The Natural and Social Conditions for Soil Nutrients: The Case of a Mediterranean Village in the 1860s

Elena Galán and Enric Tello

Summary

Between 1861 and 1865, the small Catalan village of Sentmenat suffered from manure shortage. The nutrient gap was filled by transferring nutrients from uncultivated areas or vineyards to the cropland through methods such as the so-called hormigueros or the direct burial of fresh vegetable matter in ditches dug between rows of vines. While these options could alleviate the problem, they came at a cost: a lot of human and animal labor was needed. As part of the project *Environmental History of Mediterranean Agrarian Landscapes* this incident was used to answer the question if pre-industrial agriculture resulted in the mining of soil nutrients.

Did pre-industrial agriculture result in the mining of soil nutrients? The answer to this question could inform the planning of sustainable agricultural systems, but it needs an interdisciplinary approach, bridging history and ecology. Place matters for such a question, as the natural and social conditions differed markedly. Mediterranean agro-ecosystems are, as yet, understudied. The study of Sentmenat, a small Catalan village, helps to remedy this situation.

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Main data of 1859-1865	*inhabitants*	*families*	*landowners*
Population	1,713	354	208
		total land	*only cropland*
Landownership inequality (Gini coefficient)		0.58	0.51
	hectares	*% of cropland*	*% of total area*
Vegetal gardens and irrigated crops	67.8	4.2	2.5
Rain-fed herbaceous crops	365.5	22.6	13.3
Vineyards	1,066.1	65.9	38.8
Olive groves	113.1	7.0	4.1
Other rain-fed woody crops	5.2	0.3	0.2
Total cropland	***1,617.7***	***100.0***	***58.8***
Woodland and scrub	698.4	--	25.4
Pasture	341.4	--	12.4
Unproductive or developed	92.5	--	3.4
TOTAL AREA	**2,750**	--	**100.0**
	per square km	*per cropland ha*	*per sown-land ha*
Livestock Units of 500 kg (LU500)	7.25	0.12	0.46

Fig. 1: Location of the municipality of Sentmenat in the province of Barcelona, Catalonia and Spain, and main historical data (1859–1865)

Between 1861 and 1865, Sentmenat had a population density of 59 inhabitants per square km, similar to northern European rural areas at that time, but a lower livestock density of only 12 livestock units (500 kg) per square km of cropland. The village therefore suffered from manure shortage. The nutrient gap was filled by transferring nutrients from uncultivated areas or vineyards to the cropland through methods such as the so-called hormigueros, in which piles of dried vegetation were burned in small charcoal-kilns under a soil cover to generate both anoxic combustion and fertilizer, or the direct burial of fresh vegetable matter in ditches dug between rows of vines. While these options could alleviate the problem, they came at a cost: a lot of human and animal labor was needed.

