NOT ALWAYS A CO_2 SINK: THE MANAGEMENT MATTERS

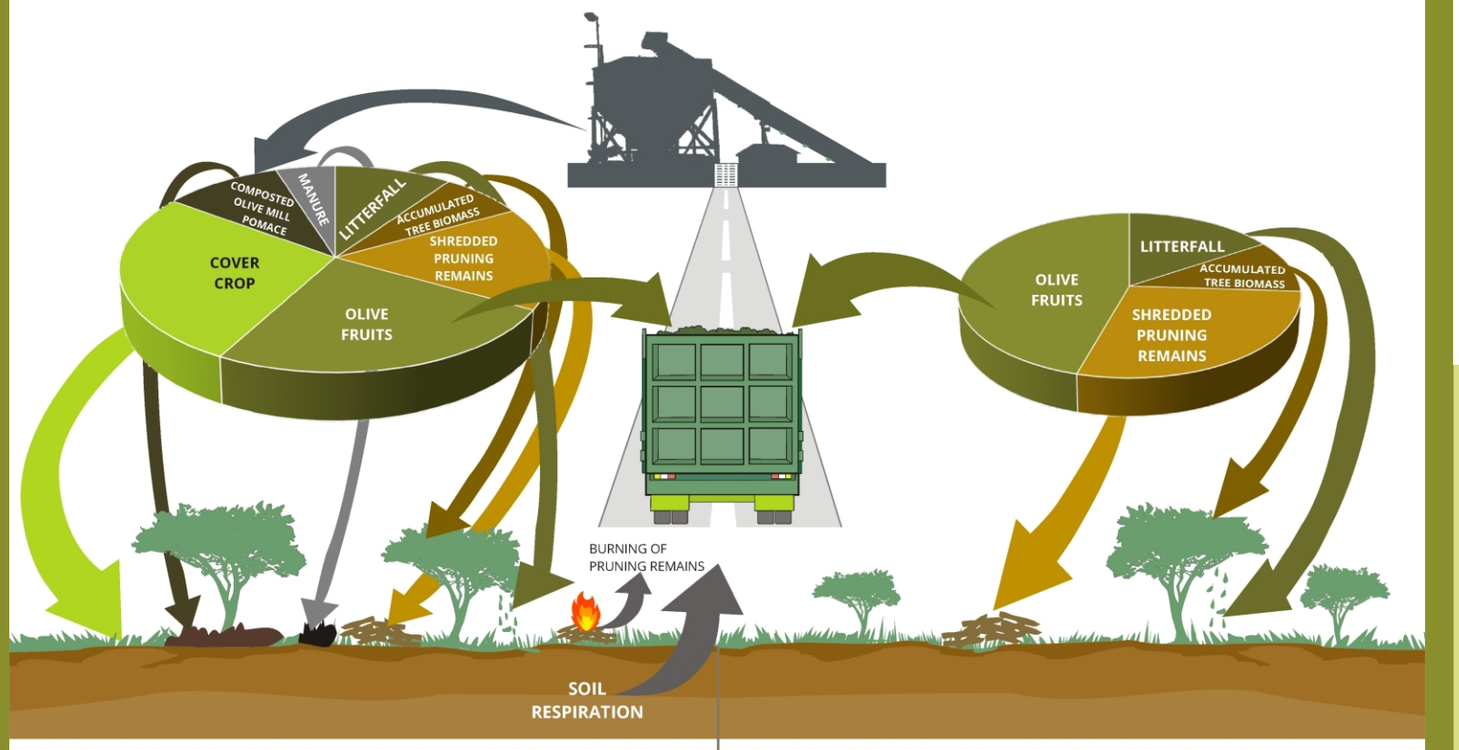
Practical Abstract #3 on the carbon footprint of olive groves

1- AN INCOMPLETE VISION

The debate about the ability of olive groves to store CO_2 often focuses solely on the capacity of trees to absorb it from the atmosphere, overlooking the crucial role that soils can play in storing carbon. By evaluating the carbon balance at the farm level, considering carbon flows across all components of the agroecosystem, it becomes possible to determine whether an olive grove functions as a carbon sink (achieving a positive net balance of CO_2 in the form of organic carbon) or, conversely, as a carbon source (emitting net CO_2 and thus losing carbon).

