Quantification of Soil Carbon in Ituri Forest, Dem. Rep. Congo

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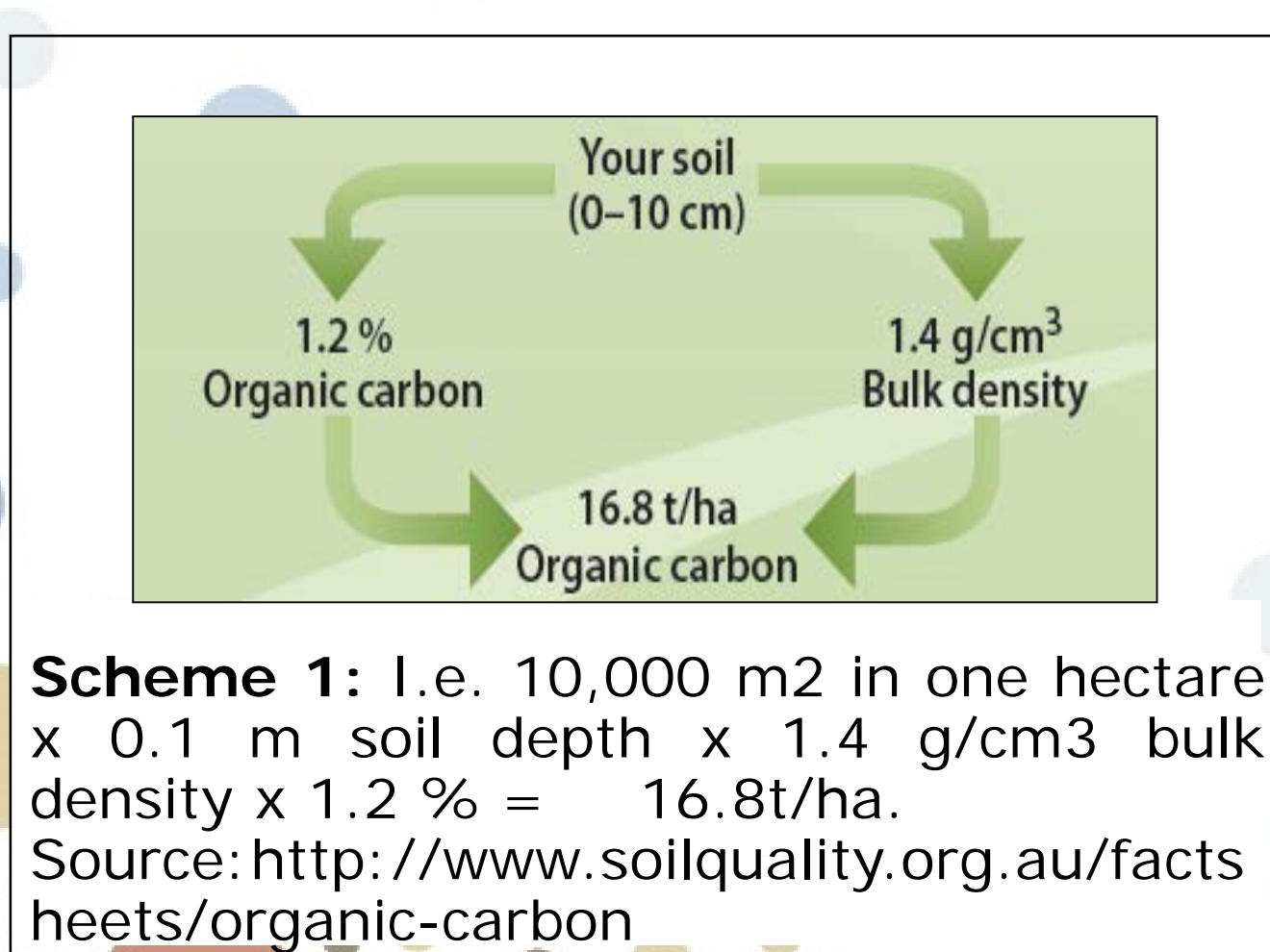
INTRODUCTION

Promoting carbon sequestration to offset atmospheric carbon dioxide by offering some sort of incentives via direct payments or carbon credits is a current topic of interest. However, several questions arise such as:

➢ What is the best way to determine the quantity and quality of carbon in soils?

