



1st Brazilian
BioEnergy
Science and
Technology
Conference

Campos do Jordão - August 14th to 18th, 2011

Room Bariloche

09:00 - 10:30

Parallel Session 14 - Agriculture

Chair:

Carlos Eduardo P. Cerri, ESALQ

Keith L. Kline, ORNL

Indicators to support environmental sustainability of agricultural production and bioenergy crops

Helio Antonio Wood Joris, IAC

Stalk yield and nitrogen exports after nitrogen fertilization of two ratoons of sugarcane

Edgar Ferreira Gomes de Beauclair, ESALQ

Efficiency of a Humic Acid Based Soil Conditioner in Sugar Cane Crop



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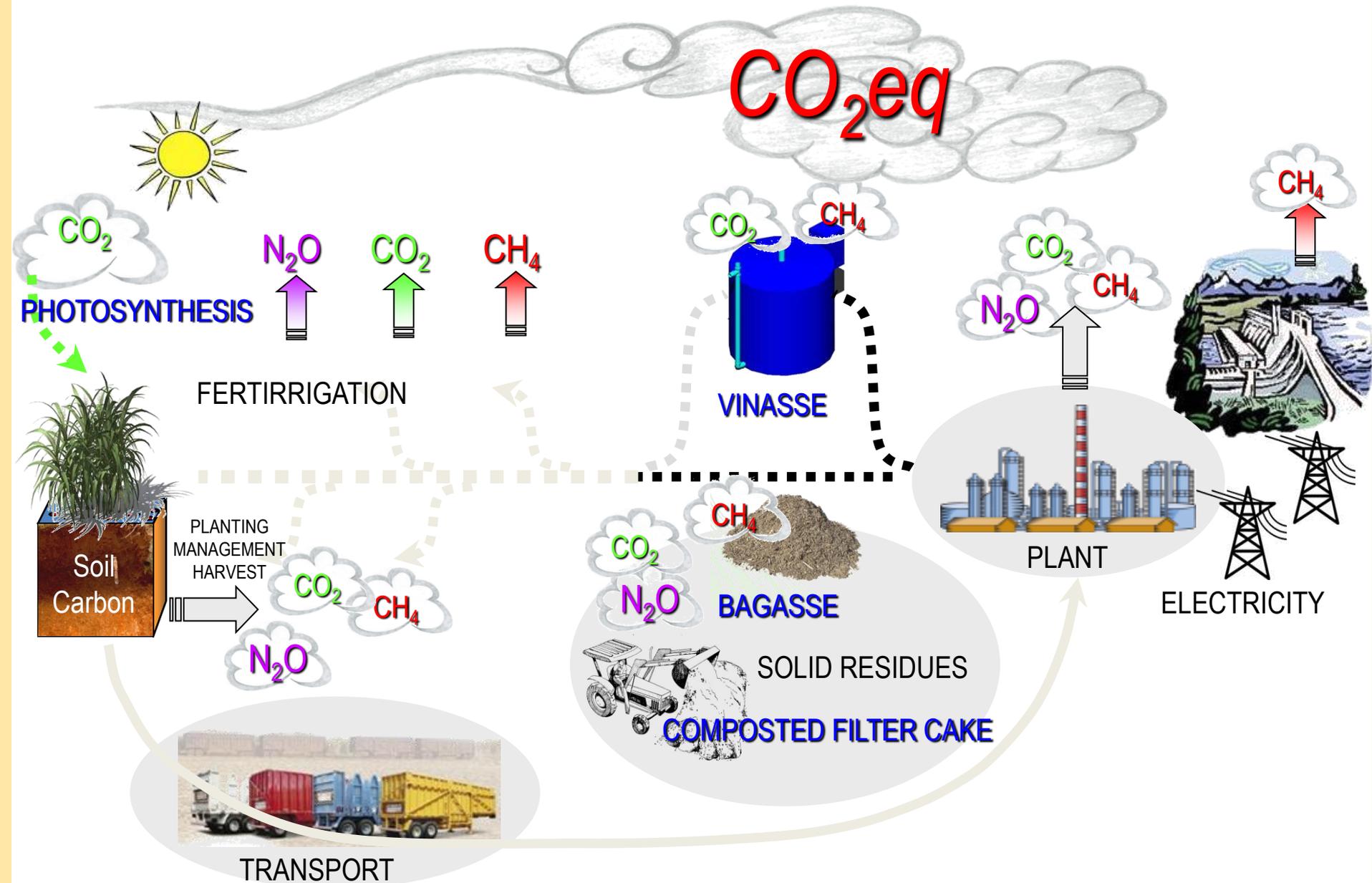
Campos do Jordão - August 14th to 18th, 2011

Soil carbon stocks and greenhouse gas emissions in the sugarcane agrosystem in Brazil

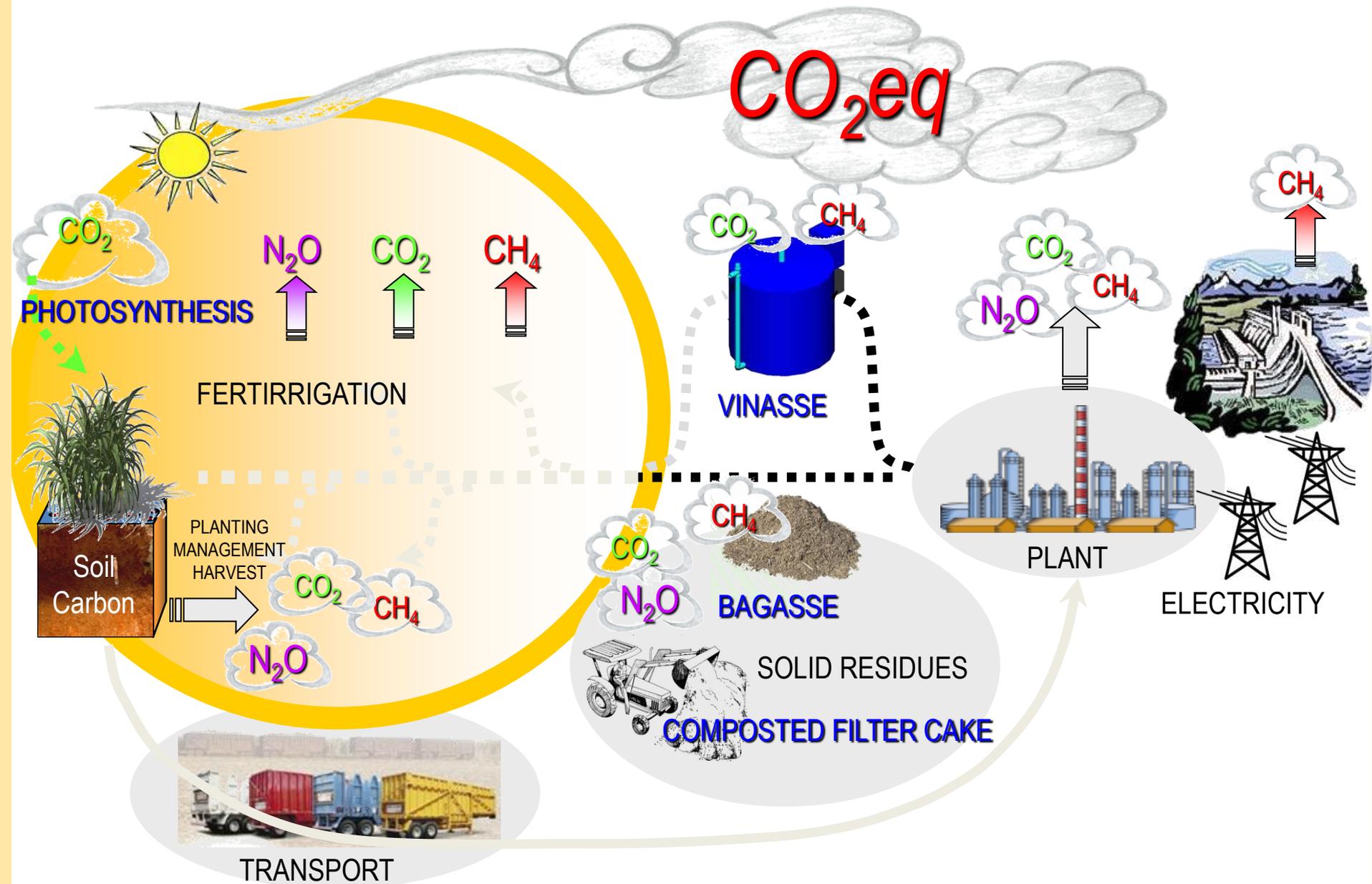
C.E.P. Cerri; M.V. Galdos, J.L.N. Carvalho; B.J. Feigl; C.C. Cerri