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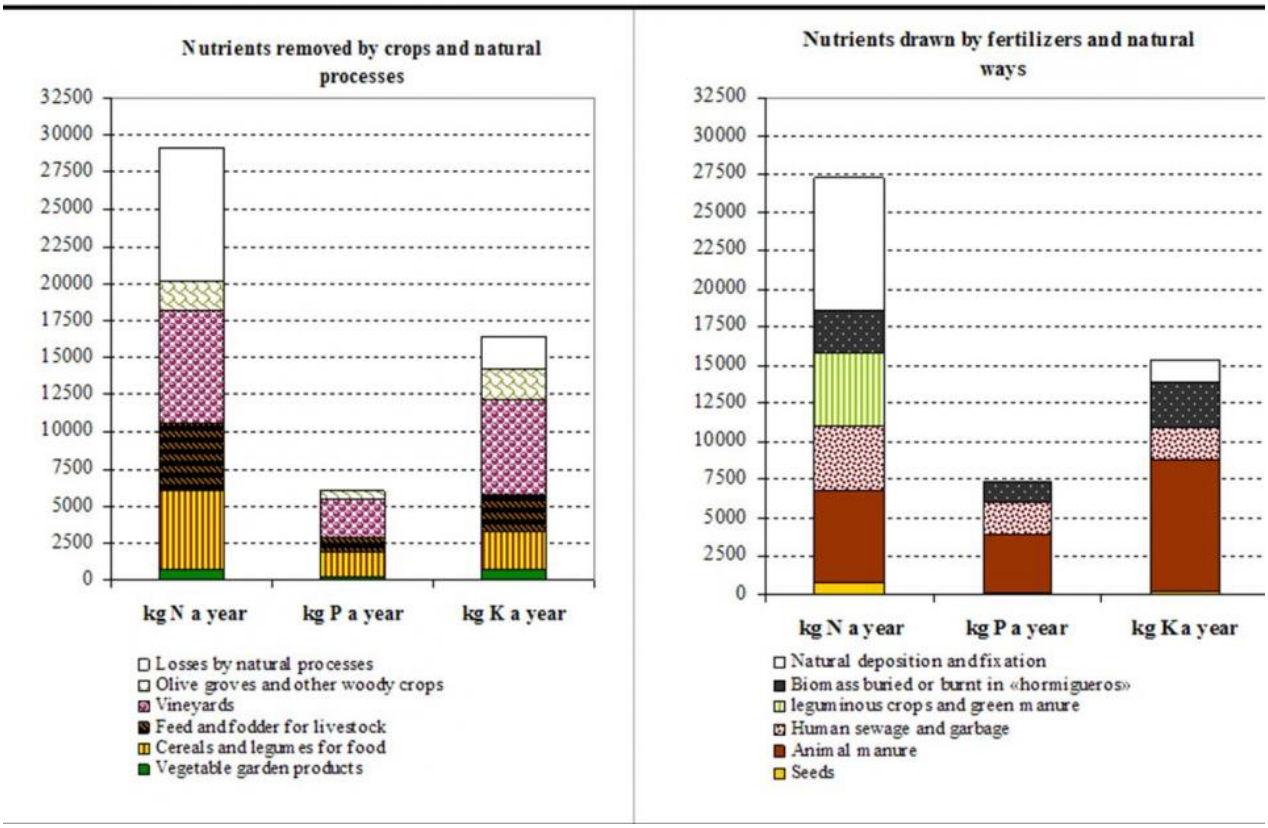

Fig. 2: Summary of the nutrient balance in Sentmenat, circa 1861–1865

It seems this type of intensive organic agriculture could sustain cropland fertility. To calculate the balance, we assumed that the soil's nutrient losses were lower than 50% in nitrogen, 10% in phosphorous and 20% in potassium (the three main macronutrients required for plant growth). As shown in figure 2, nutrient input was large enough to replace these main macro-nutrients taken from the soil. Nevertheless, contemporary agronomists were correct in bemoaning the inadequacy of local livestock densities.

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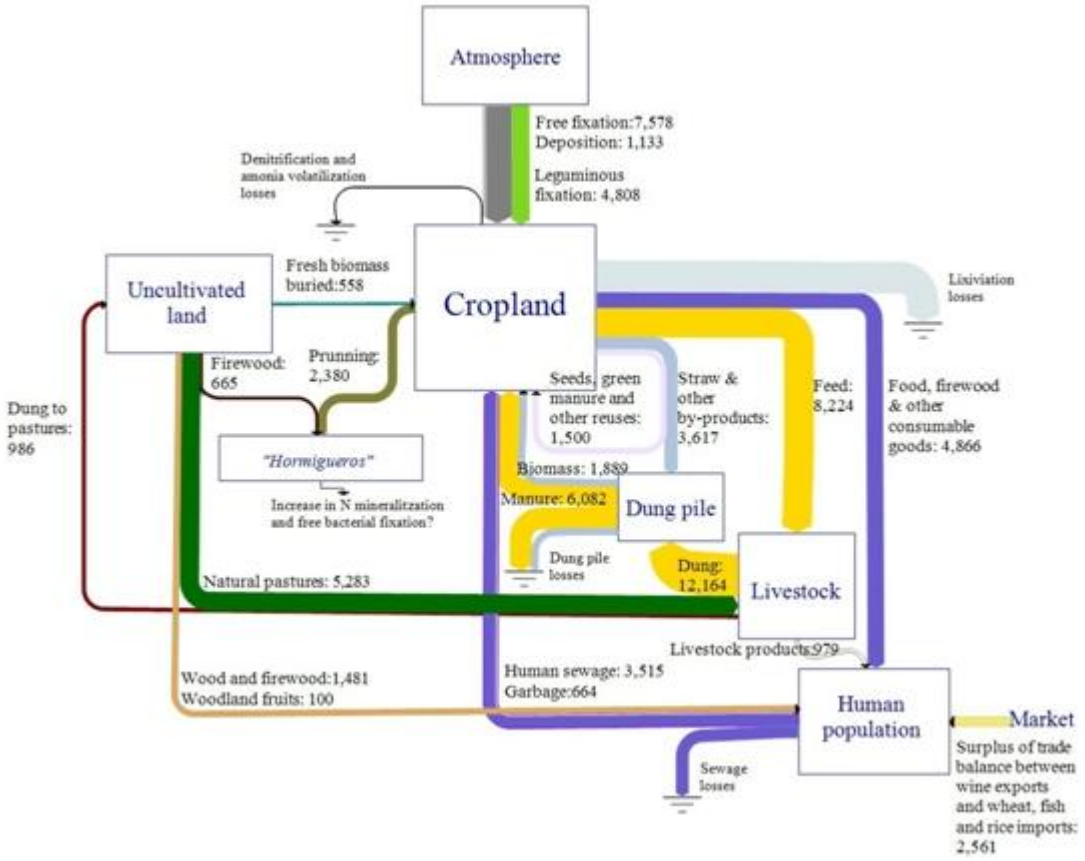