➢ How much carbon can a soil sequester?

To address these questions, inventories of soil carbon concentrations are needed for constant monitoring of current carbon status and potential for sequestration.

METHODOLOGY

This study was conducted at Lenda1 Forest Dynamics Plots (FDP) in the Okapi Faunal Reserve (OFR), Ituri Forest, Democratic Republic of Congo. Lenda1 Forest Dynamics Plot is located at the north of Lenda2, at 1° 19' N latitude and 28° 38' E longitude. Surface soil samples (0-10 cm depth) were collected along a 20 m x 20 m grid in the 10 ha plot. A portable GPS receiver was used to record the coordinates of each sampling location. Soil samples were air-dried and brought to Harvard Forest, Harvard University for analysis of soil organic carbon and other nutrients. Soil organic carbon density (SOCD) was calculated according to Pluske, Murphy and Sheppard as shown below :

Scheme 1: I.e. 10,000 m2 in one hectare x 0.1 m soil depth x 1.4 g/cm3 bulk density x 1.2 % = 16.8t/ha.
Source: http://www.soilquality.org.au/factsheets/organic-carbon

OBJECTIVES

The objective of this study was to assess the status of soil carbon and other nutrients in Ituri Forest, Democratic Republic of Congo.
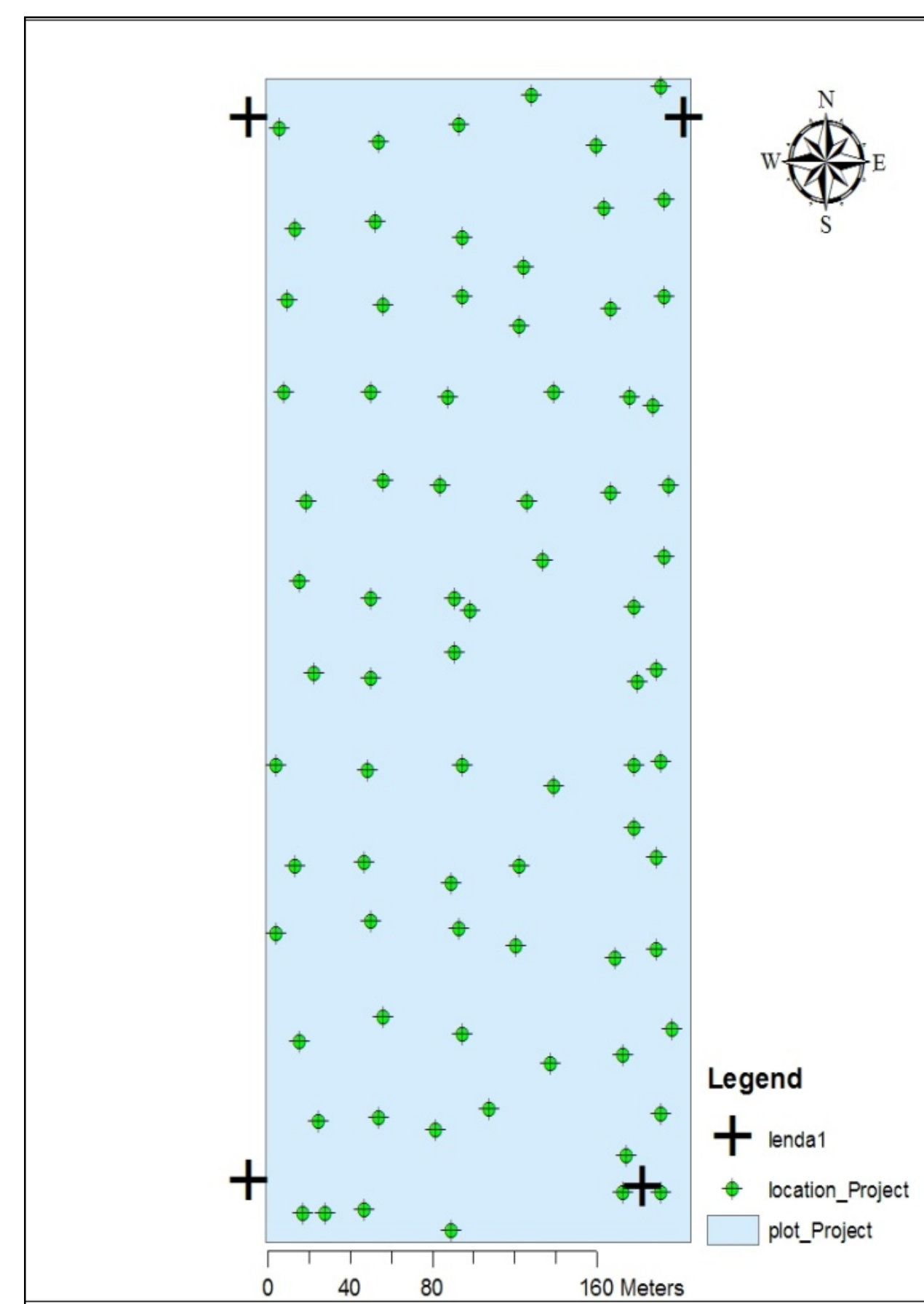
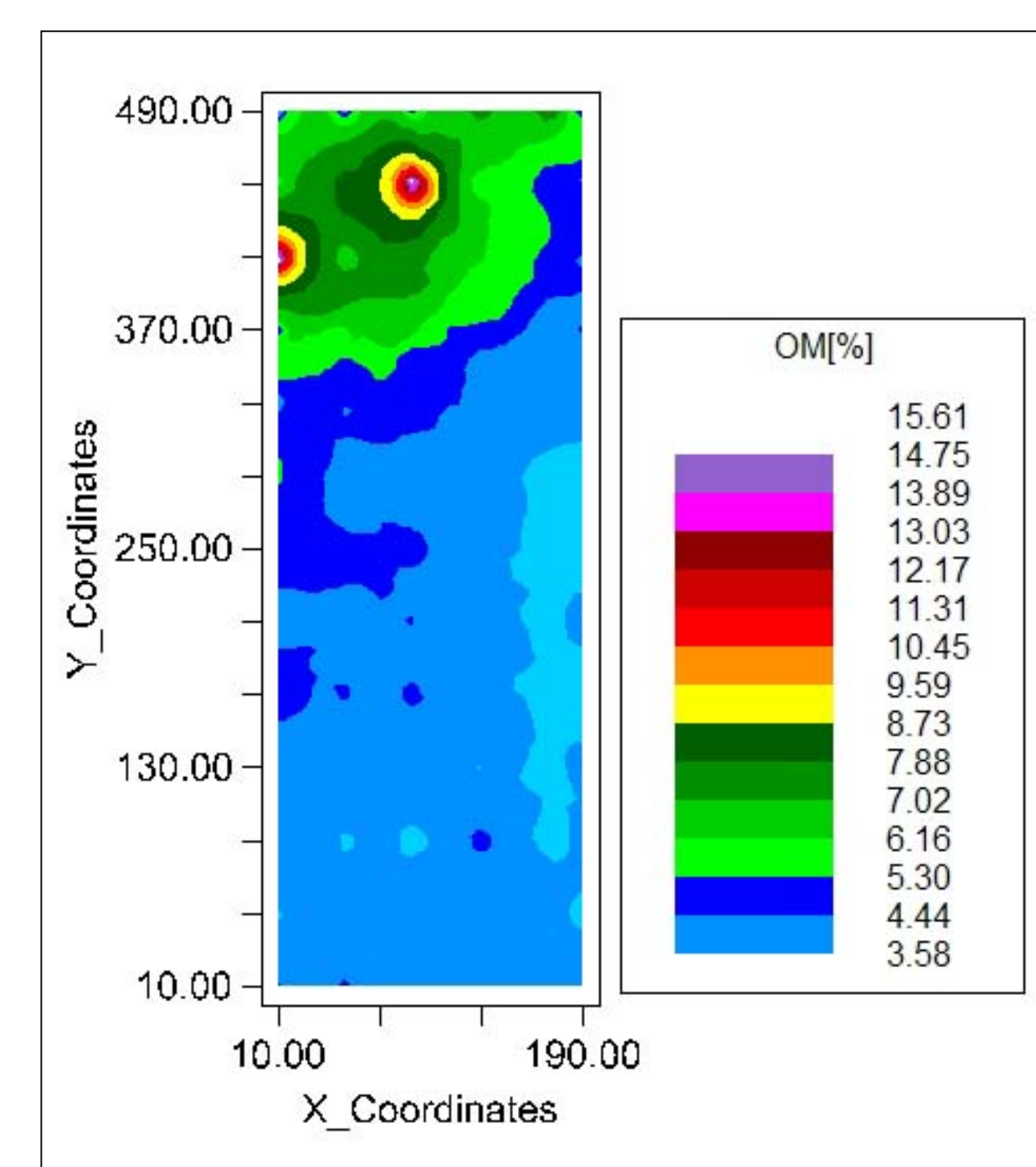**Fig. 1:** Sampling design in the 10ha plot at Lenda1, Forest Dynamic Plot, Ituri Forest