August 18th 2011

Carbon footprint of ethanol



Carbon footprint of ethanol



Soil carbon stock change in the sugarcane system

Harvesting: burning



Harvesting: no-burning



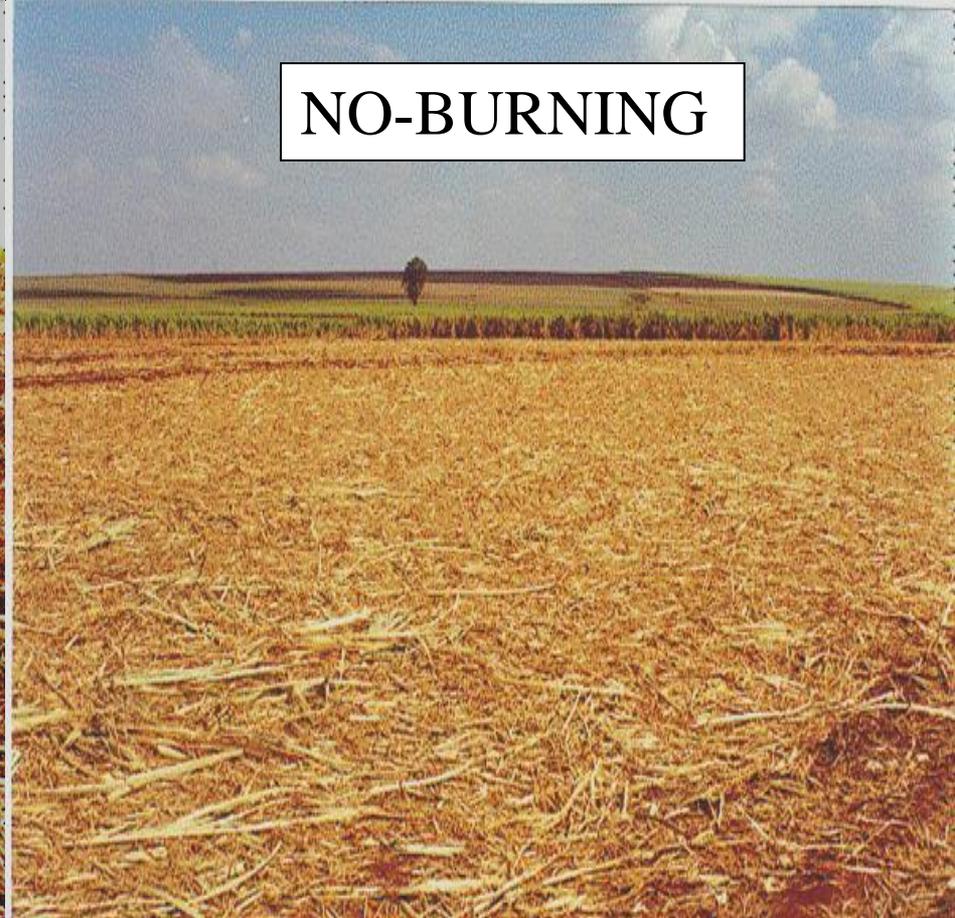
Sugarcane harvest system: burning x no-burning

Sugarcane harvesting system

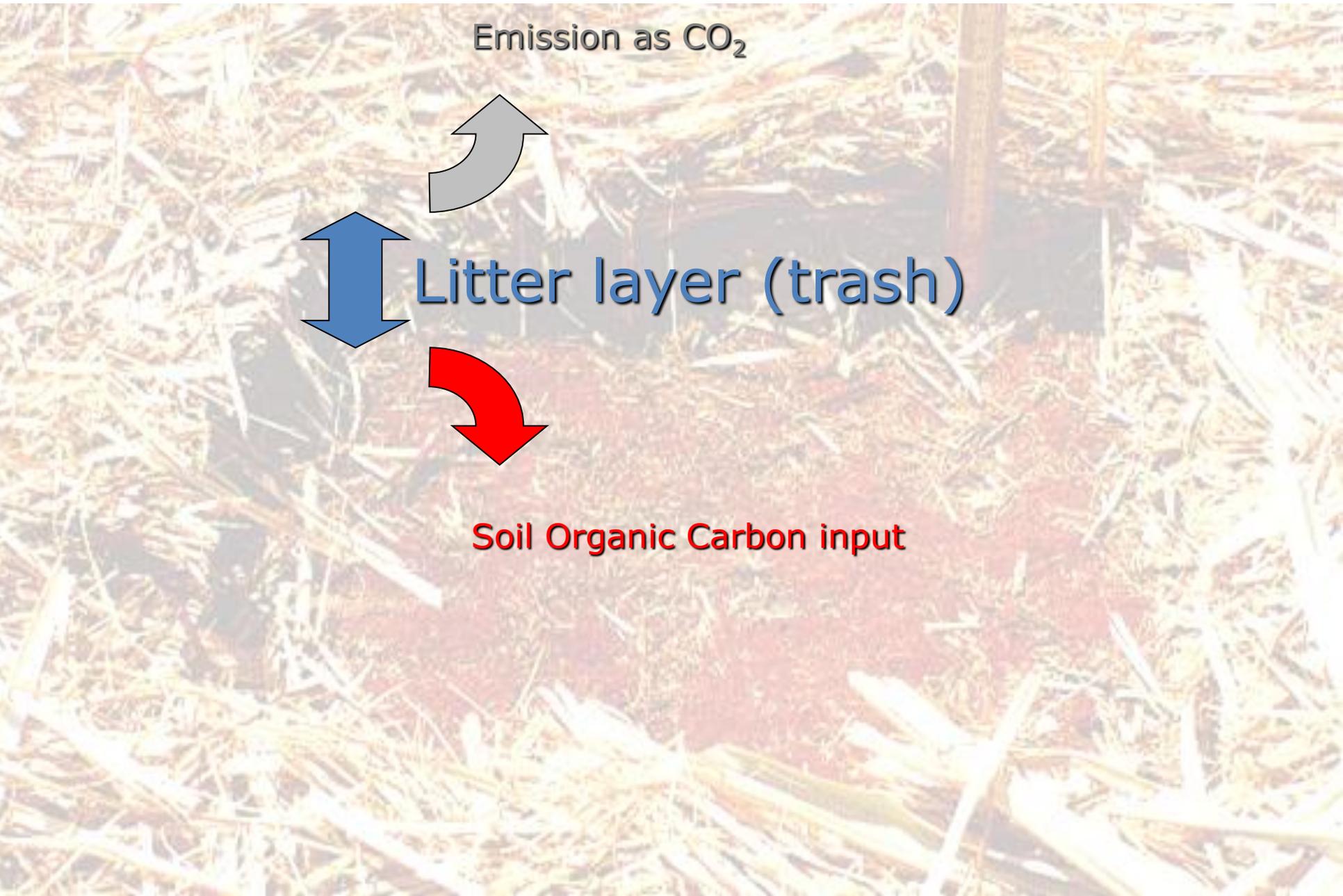
BURNING



NO-BURNING



Transference of carbon from litter to soil and atmosphere



Emission as CO₂

Litter layer (trash)

