

**Dynamique de la matière organique à l'échelle d'un  
terroir agro-pastoral de savane ouest-africaine  
(sud-Sénégal)**  
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## ABBREVIATIONS

ABB	available biomass for burning	FU	feed unit
ABT	Alimentation du Bétail Tropical (Program for the “Improvement of Feeding Systems of Tropical Livestock”, ISRA/CIRAD-EMVT)	GHG	green house gas
Adu	adult	GLM	general linear model
AGB	above-ground biomass	GN	groundnut
BGB	below-ground biomass	INRA	Institut National de la Recherche Agronomique (French Institute for Agronomic Research)
CEC	cationic exchange capacity	IRD	Institut de Recherche pour le Développement (French Institute for Research and Development, formerly ORSTOM)
CI	cropping intensity	ISRA	Institut Sénégalais de la Recherche Agricole (Senegalese Institute for Agricultural Research )
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (French International Centre for Agricultural Research in Hot Regions)	LS	least square
CNRS	Centre National de la Recherche Scientifique (French National Centre for Scientific Research)	LUS	land use system
Com	compound	LW	live weight
Cor	corralled	MA	maize
DM	dry matter	MI	millet
DMI	dry matter intake	MW	metabolic weight
EMVT	Département Elevage et Médecine Vétérinaire (Department of Animal Production and Veterinary Medicine)	NF	non-fractionated
ENGREF	Ecole Nationale du Génie Rural des Eaux et des Forêts (French Institute of Forestry, Agricultural and Environmental Engineering)	OF	old fallow
Equ	equipment	OM	organic matter
FA	fallow	OMI	organic matter intake
FOME	faecal organic matter excretion	OS	owned surface
		PC	principal component
		PCA	principal component analysis
		PET	potential evapotranspiration
		Pm	permanent
		POD	available phosphorus (Olsen method modified by Dabin, 1967)



P <sub>t</sub>	total phosphorus	SOM	soil organic matter
RI	rice	SSA	sub-Saharan Africa
RI	rice	TLU	tropical livestock unit
R <sub>s</sub>	correlation coefficient of Spearman	UWS	upper woody strata
SAS	statistical Analyses System	Wa	household waste
Sea	seasonal	WAS	West African savanna
SOC	soil organic content	WU	working unit
SODEFITEX	Société des Fibres Textiles	YF	young fallow

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Organic matter  
dynamics  
in mixed-farming  
systems  
of the West African  
savanna:  
a village case study  
from south Senegal  
RAPHAËL MANLAY

Organic matter (OM) is a multi-purpose tool in West African smallholder mixed-farming systems, but its supply has been decreasing for several decades. To assess the viability of a mixed-farming system of south Senegal, carbon (C), nitrogen (N) and phosphorus (P; available in soil and noted  $P_{OD}$ ) budgets (stocks and flows) were thus quantified.

The village territory of the study showed a ring-like organisation with growing intensification of fertilization and cropping practices from the periphery (bush ring) to the compounds (compound fields).

Stocks in plant and soil averaged 55 tC, 26 tN and 43 kgP ha<sup>-1</sup> in old fallows. They were 100, 30 and 250 % higher than in the bush cropped fields, plant biomass accounting for nearly all of the rise. C, N and P amounts recorded in the soil of compound fields were higher than those of the bush field, but the increase was restricted mainly to the 0-10 cm layer. However, the rather weak response of local sandy soils to management can be interpreted only by reassessing the bio-thermodynamical signification of soil organic carbon cycling in the maintenance of the integrity of local agroecosystems.

Manageable stocks of the whole village territory were estimated to 30 tC, 1.5 tN and 26 kgP ha<sup>-1</sup> in 1997. Carbon was stored mainly in soil. Livestock, crop harvest and wood collecting were responsible for respectively 59, 27 and 14 % of the C uptake on the village territory. As a result, large C flows were set towards the compound ring (3.8 tC ha<sup>-1</sup> y<sup>-1</sup>). N and P depletion of the system amounted to 4 kgN and 1 kgP ha<sup>-1</sup> y<sup>-1</sup>, suggesting that the system was close to nutrient balance.

Under current demographic growth rate, C depletion may reach 0.38 tC ha<sup>-1</sup> y<sup>-1</sup> and C demand may double during the next three decades. Without any intensification of farming practices, the viability of the system might soon be called into question.

DOCTORAL THESIS

ENVIRONMENT