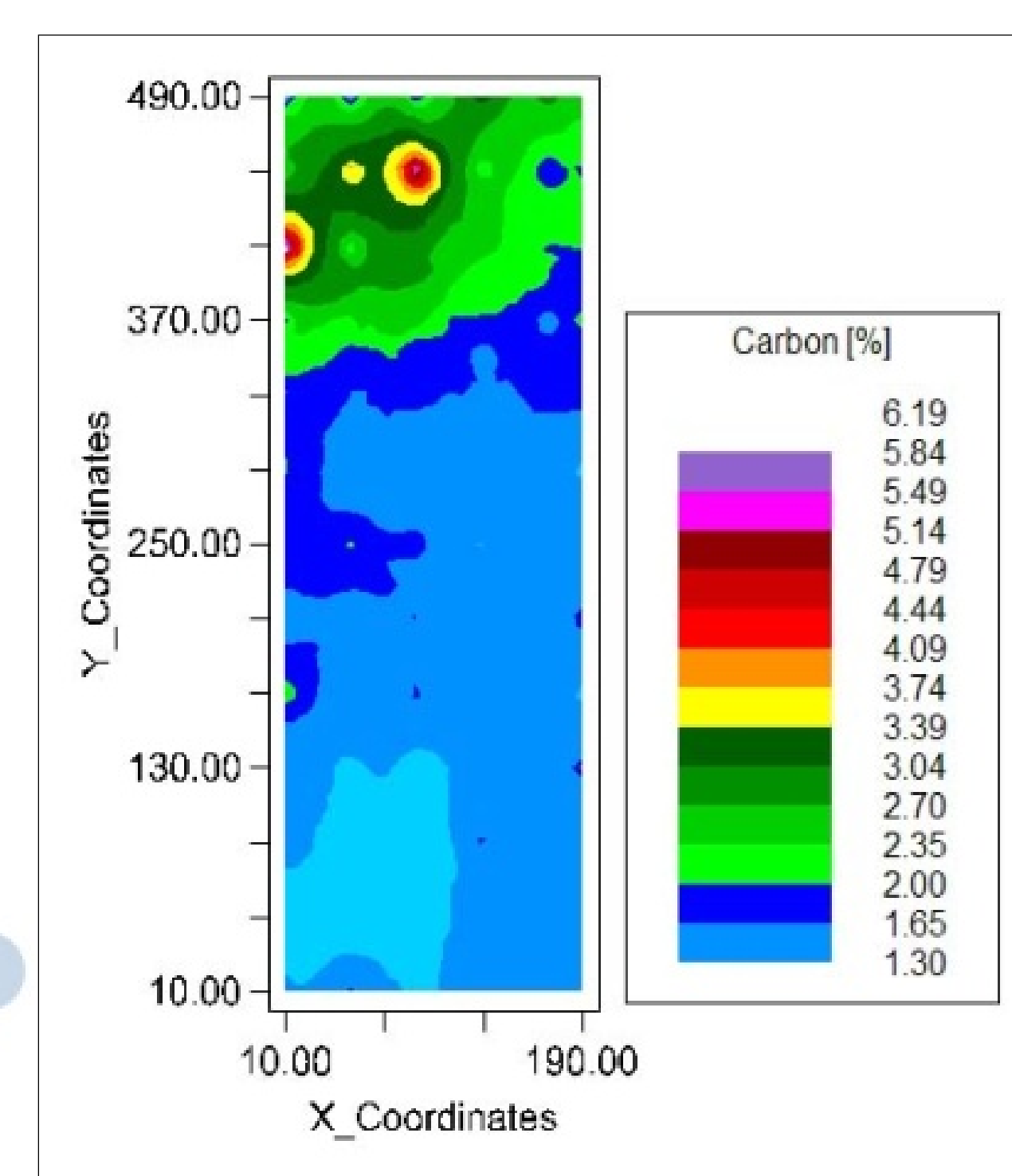**Fig. 2:** Distribution of soil organic matter (OM) across the 10 ha plot