Soil Organic Carbon input

Litter decomposition

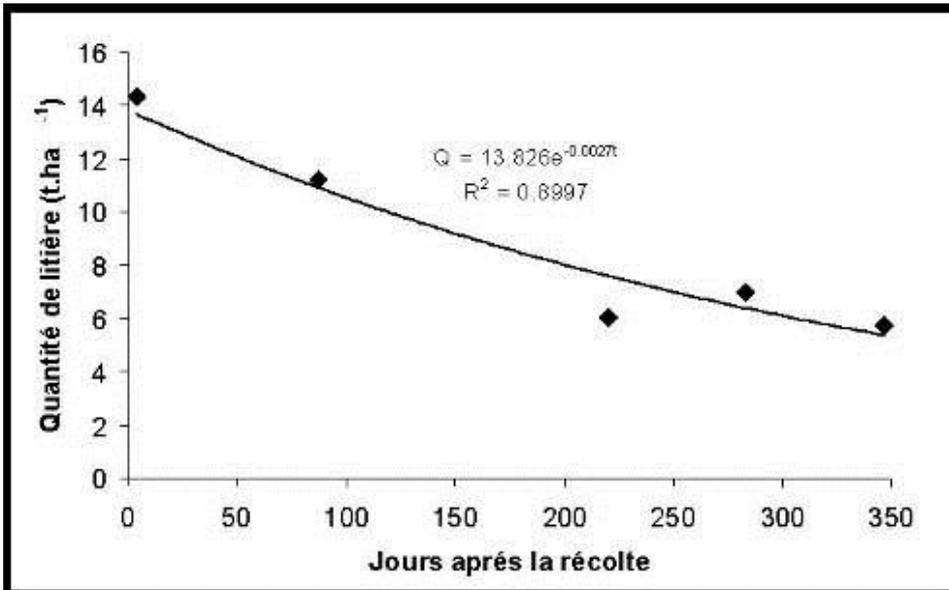


First year

→ “half-life” 207 days

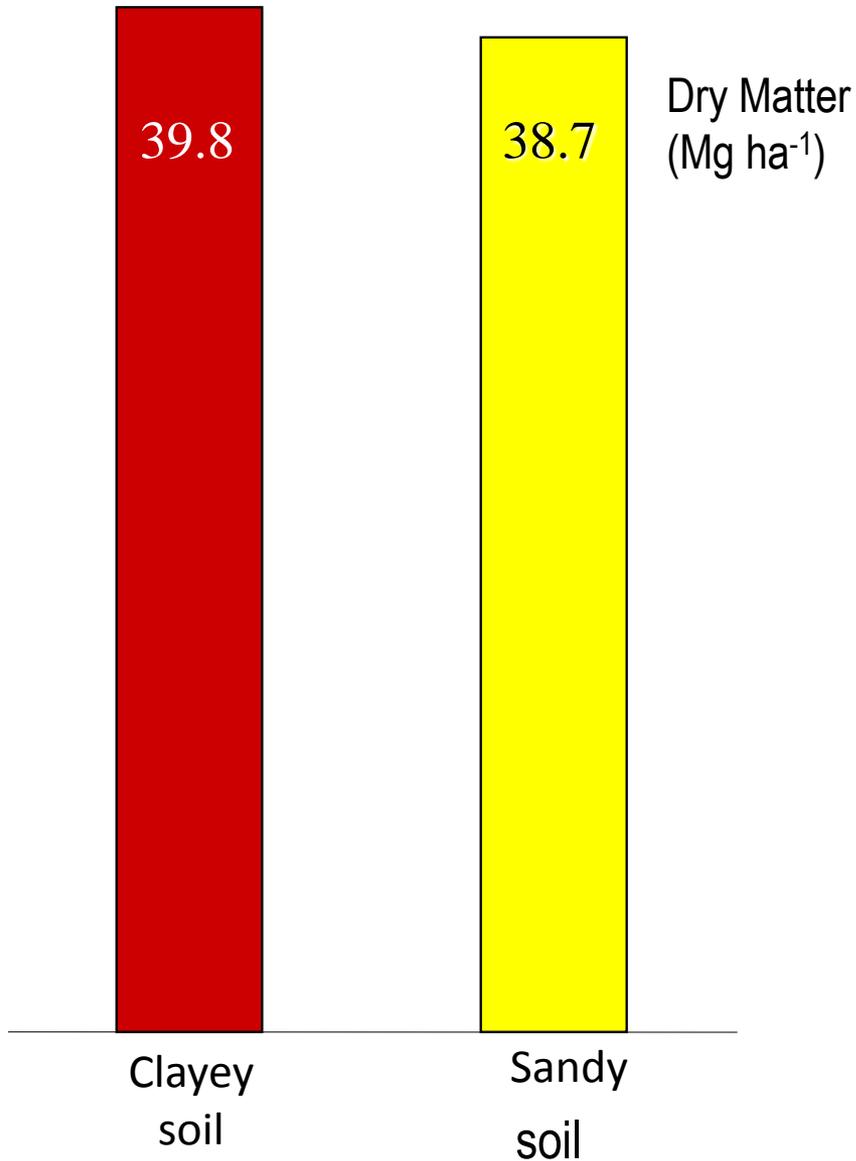
Several years

→ “half-life” 257 days

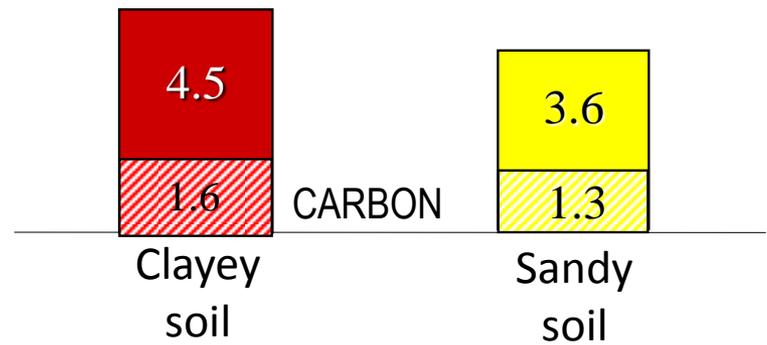


Vulnerable compartment

Litter input 3-year cycle



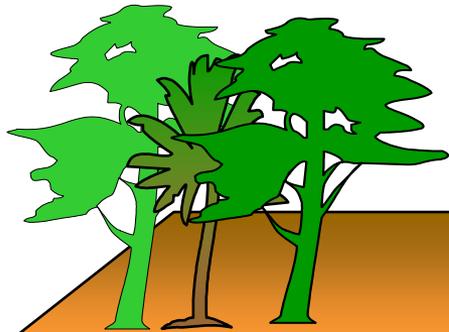
Remaining litter after 3 years



Stock changes under sugarcane

Native vegetation

Burned sugarcane



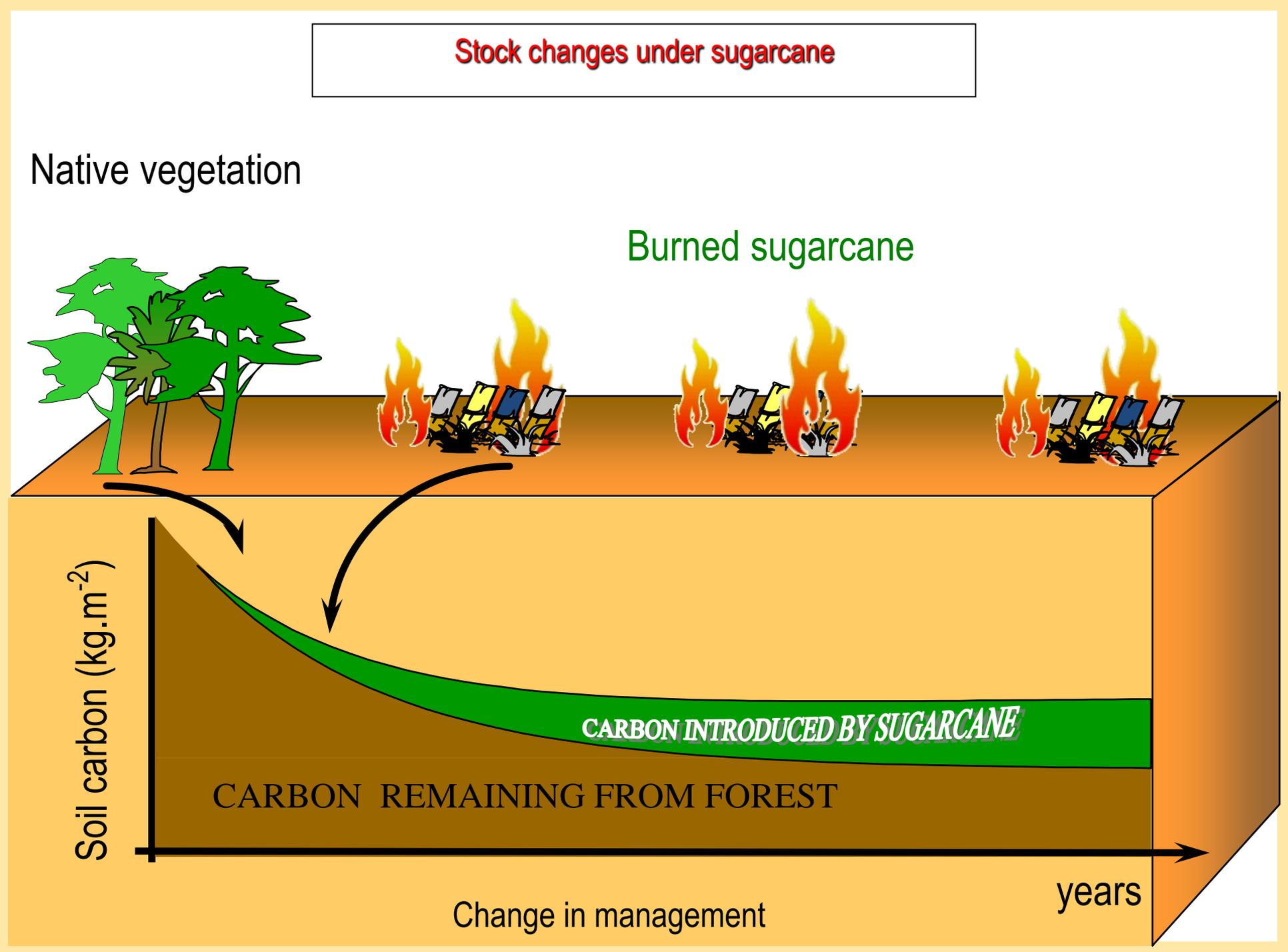
Soil carbon ($\text{kg}\cdot\text{m}^{-2}$)

CARBON REMAINING FROM FOREST

CARBON INTRODUCED BY SUGARCANE

Change in management

years

