

# Soil inorganic carbon

stocks, functions, losses and their consequences

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# Soil Carbon



❖ **Organic Carbon** → (e.g. Plant litters, Microbial biomass)

## ❖ Inorganic Carbon

- Geogenic carbonates
- Biogenic carbonates
- Pedogenic carbonates



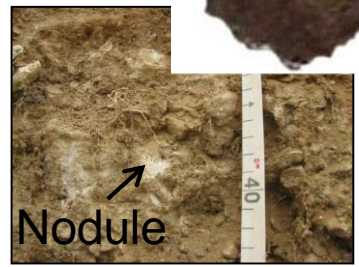
Limestone



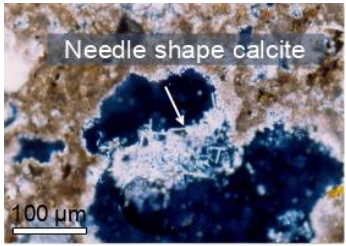
Shells



1 cm

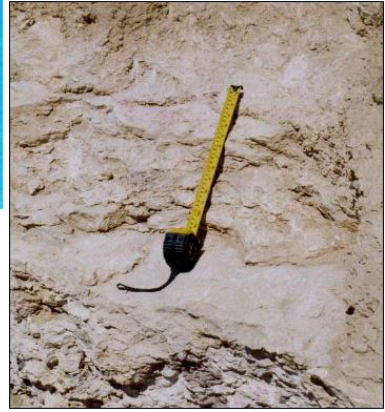


Nodule



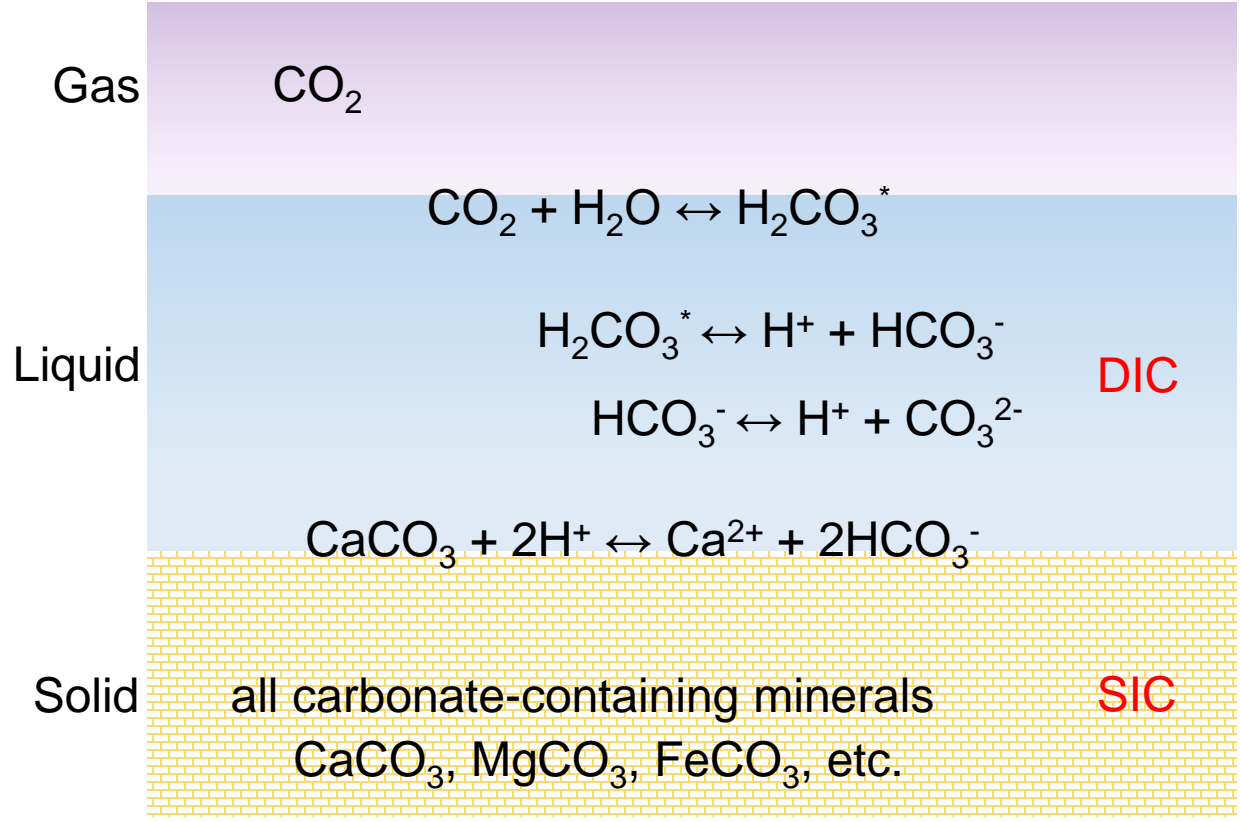
Needle shape calcite

100 μm

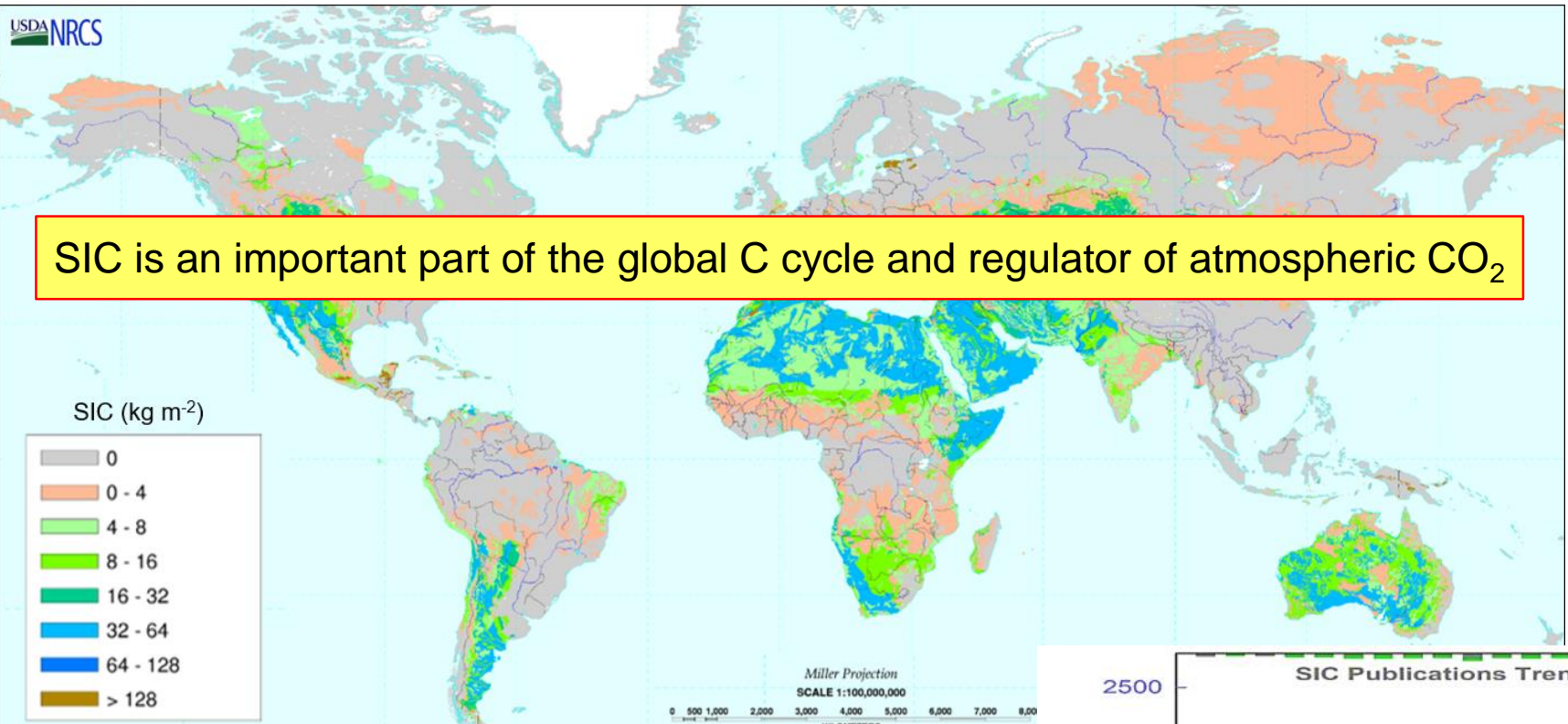


(Zamanian et al., 2016)