Fig. 3: Distribution of Soil Organic Carbon (SOC) across the 10 ha plot

MAIN RESULTS

Coefficient of variation (CV) for soil bulk density (BDY) was less than 20%, suggesting that there was less variability and that BDY was well measured. Therefore, any effect of BDY in overestimating soil organic carbon (SOC) can be ruled out. The results of this preliminary study also showed the potential for soil carbon sequestration in this 10 ha pristine forest plot, dominated by *Gilbertiodendron dewevrei*. SOC averaged 29.61 tons /ha in the 0-10 cm layer in Ituri Forest. This value seems to suggest greater SOC storage in Ituri Forest as compared to nearby forest of the same region. In fact, although they sampled in different forests and higher soil layer but in the same province, Doetterl *et al.* (2016) reported SOC values of 23.10 Mg C/ha in Yoko Forest and 55.70 Mg C/ha in Yangambi Forest for the 0-30 cm depth. Our results for a third of their sampling depth shows higher values of SOC.

Variable	Mean	SD	C.V.	Min.	Med.	Max.
BDY (g/cm³)	1.69	0.17	9.88	0.92	1.73	1.89
SOC (gkg⁻¹)	1.80	1.13	62.65	0.78	1.53	7.71
N (%)	0.19	0.12	64.94	0.09	0.16	0.86
C/N	9.38	0.97	10.30	7.20	9.35	11.78
OM (%)	4.68	2.81	60.06	2.28	4.00	20.56
SOCᴅ (tons/ha)	29.61	16.39	55.36	14.55	25.06	130.65