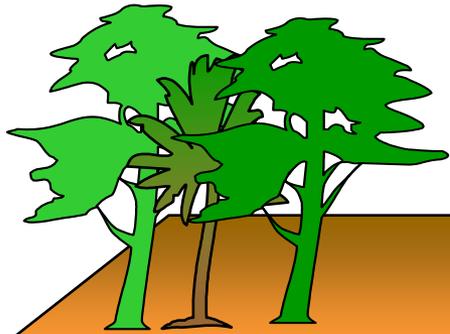


Stock changes under sugarcane

Native vegetation

Burned sugarcane

No-burning sugarcane



Soil carbon

CARBON INTRODUCED BY SUGARCANE

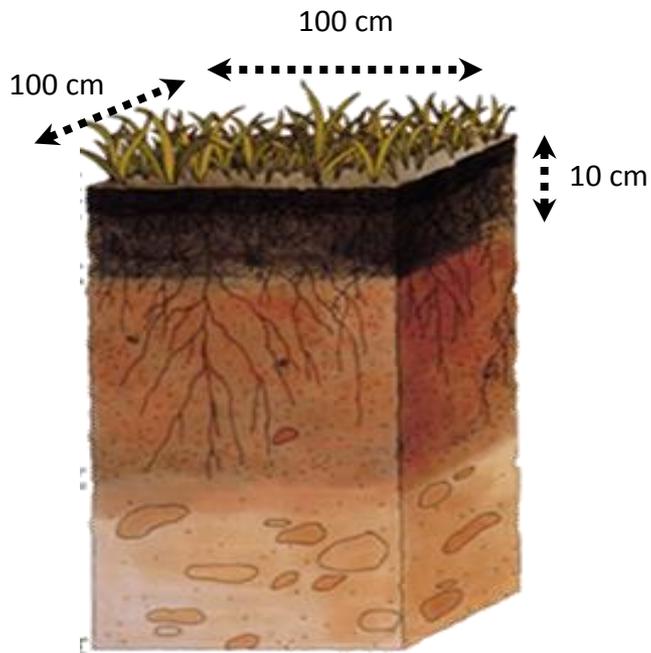
C litter

CARBON REMAINING FROM FOREST

Change in management



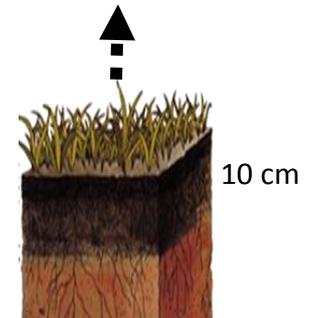
Soil carbon stocks



$$S = \text{C content} \times d \times \text{layer}$$

↑
% C

↑
 $d = \frac{m}{v}$



$$\text{kg C m}^{-2} \text{ or Mg C ha}^{-1}$$

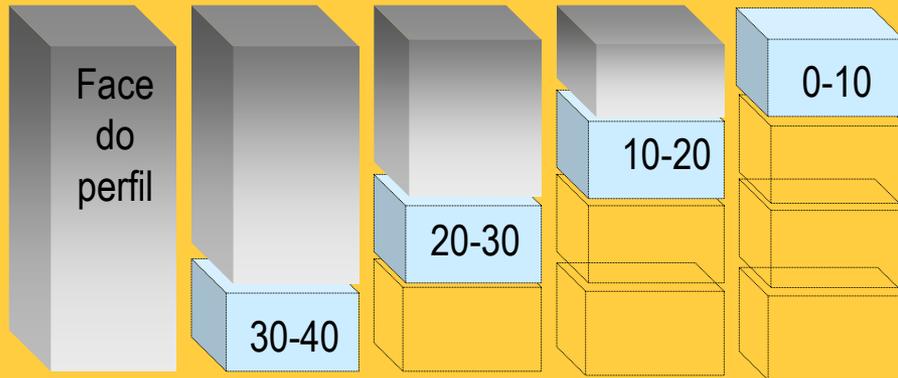
Soil Carbon Stocks

Necessary data for each soil layer:

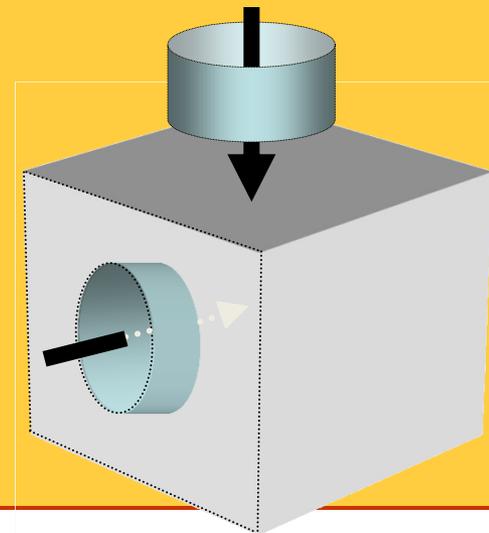
- Carbon content
- Soil bulk density (BD)