Fig. 3: Annual flows of N in the municipality of Sentmenat, circa 1861–1865 (kg)

Paucity of manure coupled with labor shortage meant that actual fertilization did not always balance crop extractions in each farm or plot. In spite of the fact that the maximum potential of fertilizers available was probably enough to maintain soil fertility, social inequality affected the availability of livestock manure, woodland or scrubland cuts, and latrines. For example, we believe that poorer wine-growing tenants, especially, may have worked with a nutrient deficit.

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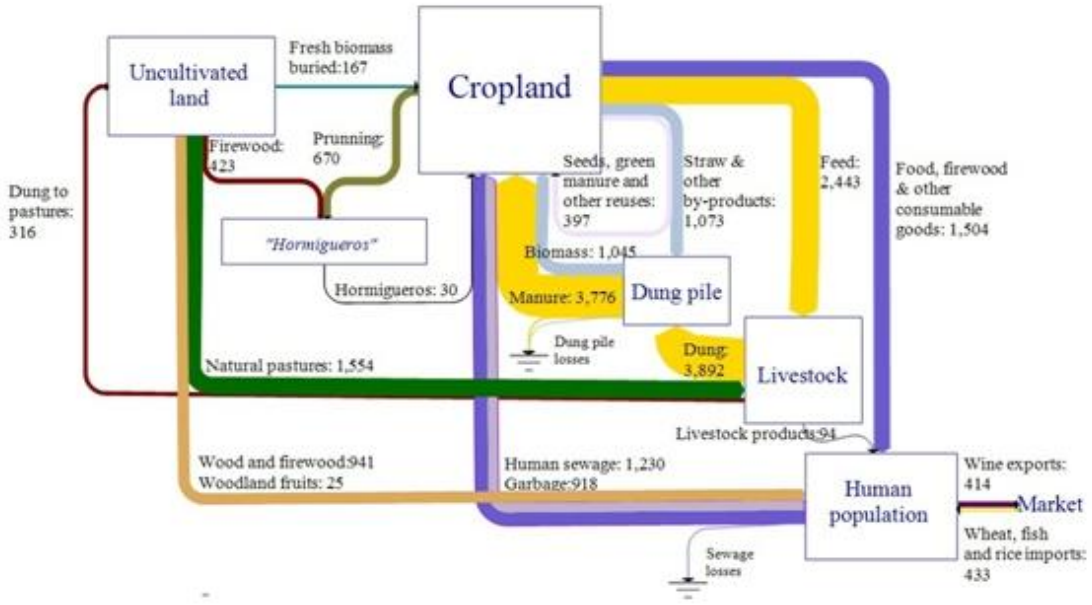

Fig. 4: Annual flows of P in the municipality of Sentmenat circa, 1861–1865 (kg)