Tab. 1: Summary of simple statistics for soil properties in the 10 ha plot, Lenda1, Ituri Forest
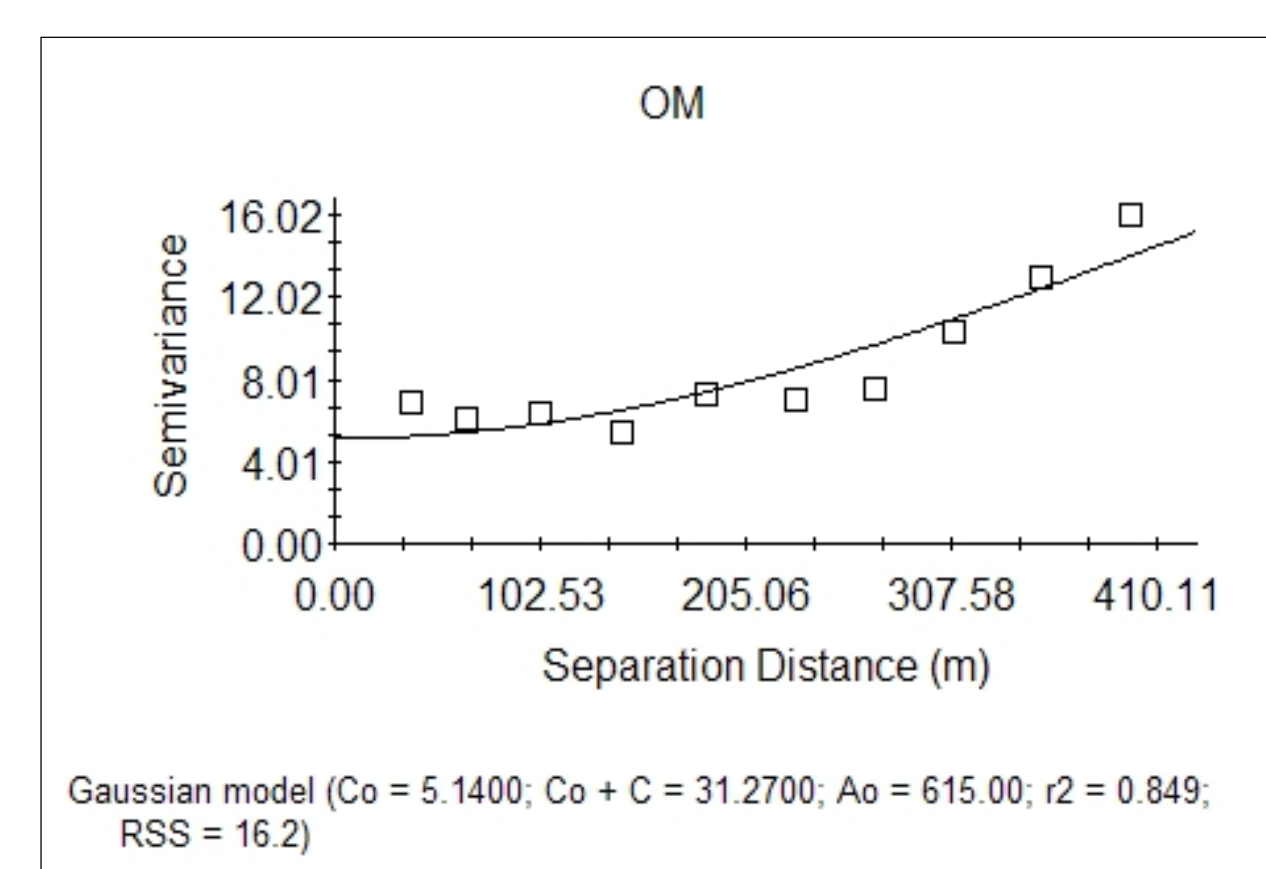
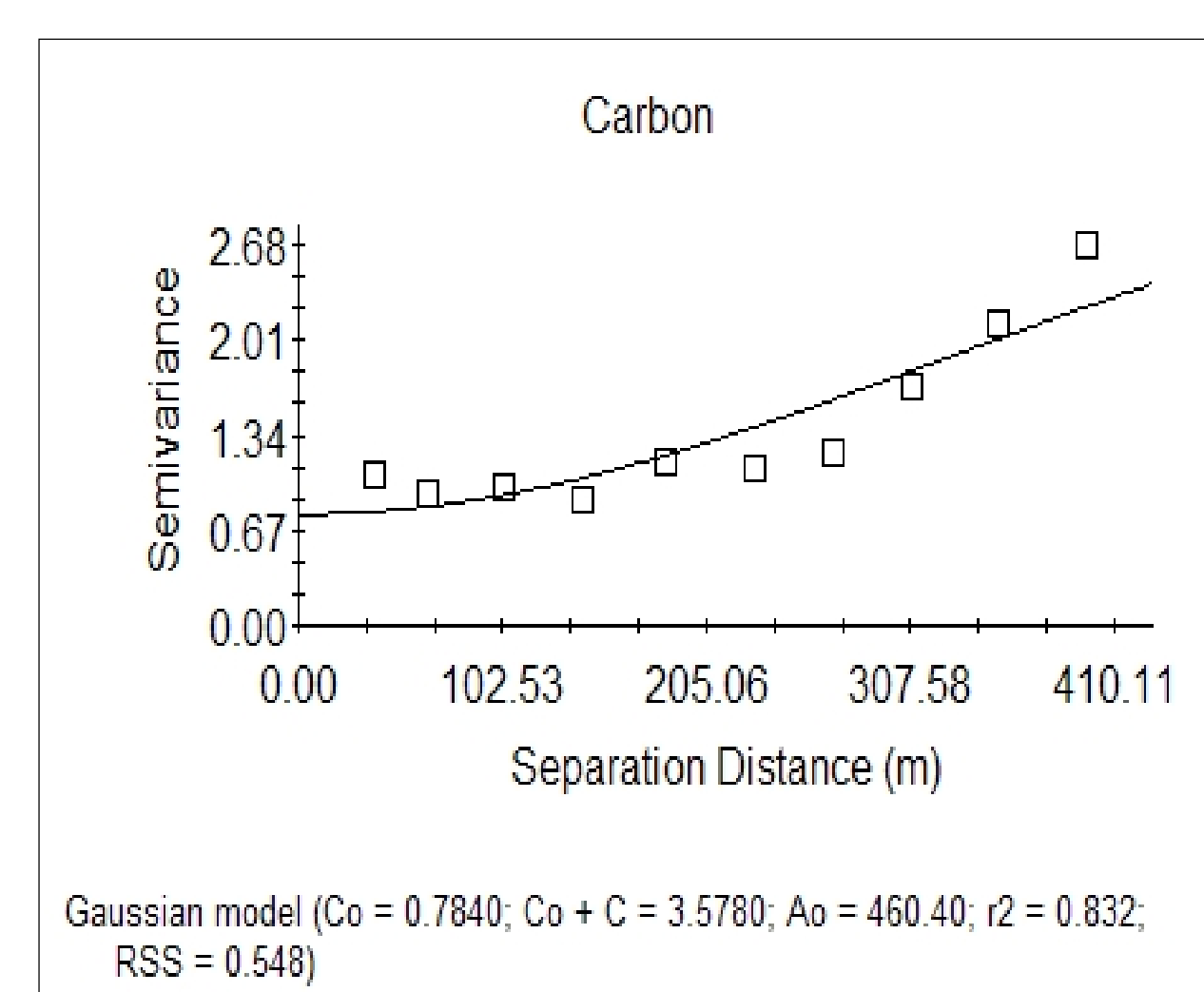**Fig. 4:** Variogram model for Soil Organic Matter