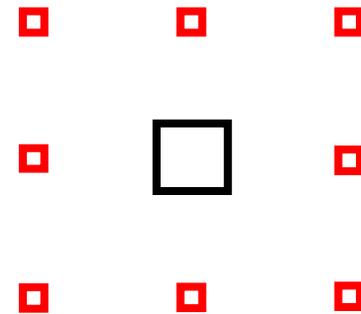
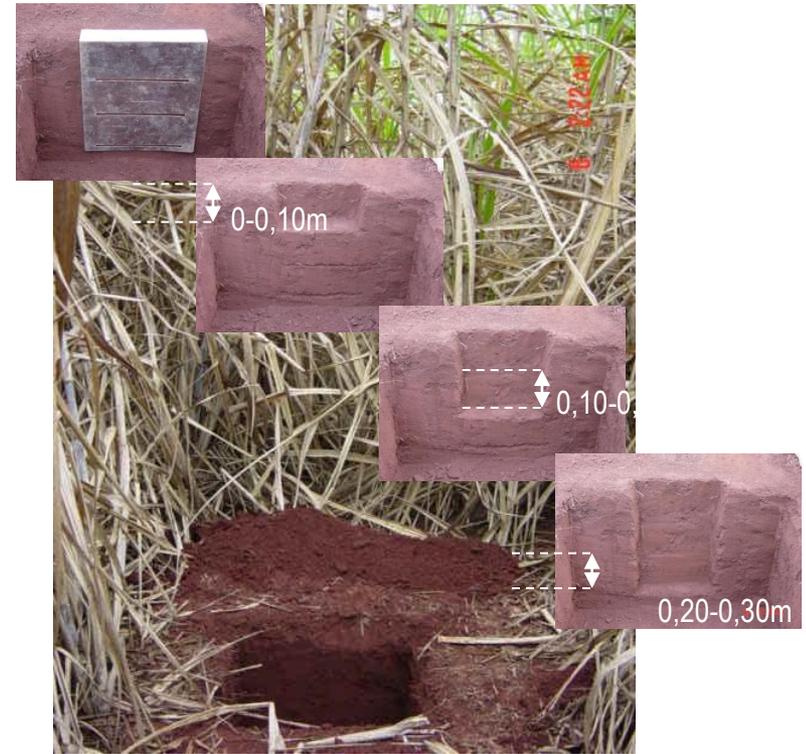
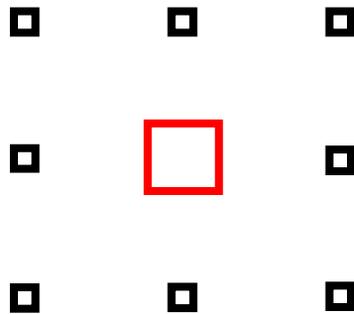
Carbon content



Bulk density



Soil Carbon Stocks



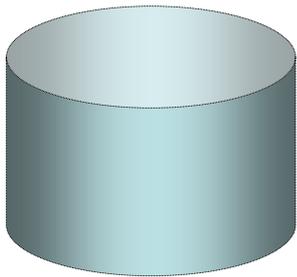
Sample preparation and analyses



Soil density calculation



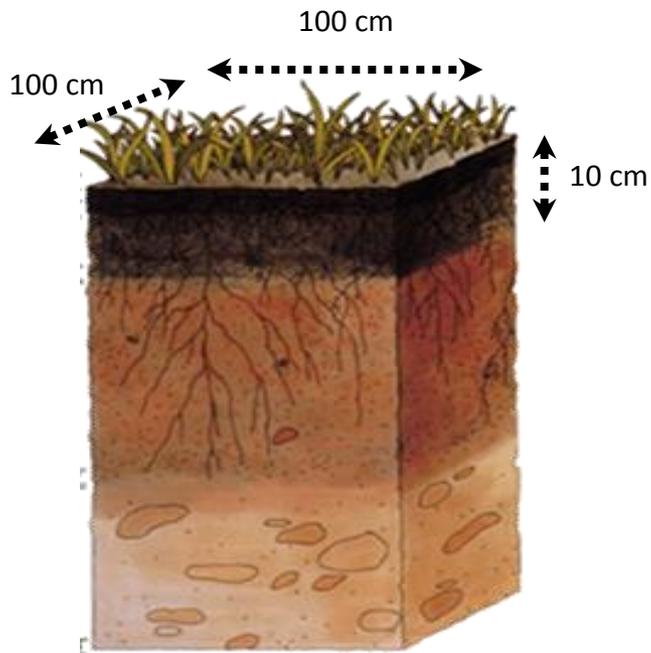
$$d = \frac{m}{v}$$



Mass of soil contained in a cylinder = m

Volume of the cylinder = v

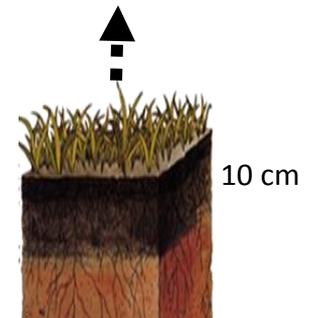
Soil carbon stocks



$$S = \text{C content} \times d \times \text{layer}$$

↑
% C

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$$\text{kg C m}^{-2} \text{ or Mg C ha}^{-1}$$

Preliminary results

Soil carbon stocks (0-30 cm)



