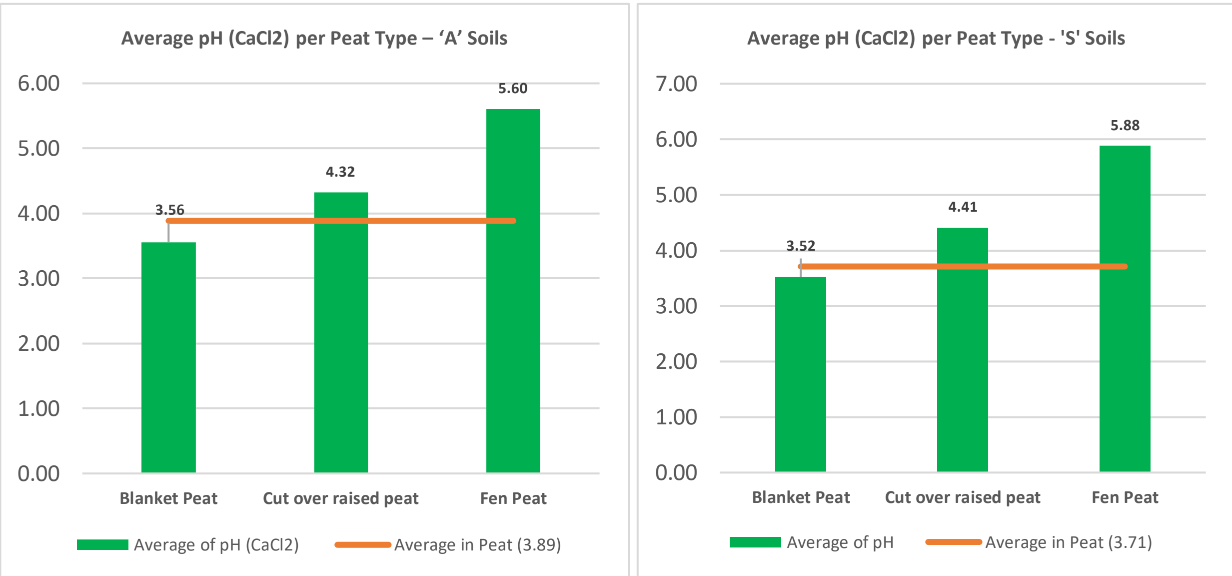


Figure 11 – The mean average pH values per peat type for 'A' soils (seen left) and 'S' soils (seen right). The values above the bars represent the mean average pH values for their respective peat type.

4. Recommendations for Further Research

1. The lack of consensus on peatland cover within the Irish landscape promotes the necessity for improved peatland mapping. Having a clearer understanding of peatland cover and where peatlands are located will ultimately assist in determining where further geochemical studies can take place and assist in meeting the targets of Europe's Climate Action Plan 2021.
2. The assessment of Zn concentrations resulted in a range of factors which might explain the higher levels, being hypothesised. However, there was no clear conclusion as to pinpoint the source of Zn. Thus, a targeted study of particular bogs where there is a potential contaminant source nearby, such as a factory, mine, or surrounding agricultural land, would be recommended for further research.
3. The LOI values of fen peat were lower than expected. However, further research, obtaining more fen peat samples, more wholly within peat, may help to clarify why this was the case, or if it was purely due to a low fen peat sample size and fen peat sampling locations.
4. The pH was found to increase with depth for the fen peats. This is hypothesised to be due to the influence of groundwater. Thus, understanding the hydrogeological behaviour and obtaining groundwater pH data underlying peat samples could assist in supporting this theory.

5. Conclusion

Investigating the geochemical signature variations has provided an insight into Irish peatlands. It is clear that cut over raised and fen peat tend to contain higher average elemental levels compared with blanket peat, based on Tellus samples collected to date, though this could change as more data become available for other parts of the country.

A few factors were identified to account for the highest Zn concentration sampling points, such as bedrock geology and the presence of wire and industrial sources nearby. However, without further investigation, it cannot be concluded in confidence if these are just hypotheses or really do contribute to the higher Zn values at these sampling locations.

Bedrock geology and land-use research was conducted to investigate K levels. Bedrock geology typical of containing clay minerals and orthoclase, combined with agricultural land-use, indicated why these areas may exhibit higher K ICP values.

The LOI and pH were investigated, and it was concluded from this study that blanket peat exhibited the highest LOI values for both the ‘A’ and ‘S’ soils. The LOI mean average values decreased with depth for each peat category. This may be because the peat layers are thin and overlie a mineral soil. The pH was highest for fen peats, which is expected due to the slightly alkaline nature of fens, and the acidic nature of Blanket and Cut over raised peats. The increase in pH with depth for the fen peats was hypothesised to be due to groundwater influence.

This investigation provides a snapshot of the geochemistry of Irish peatlands. However, further work is required to continue to better understand Irish peatlands and to guide future research and support the goals of the Climate Action Plan 2021 targets.