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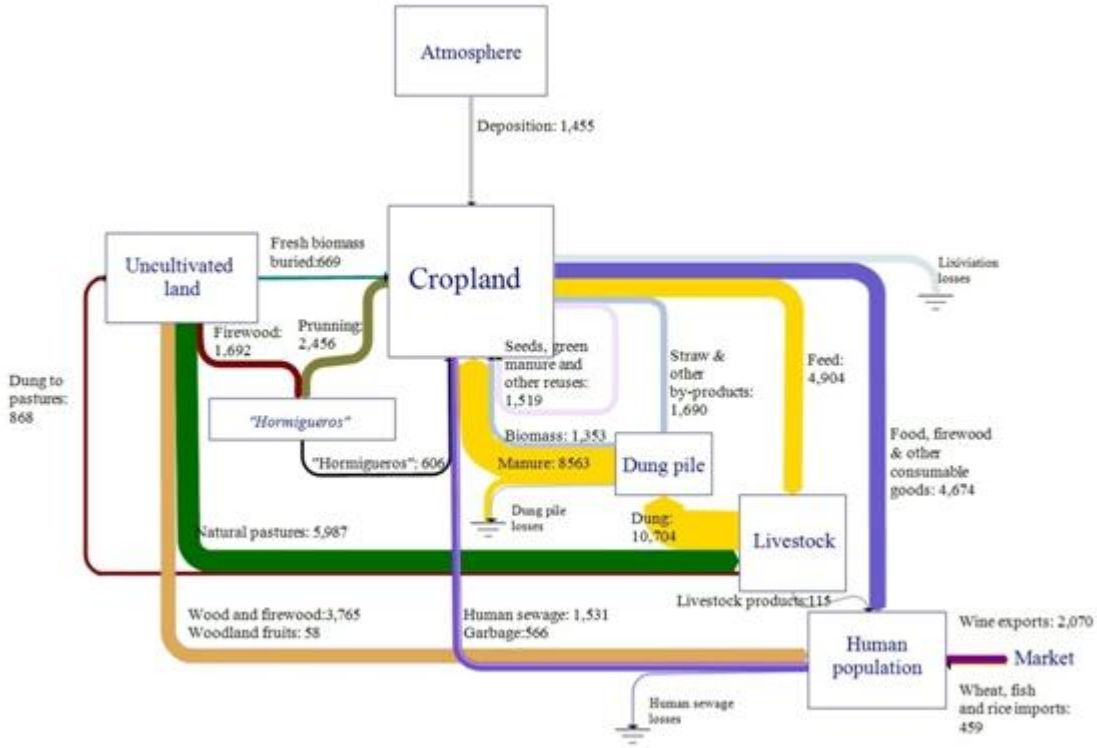

Fig. 5: Annual flows of K in the municipality of Sentmenat circa 1861–1865 (kg)

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Further readings:

- Garrabou Segura, Ramón, and Manuel González de Molina. *La reposición de la fertilidad en los sistemas agrarios tradicionales*. No. 631.422 R425r. Madrid: Icaria Edit, 2010.
- González de Molina, Manuel. "A Guide to Studying the Socio-Ecological Transition in European Agriculture." DT–SEHA Working Paper 1006, Spanish Society for Agricultural History, 2010. View PDF.
- Tello, Enric, Ramon Garrabou, Xavier Cussó, José Ramón Olarieta, and Elena Galán. "Fertilizing Methods and

Nutrient Balance at the End of Traditional Organic Agriculture in the Mediterranean Bioregion: Catalonia (Spain) in the 1860s." *Human ecology* 40, no. 3 (2012): 369–383.

Related links:

- Homepage of the project Environmental History of Mediterranean Agrarian Landscapes http://www.ub.edu/histeco/p2/eng/index.php

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Elena Galán, B.A. and Master in Environmental Sciences at the Autonomous University of Barcelona (ICTA), and Predoc Research Scholar at the University of Barcelona, is preparing her PhD dissertation in Economic History on *The End of Past Organic Agricultural Systems in Spain (1860-1960)*. She is developing the *Manager of Energy and Nutrient Balances of Agricultural Systems* (MENBAS), an accounting tool that will be soon offered as an Open Access resource at the University of Barcelona aimed at create a database on this issue able to perform international comparisons.

Enric Tello

Enric Tello, PhD in Geography and Contemporary History, is full professor and Head of the Department of Economic History and Institutions at the University of Barcelona, where he leads a transdisciplinary research group working on social metabolism and landscape ecology of past and present agricultural or urban systems. This project intends to understand the main socio-ecological transitions experienced in history, and also to identify their driving forces or ruling agencies in order to get useful knowledge to foster new sustainability-oriented transitions in future. It also aims to recover some traditional knowledge useful to develop retro-innovations for organic agriculture, more sustainable cities, or better landscapes.