48.95

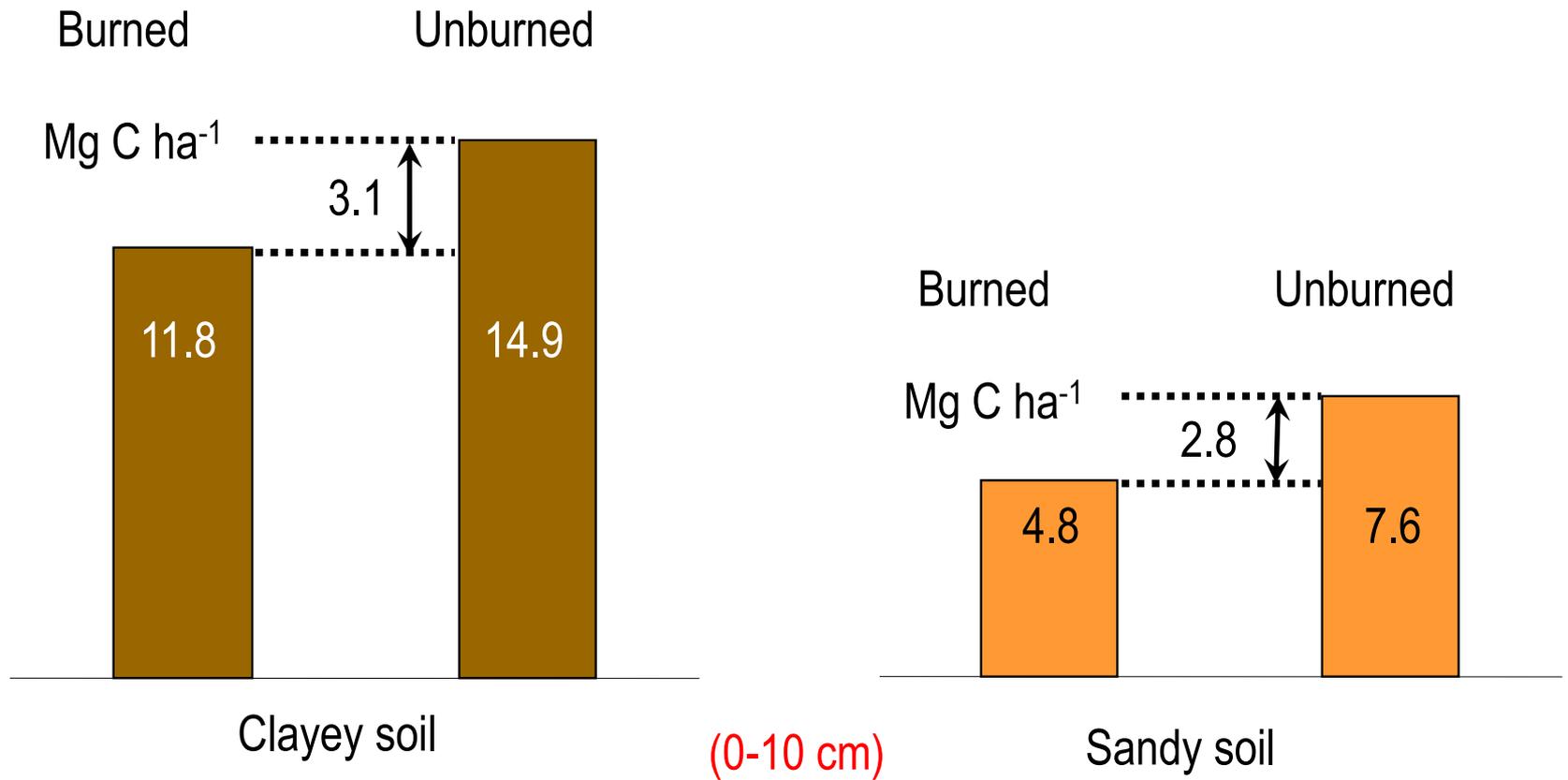


55.45

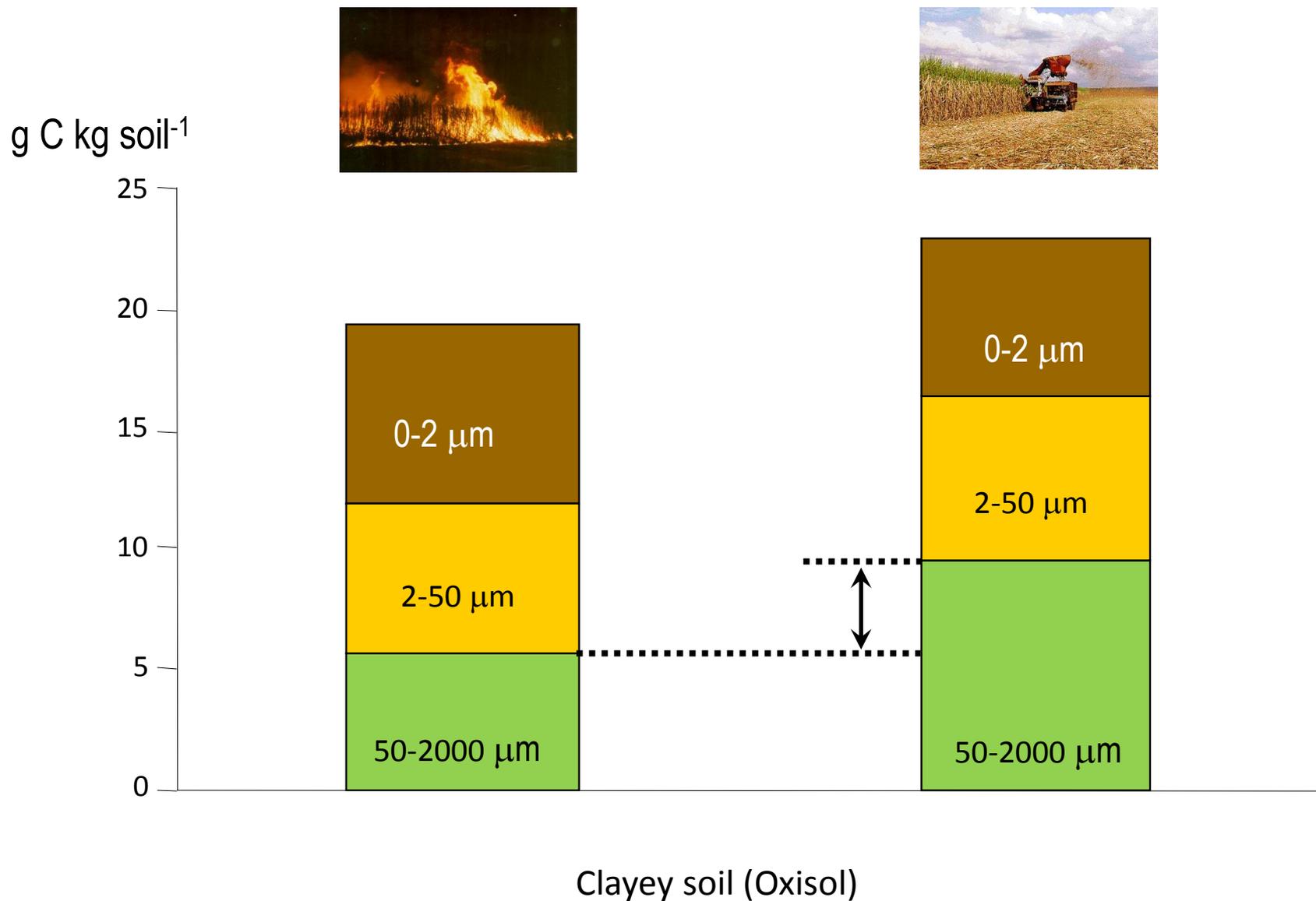
$\Delta C = 6.5 \text{ Mg C ha}^{-1}$ in 4 years

Soil $\Delta C = 1.625 \text{ Mg C ha}^{-1} \text{ year}^{-1}$

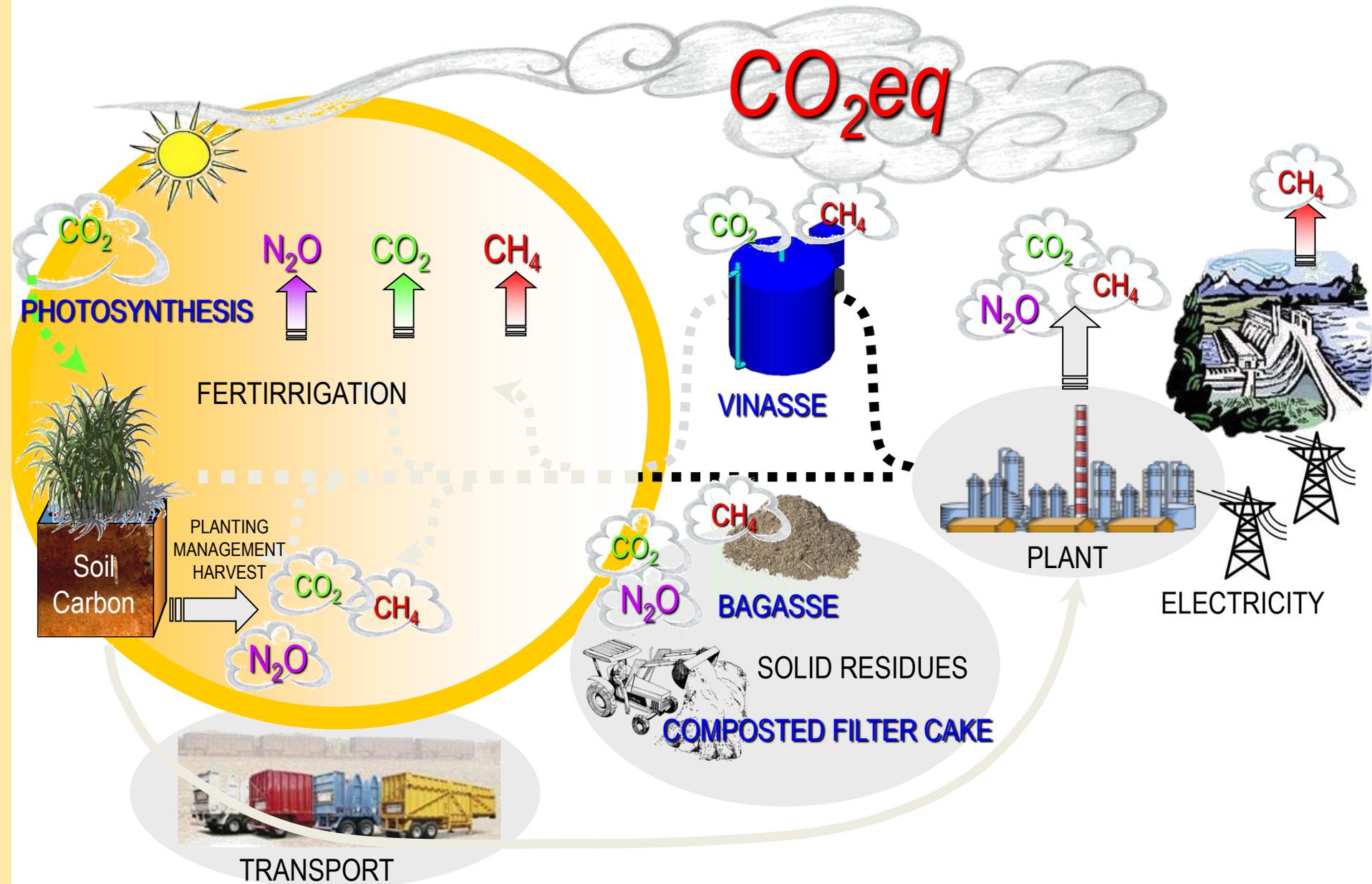
Soil carbon stocks after 3 years of unburned management