### Three phases of the soil system



# SIC: global distribution and stocks



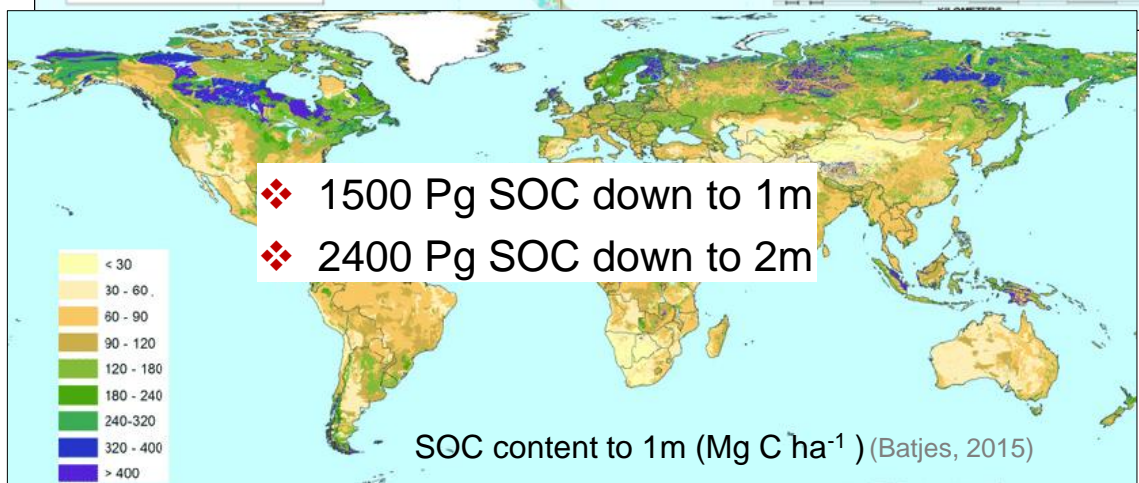
SIC is an important part of the global C cycle and regulator of atmospheric CO<sub>2</sub>

❖ 7.49 10<sup>9</sup> ha (ca. 54%)  
(Zamanian et al., 2018)

❖ 960 to 1783 Pg SIC down to 1m  
(Batjes, 1996; Eswaran et al., 1995)

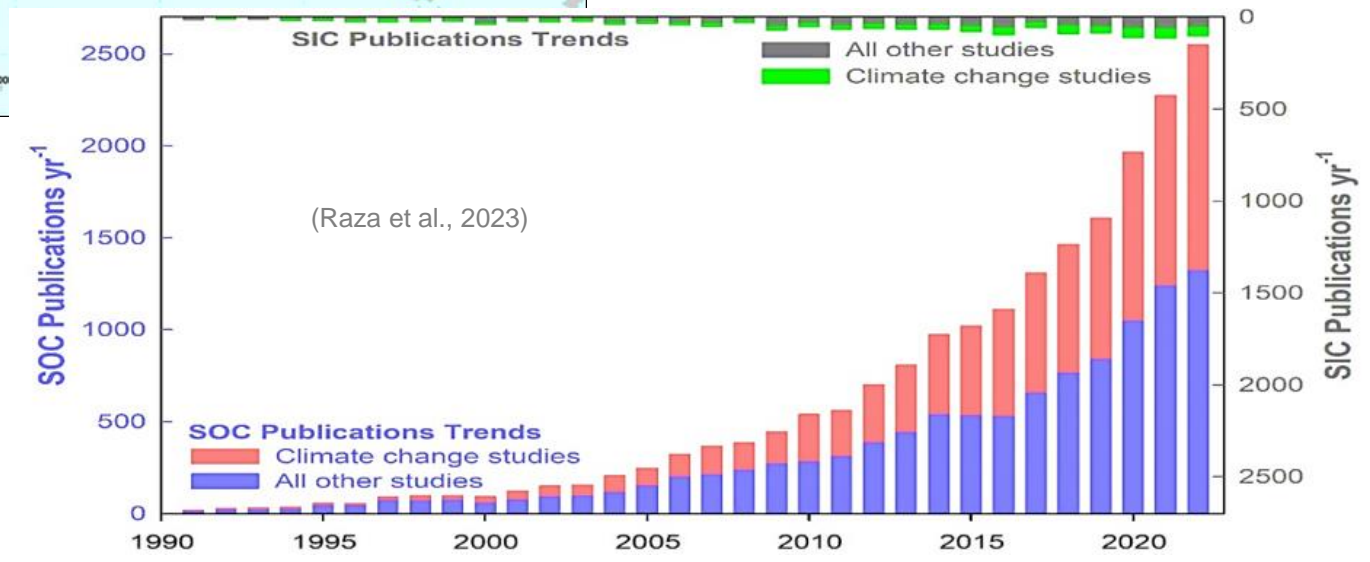
❖ ca. 2300 Pg SIC down to 2m  
(Zamanian et al., 2021)