Gaussian model (Co = 5.1400; Co + C = 31.2700; Ao = 615.00; r2 = 0.849; RSS = 16.2)

Fig. 5: Variogram model for Soil Organic Carbon

Gaussian model (Co = 0.7840; Co + C = 3.5780; Ao = 460.40; r2 = 0.832; RSS = 0.548)
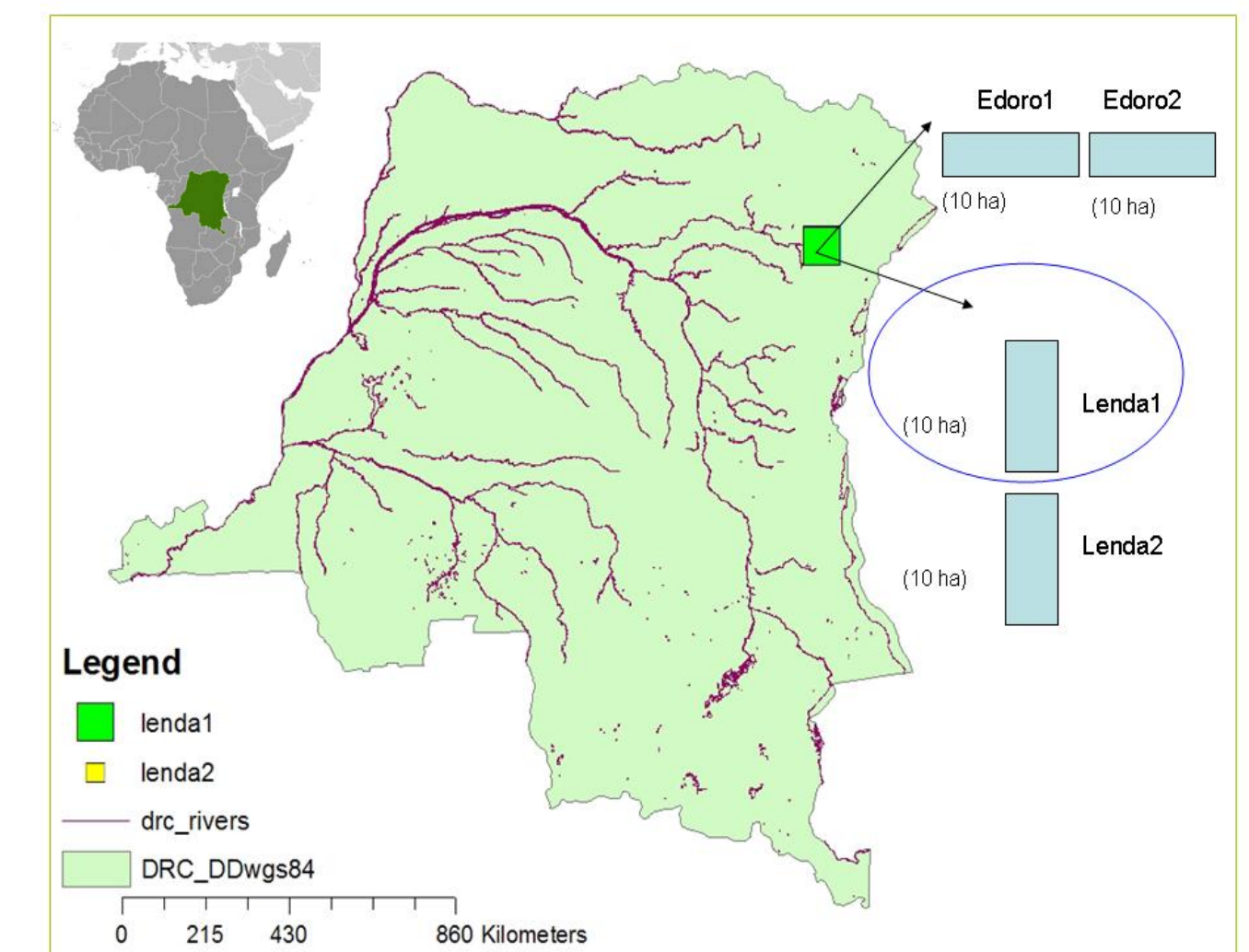
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Fig. 6: Location of Lenda et Edoro Forest Dynamic Plots, Ituri Forest, Dem. Rep. Congo

Fig. 7: Okapi Faunal Reserve, Ituri Forest, Dem. Rep. Congo

Fig. 8a: Soil sampling in the 10 ha plot, Ituri Forest, Dem. Rep. Congo

Fig. 8b: Post sampling in the 10 ha plot, Ituri Forest, Dem. Rep. Congo

CONCLUSIONS

It is suggested the study be pursued to include deeper soil layers (10-100 cm) for a better assessment of soil organic carbon in Ituri Forest, Democratic Republic of Congo.