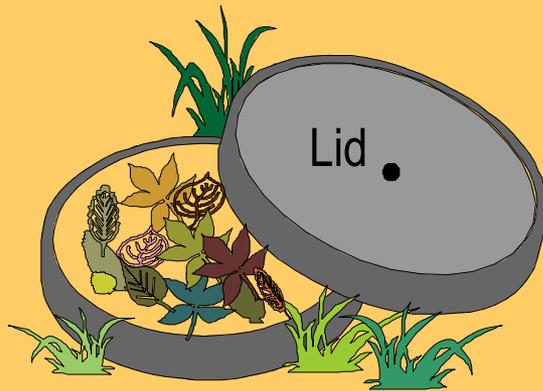
Carbon content in the granulometric fractions



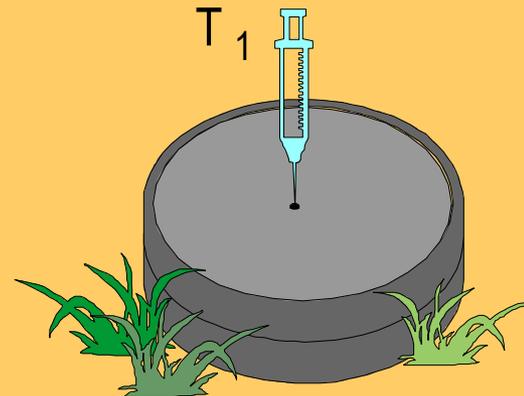
Carbon footprint of ethanol



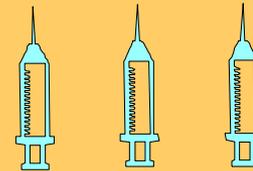
Field sampling of gases



Base



Incubation chamber



T_2 T_3 T_n

Hermetic syringes
for gas collection

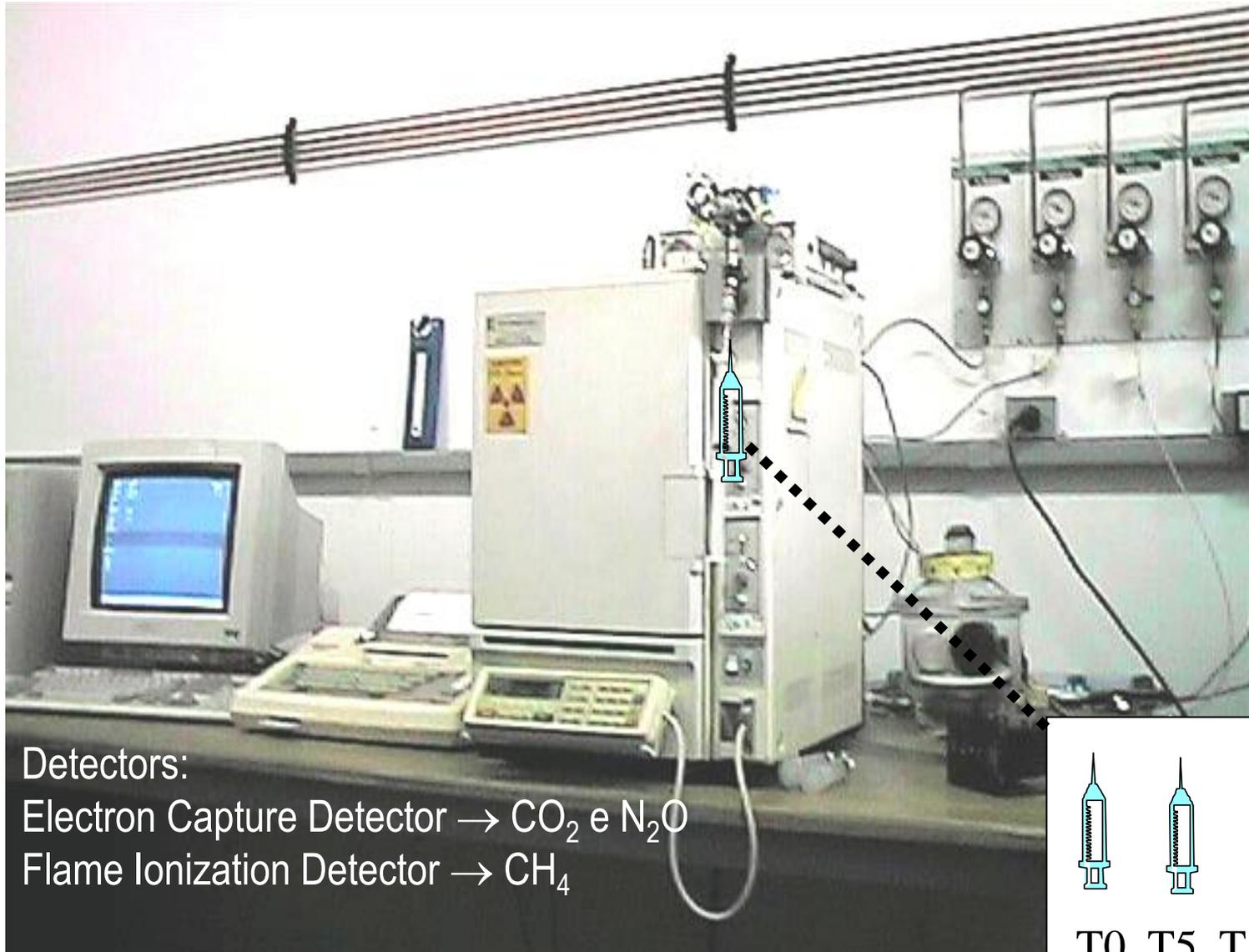
Measuring soil gas emissions under sugarcane