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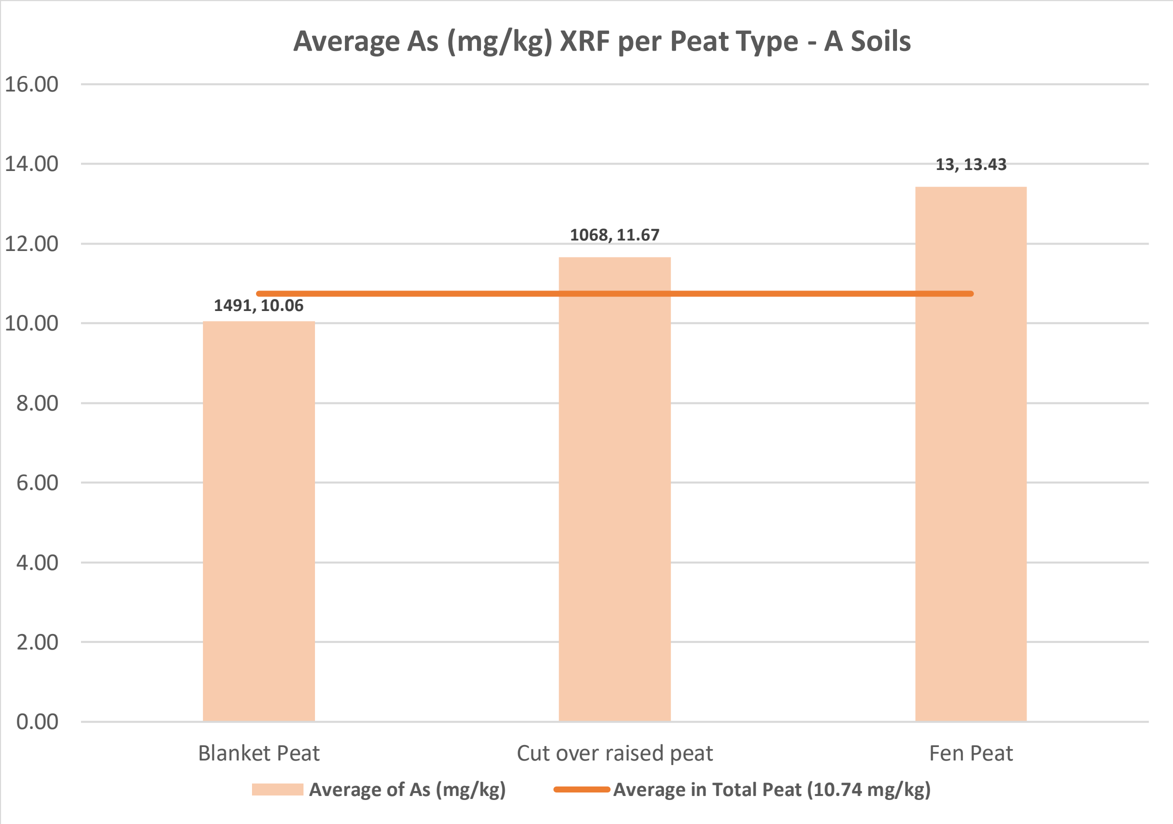
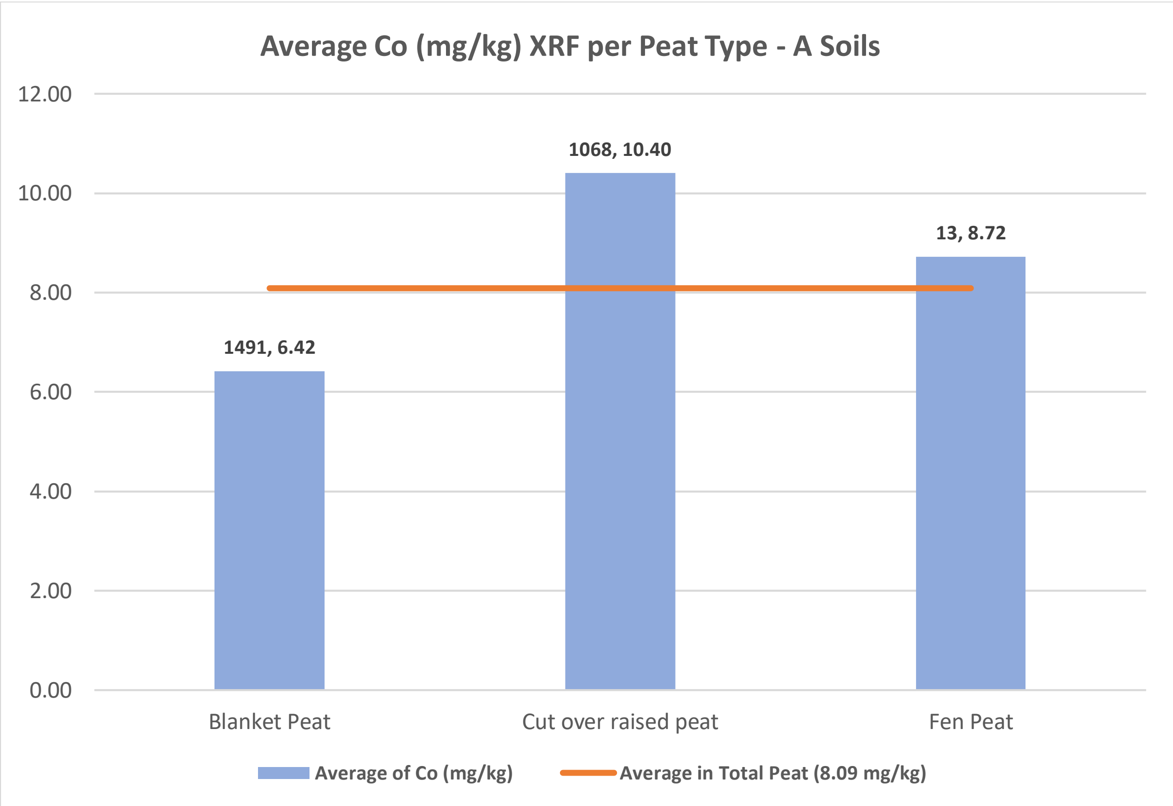