ORGANIC CARBON FLOWS

The magnitude of flows is based on data from the SUSTAINOLIVE project



REALISTIC HOLISTIC APPROACH
Trees + Soil
Inputs + Outputs

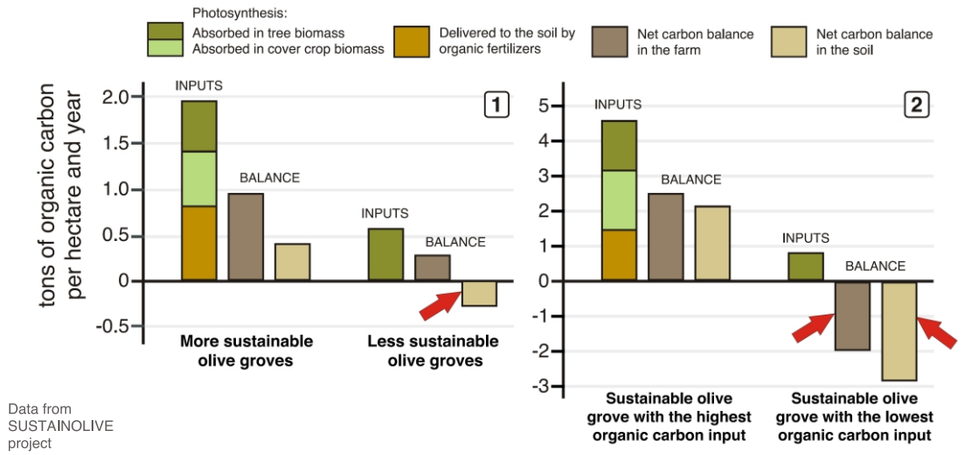
PARTIAL TRADITIONAL APPROACH
Only trees
Only inputs

3- DON´T BE CONFUSED

Slogans claiming that olive groves are carbon sinks fail to accurately reflect the reality of many olive groves. Why?: **i)** Although olive trees sequester annually atmospheric CO_2 as organic carbon into their permanent structures, in many cases, this sequestration does not compensate for the loss of soil organic carbon and/or the CO_2 eq emissions due to farming operations; **ii)** Management practices are critical: sustainable approaches enhance soil organic carbon while reducing the CO_2 eq emissions due to farming operations; **iii)** Implementing sustainable managements is essential to ensure olive groves serve as an effective and reliable tool for atmospheric CO_2 removal.

2- OLIVE GROVES CAN BE NET EMITTERS OF CO_2

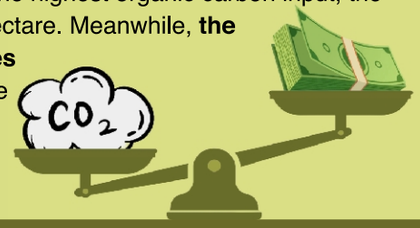
Graph 1 below compares key carbon cycle flows in 12 pairs of Spanish experimental olive groves, contrasting those managed with sustainable practices against those managed conventionally. Graph 2 provides a comparison focused on the olive groves with the highest and lowest annual organic carbon input values.The red arrows indicate negative balances.



Data from SUSTAINOLIVE project

The annual carbon storage in the trees is similar between conventional olive groves and those employing sustainable management practices. However, the implementation of cover crops in the more sustainable olive groves resulted in an increase in the soil organic carbon stocks. While this management does not immediately translate into economic profitability (such as increased harvest), it represents a **valuable long-term investment** by enhancing the reservoir of carbon and nutrients for future harvests. As a result of a higher amount of organic carbon entering the soil in sustainably managed olive groves, the overall organic carbon balance at both the soil and farm scales is substantially more favorable in these groves.

If we convert organic carbon data to CO_2, the olive groves using sustainable agronomic practices sequester an average of 3.4 tons of CO_2 per hectare and year, 3 times more than the conventional ones. In the case of the olive grove with the highest organic carbon input, the annual CO_2 sequestration rate reaches 9.7 tons per hectare. Meanwhile, **the grove with the lowest organic carbon input behaves as a net emitter**, releasing 7.3 tons of CO_2 per hectare and year. The former could earn a substantial reward for its contribution to mitigating climate change in the form of carbon credits, while the latter could not.



The conclusion is clear: while olive trees consistently store carbon, conventional management practices might lead to significant organic carbon losses in the form of CO_2 from soil respiration, which is not balanced by new inputs of organic carbon into the soil, resulting in a net carbon deficit for the agroecosystem.

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