Soil GHG emissions from residues and fertilizers



Cromatographic analysis of GHG



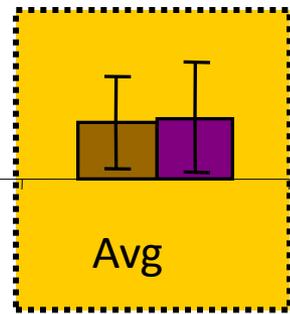
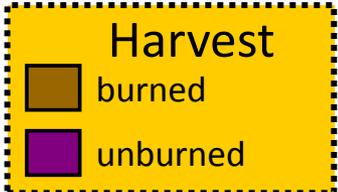
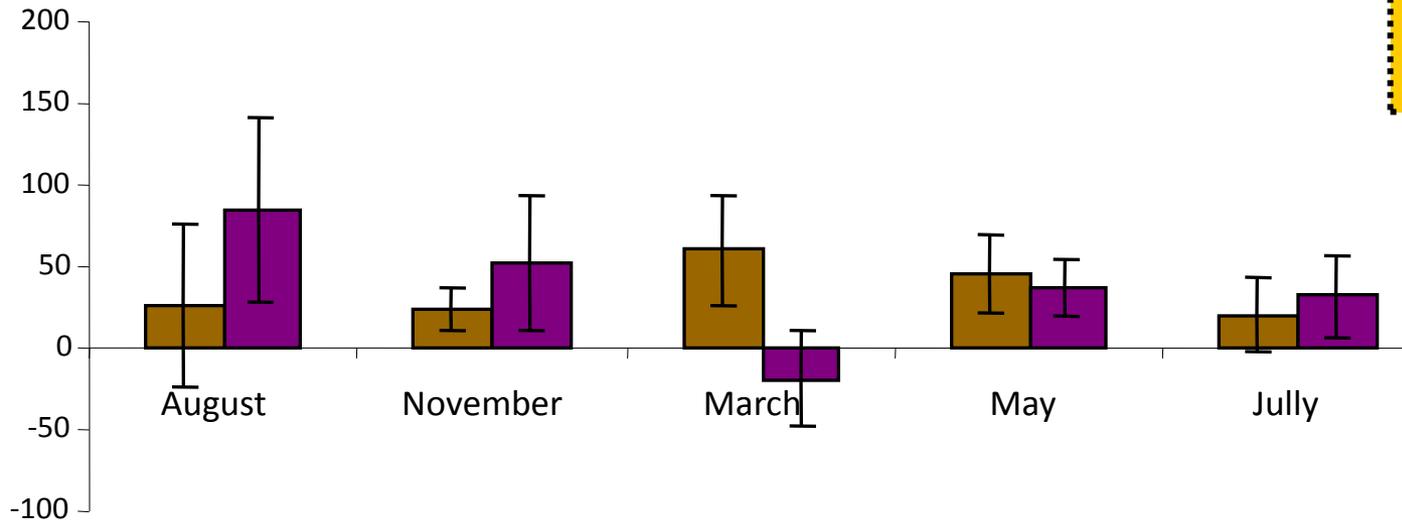
Sampling of methane emitted by vinasse



GHG Emissions

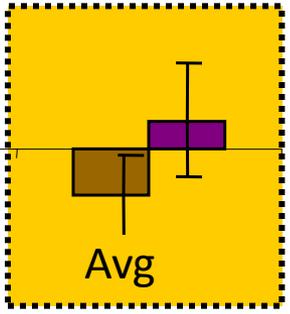
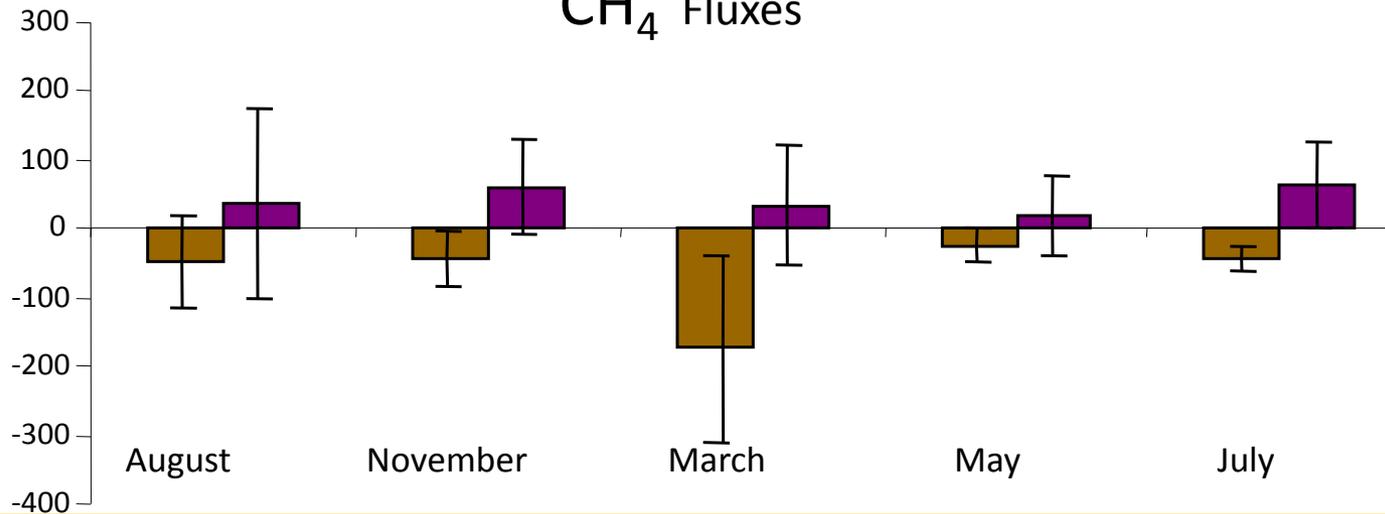
$\mu\text{g N}_2\text{O m}^{-2} \text{h}^{-2}$

N_2O fluxes

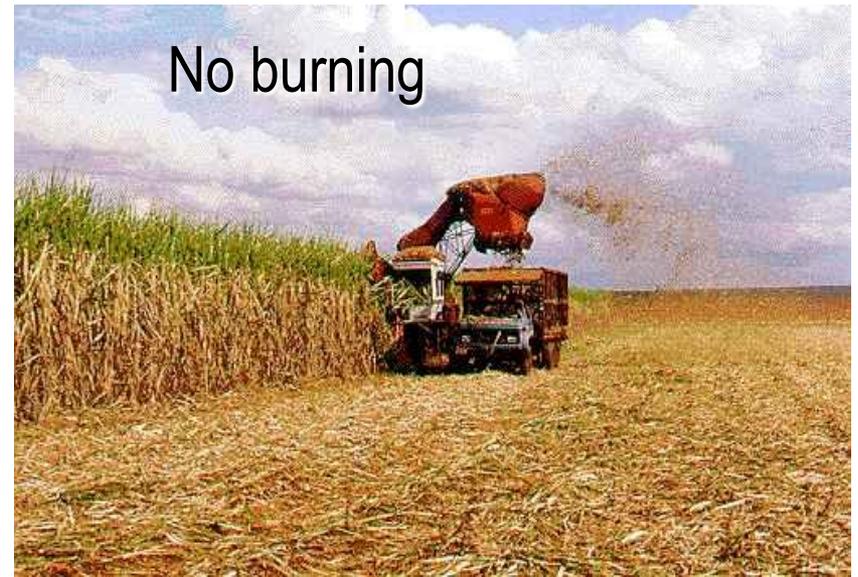


$\mu\text{g CH}_4 \text{ m}^{-2} \text{h}^{-2}$

CH_4 Fluxes



Carbon Balance ($\text{Mg C}_{\text{eq}} \text{ ha}^{-1} \text{ year}^{-1}$)



0	CO_2 : soil accumulation	-1.62
0.46	N_2O : harvesting and annual cycle	0.45
0.19	CH_4 : harvesting and annual cycle	-0.01
0.65	Total	-1.18
	Difference	-1.83

Final considerations

AGRIBUSINESS

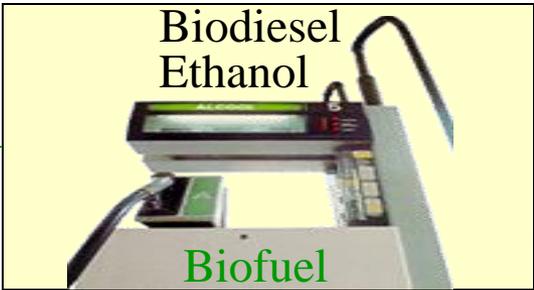


Plant Biomass

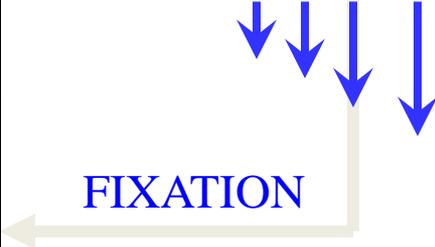
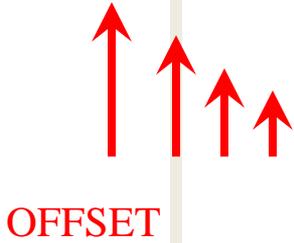
Crop residues

Decomposition

ENERGY



Significant role





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