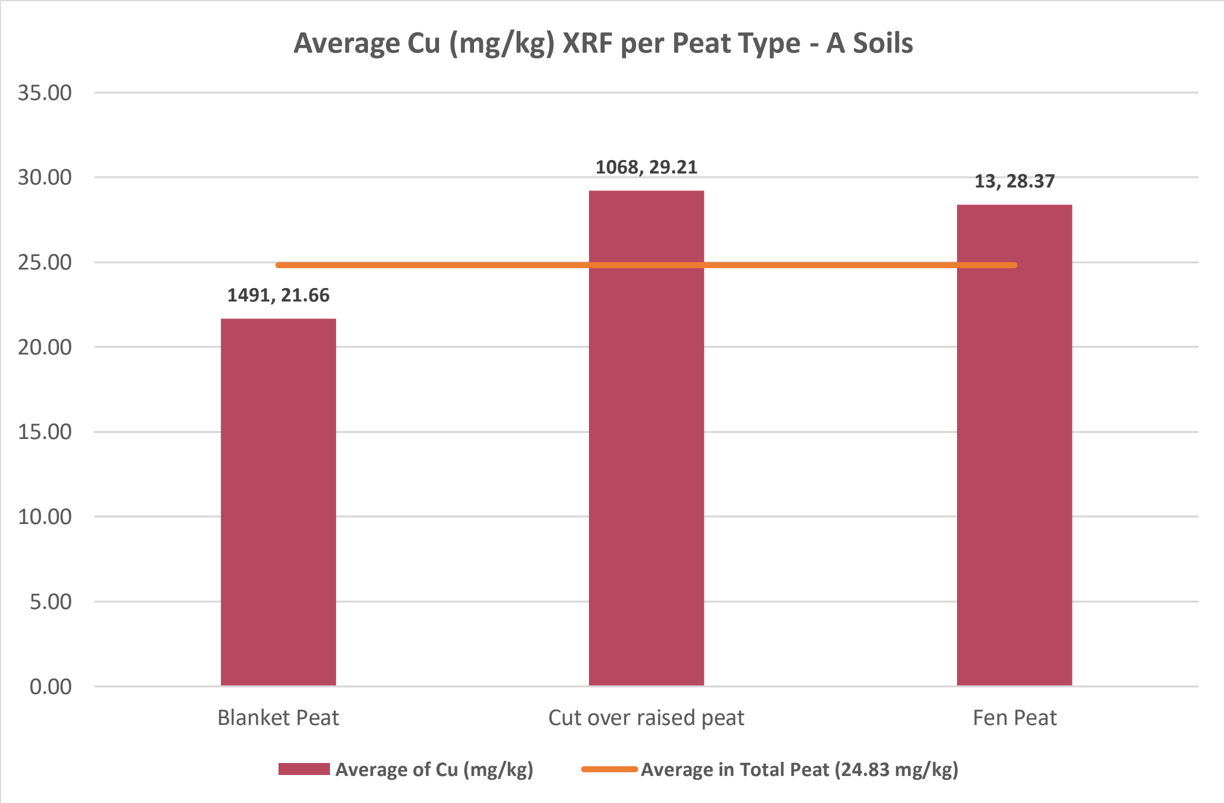
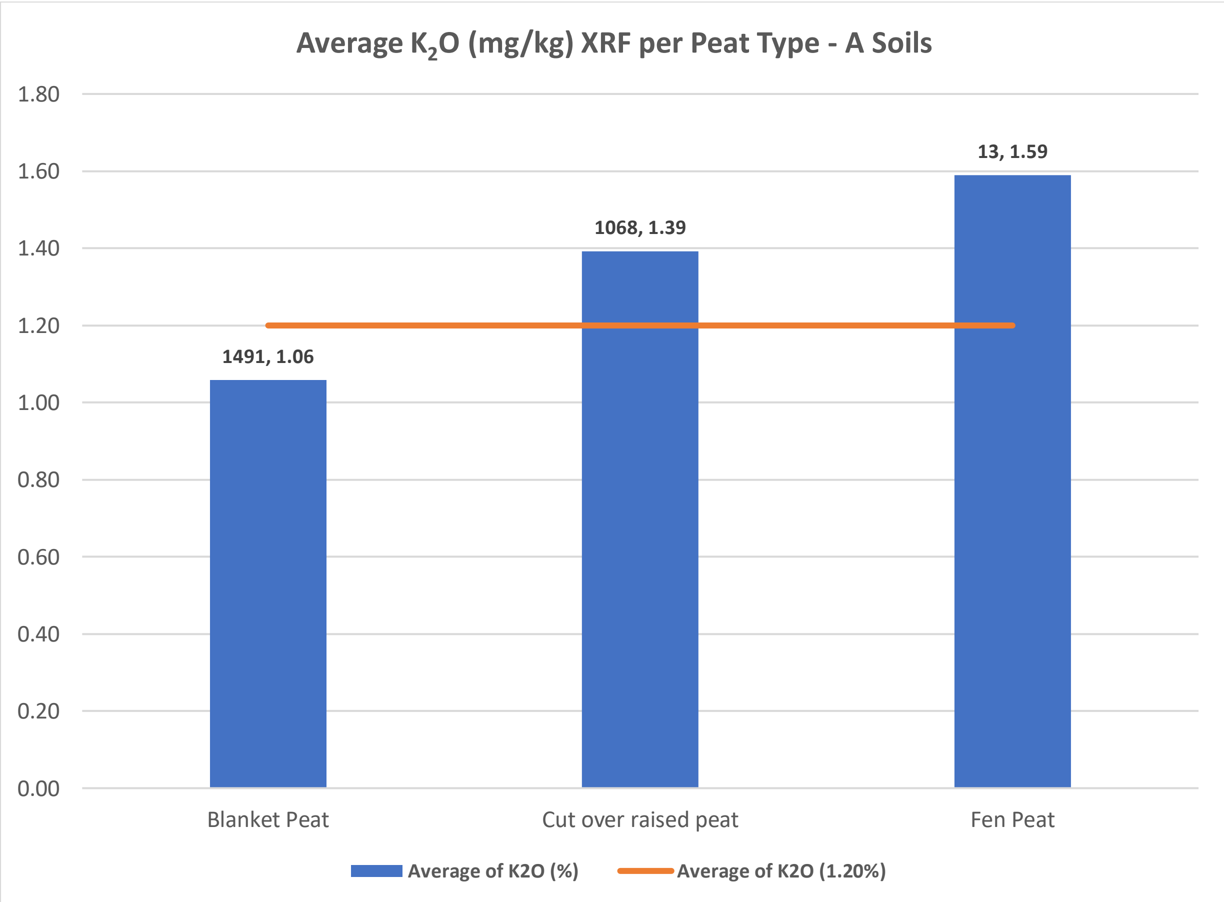
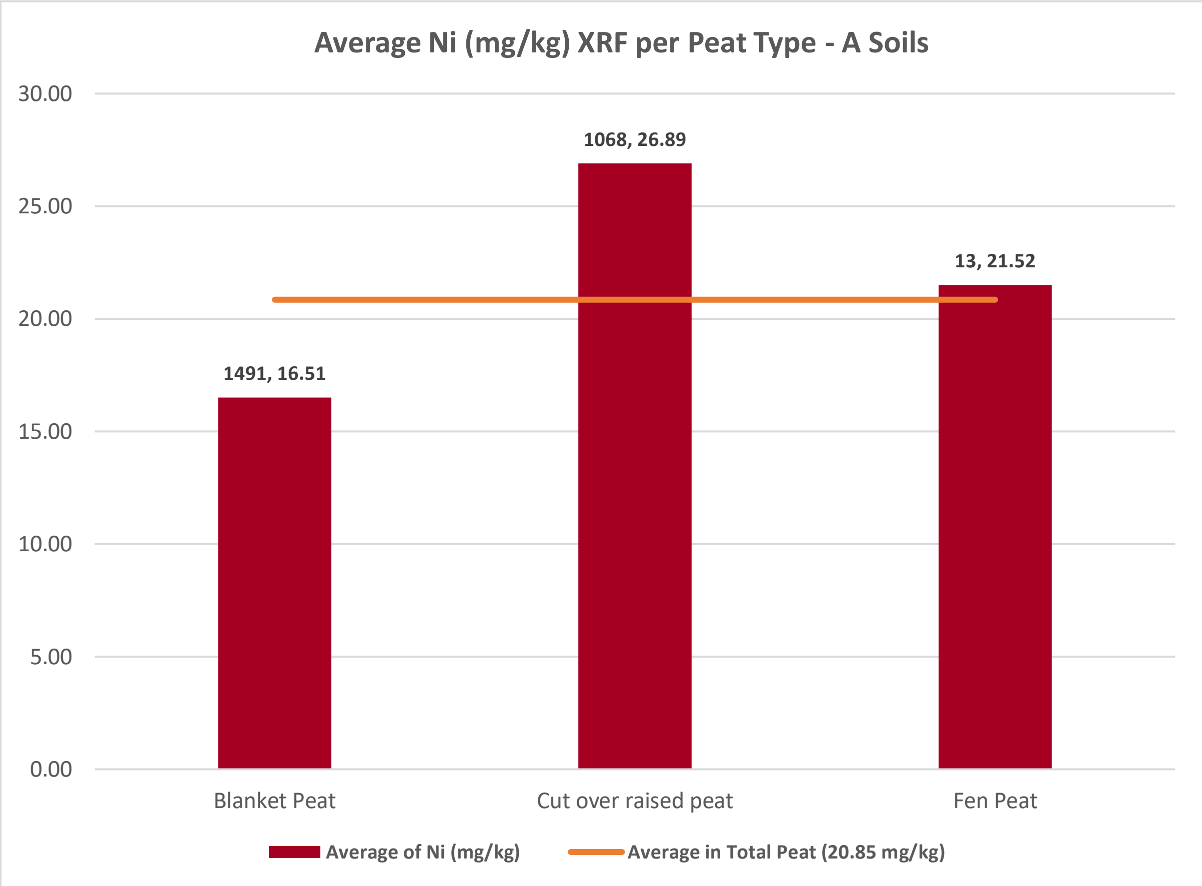
Appendix A: ‘A’ Soils Graphs

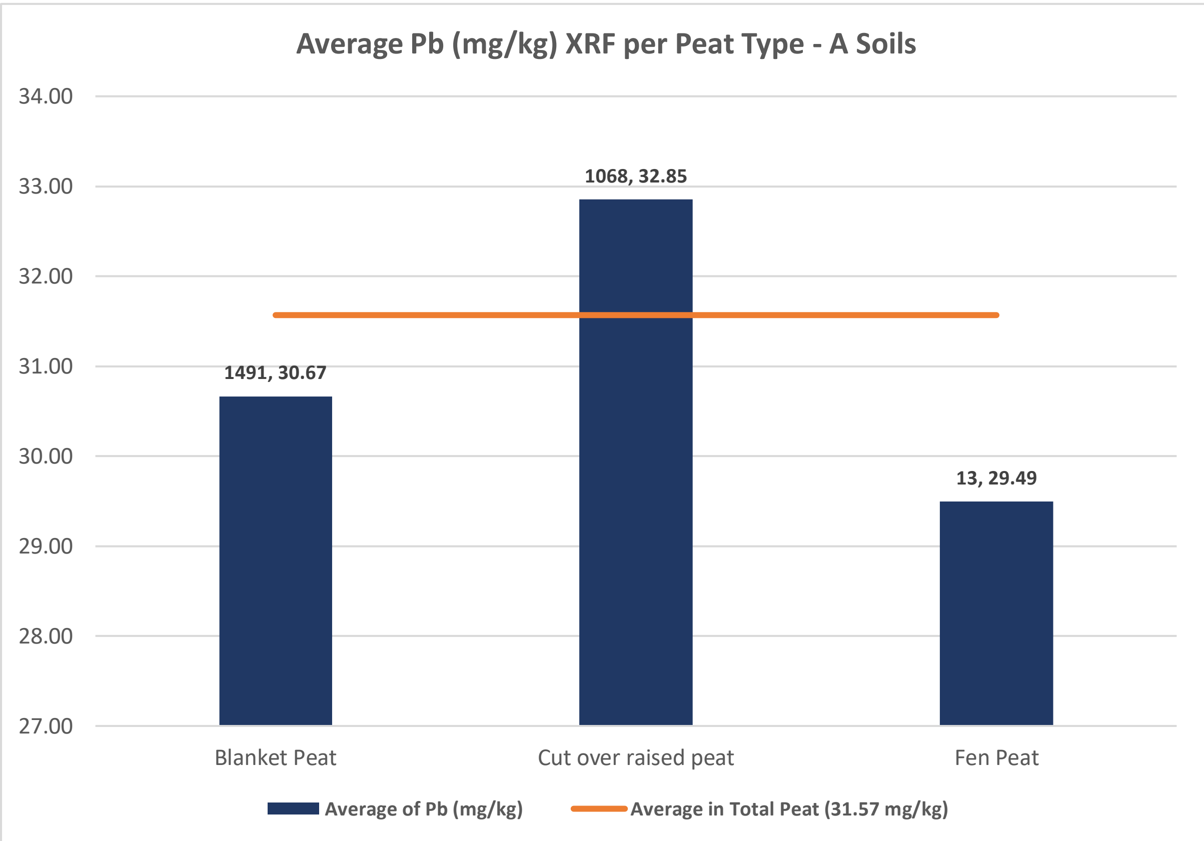


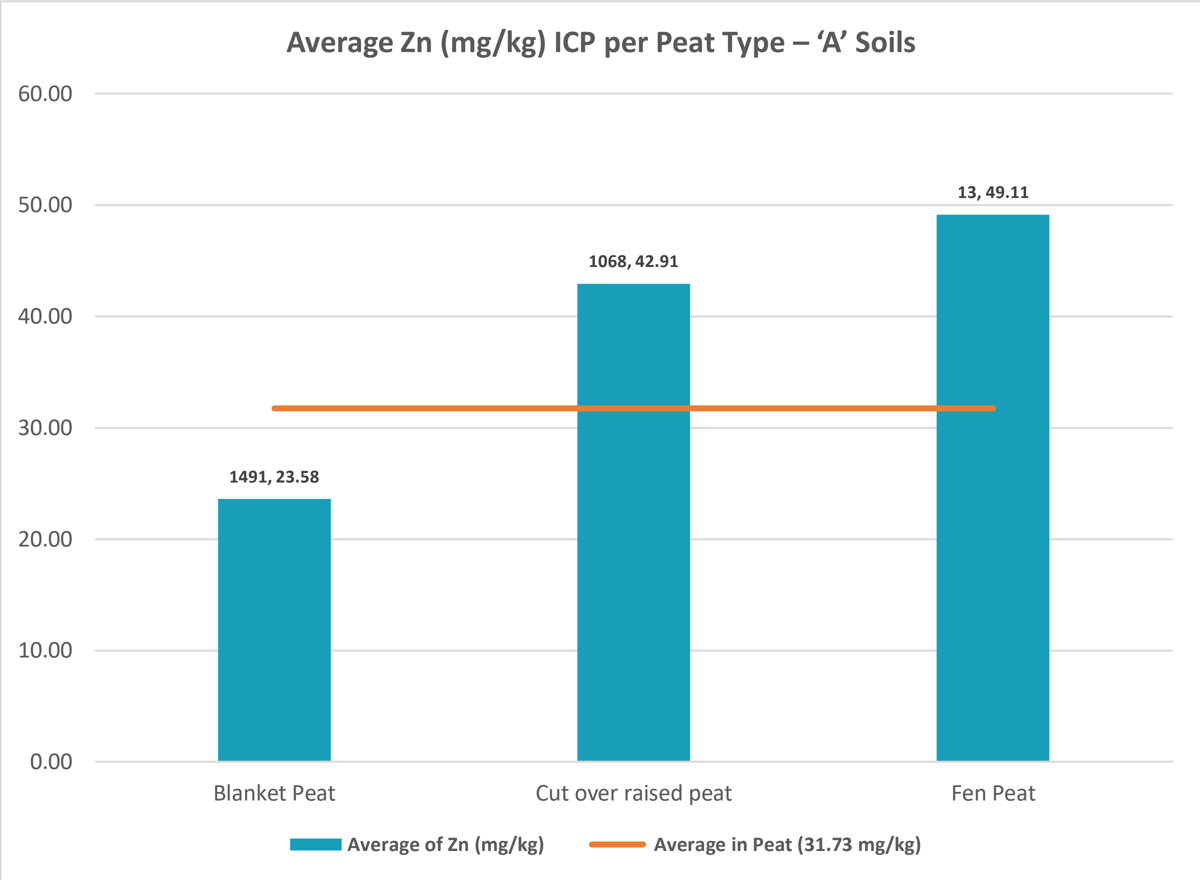



Average Cu (mg/kg) XRF per Peat Type - A Soils
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1491, 21.66
1068, 29.21
13, 28.37
Blanket Peat
Cut over raised peat
Fen Peat
Average of Cu (mg/kg)
Average in Total Peat (24.83 mg/kg)

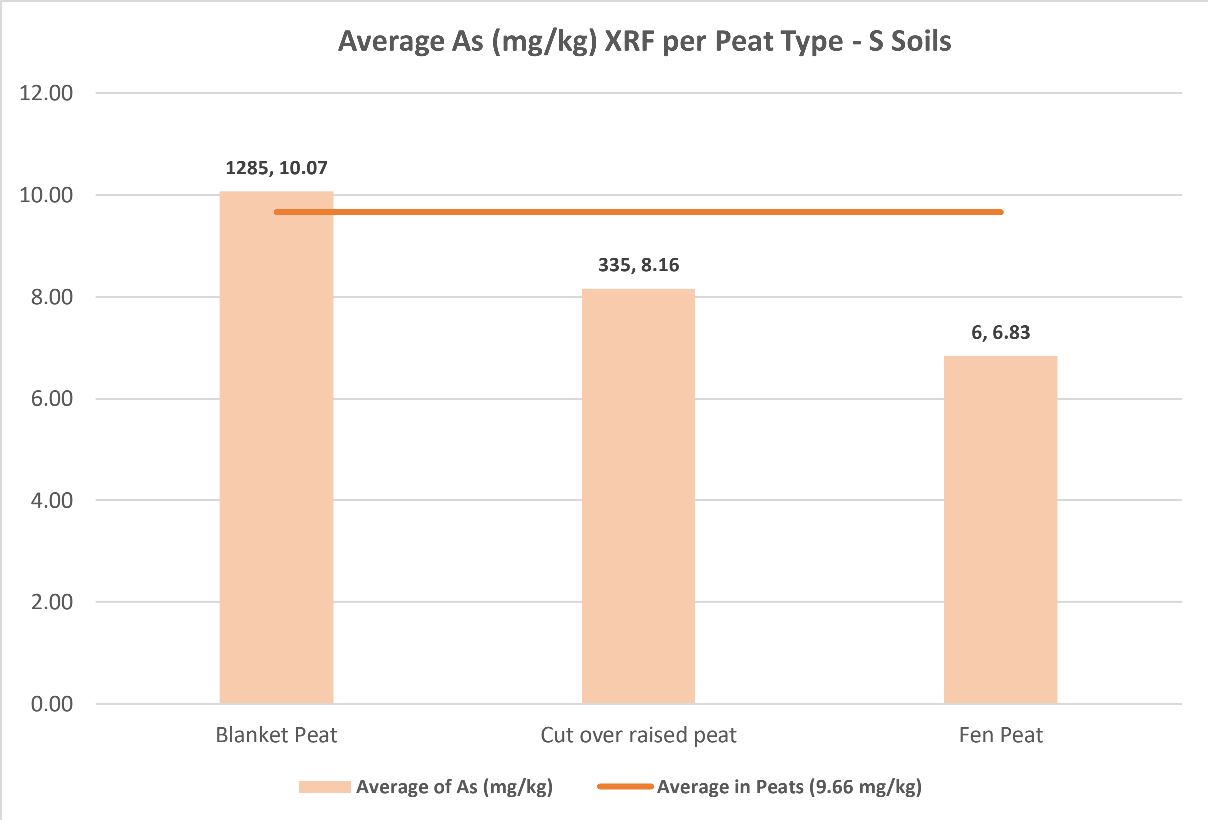

Average K_2O (mg/kg) XRF per Peat Type - A Soils
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1491, 1.06
1068, 1.39
13, 1.59
Blanket Peat
Cut over raised peat
Fen Peat
Average of K2O (%)
Average of K2O (1.20%)

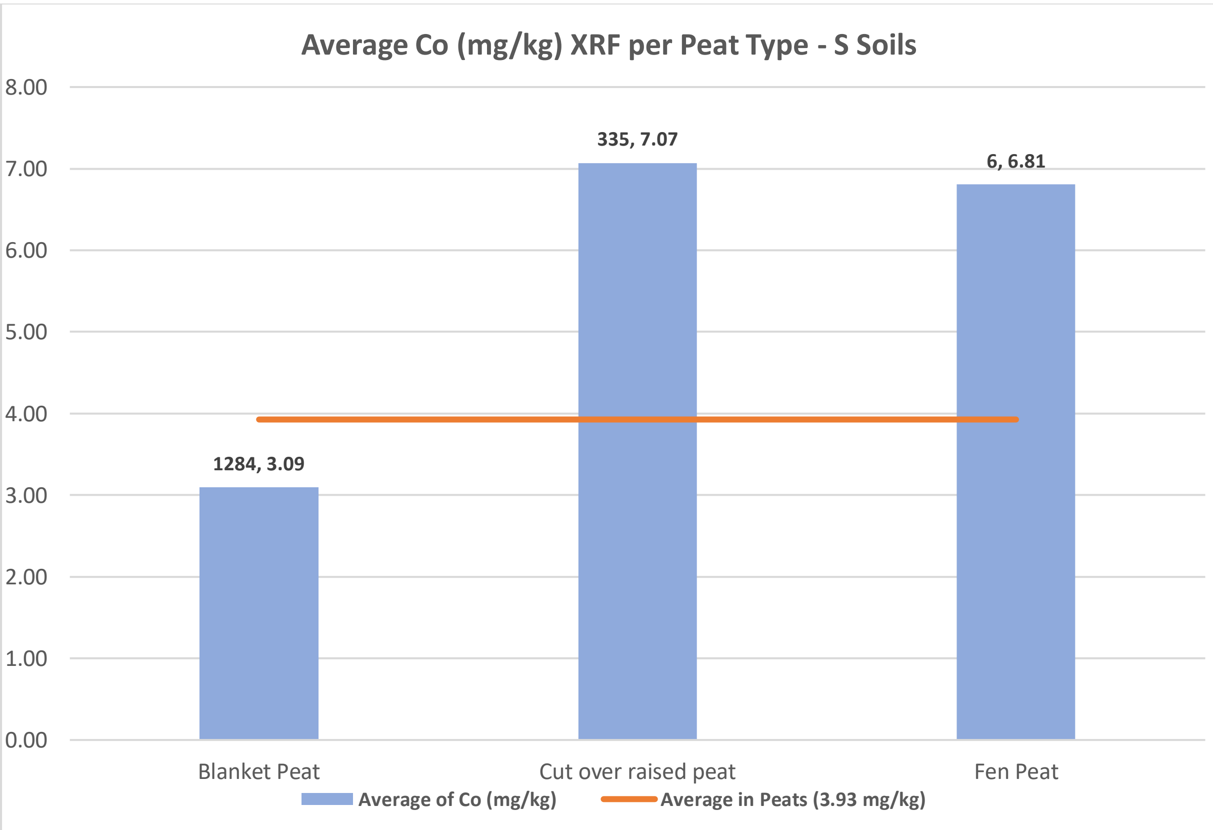

Average Ni (mg/kg) XRF per Peat Type - A Soils
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1491, 16.51
1068, 26.89
13, 21.52
Blanket Peat
Cut over raised peat
Fen Peat
Average of Ni (mg/kg)
Average in Total Peat (20.85 mg/kg)

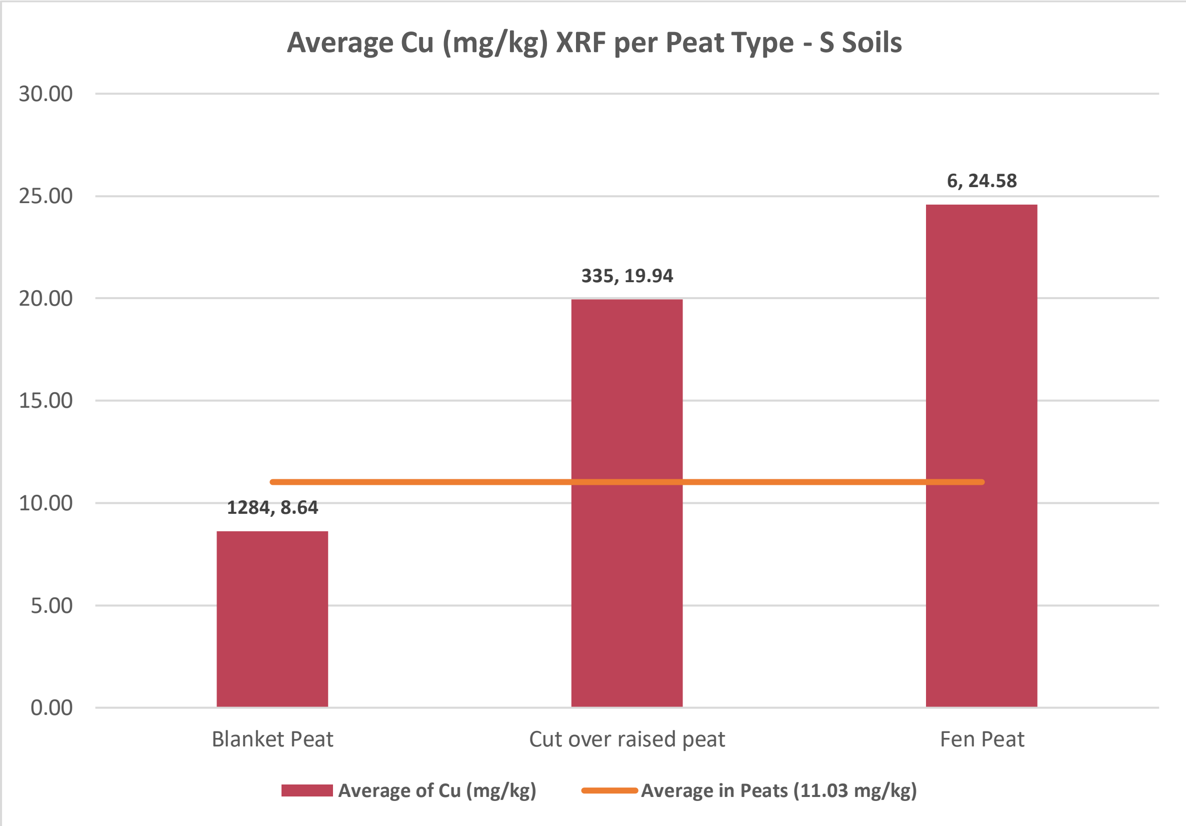

Average Pb (mg/kg) XRF per Peat Type - A Soils
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
1491, 30.67
1068, 32.85
13, 29.49
Blanket Peat
Cut over raised peat
Fen Peat
Average of Pb (mg/kg)
Average in Total Peat (31.57 mg/kg)

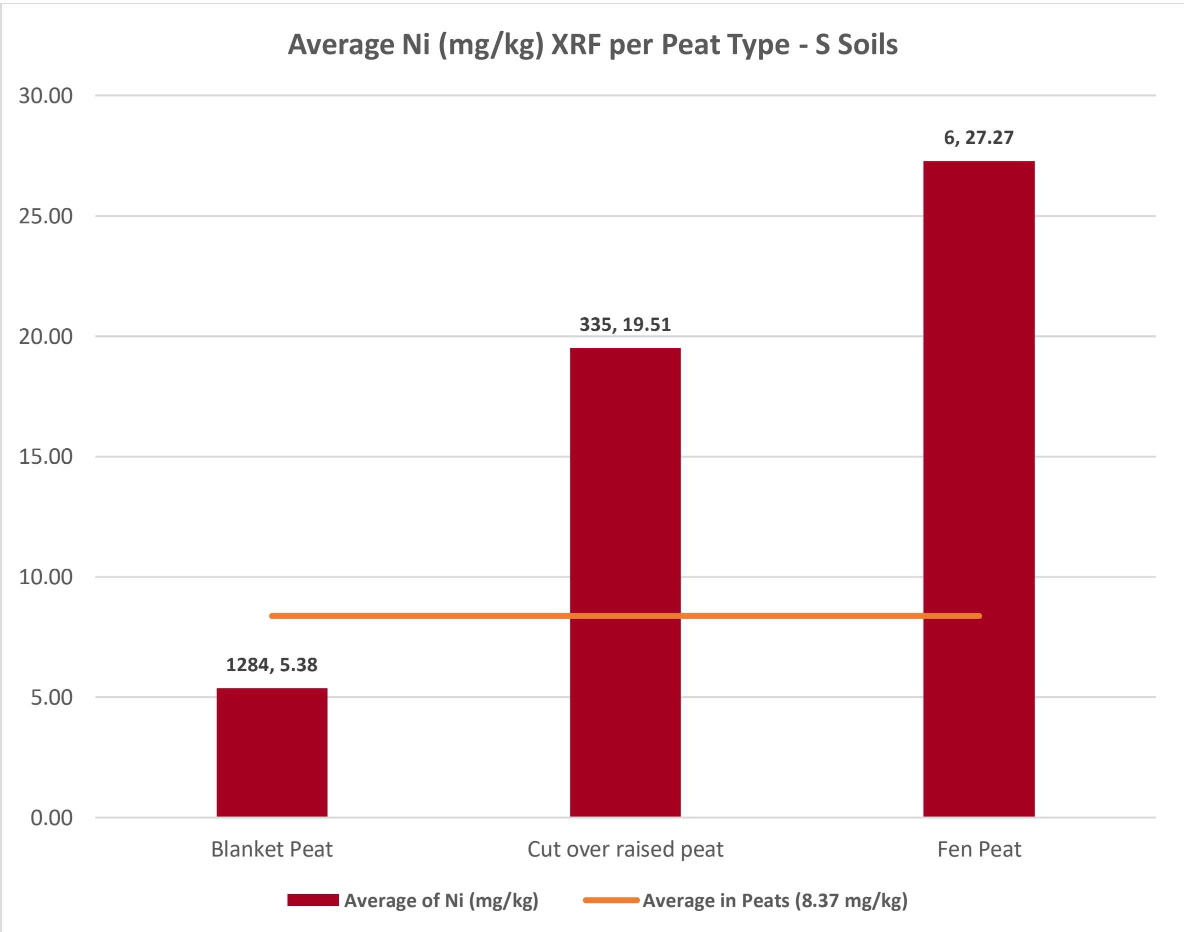

Average Zn (mg/kg) ICP per Peat Type – 'A' Soils
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1491, 23.58
1068, 42.91
13, 49.11
Blanket Peat
Cut over raised peat
Fen Peat
Average of Zn (mg/kg)
Average in Peat (31.73 mg/kg)

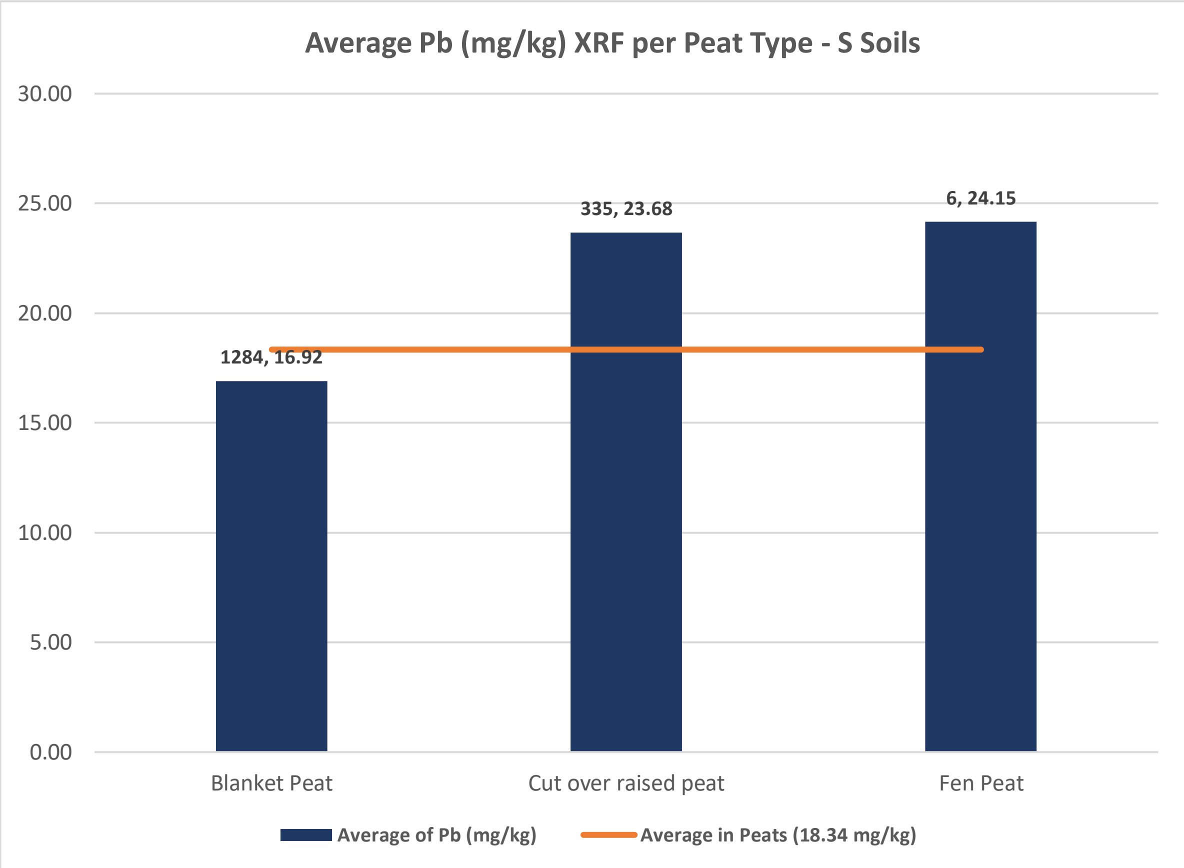
Appendix B: 'S' Soils Graphs

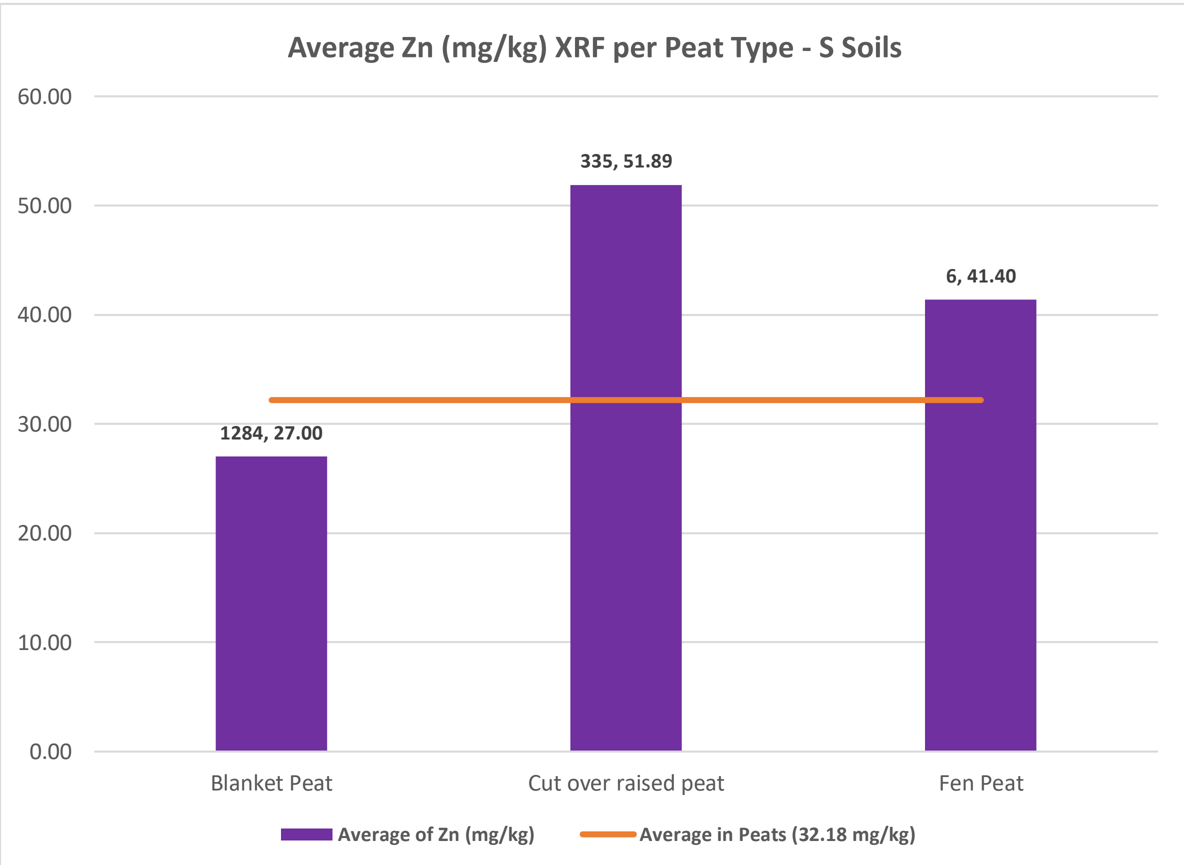





Average Cu (mg/kg) XRF per Peat Type - S Soils
30.00
25.00
20.00
15.00
10.00
5.00
0.00
6, 24.58
335, 19.94
1284, 8.64
Blanket Peat
Cut over raised peat
Fen Peat
Average of Cu (mg/kg)
Average in Peats (11.03 mg/kg)


Average Ni (mg/kg) XRF per Peat Type - S Soils
30.00
25.00
20.00
15.00
10.00
5.00
0.00
6, 27.27
335, 19.51
1284, 5.38
Blanket Peat
Cut over raised peat
Fen Peat
Average of Ni (mg/kg)
Average in Peats (8.37 mg/kg)


Average Pb (mg/kg) XRF per Peat Type - S Soils
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1284, 16.92
335, 23.68
6, 24.15
Blanket Peat
Cut over raised peat
Fen Peat
Average of Pb (mg/kg)
Average in Peats (18.34 mg/kg)


Average Zn (mg/kg) XRF per Peat Type - S Soils
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1284, 27.00
335, 51.89
6, 41.40
Blanket Peat
Cut over raised peat
Fen Peat
Average of Zn (mg/kg)
Average in Peats (32.18 mg/kg)