❖ ca. 1400 Pg DIC  
(Monger et al., 2015)



❖ 1500 Pg SOC down to 1m

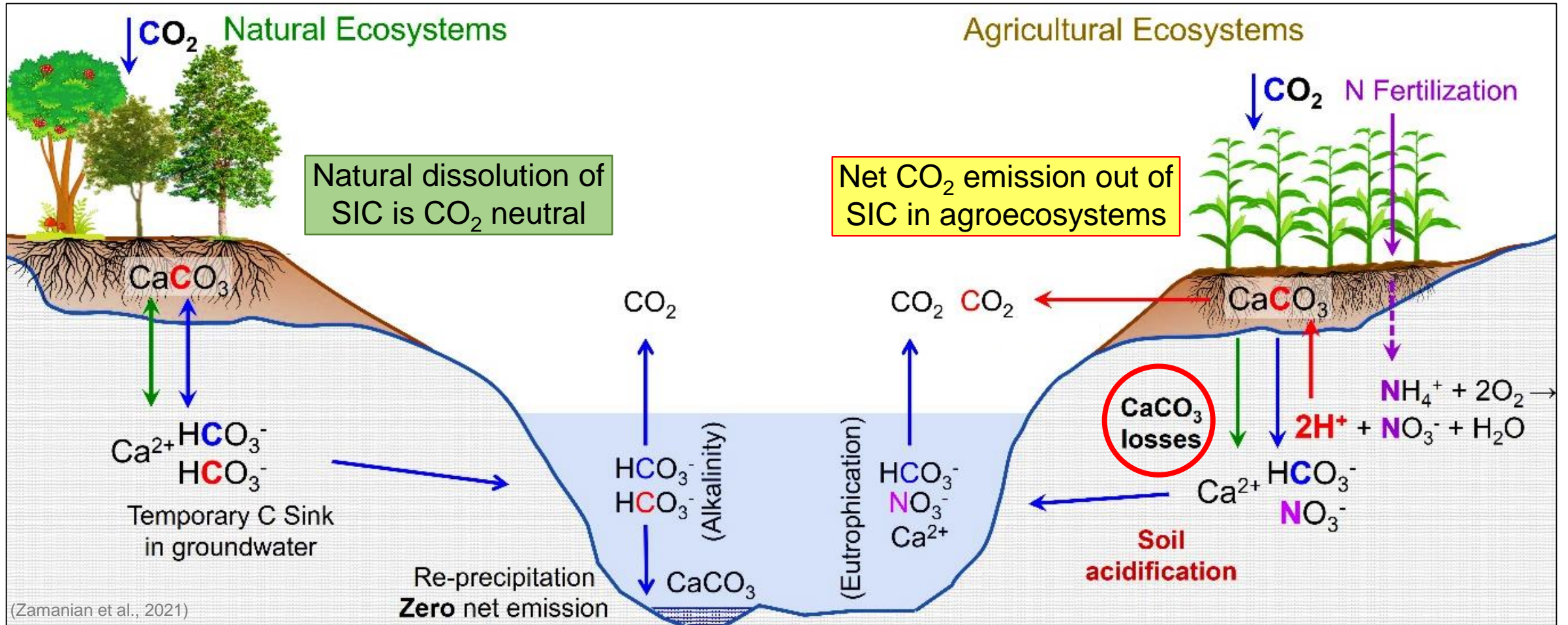
❖ 2400 Pg SOC down to 2m



(Raza et al., 2023)



# SIC and global C cycle

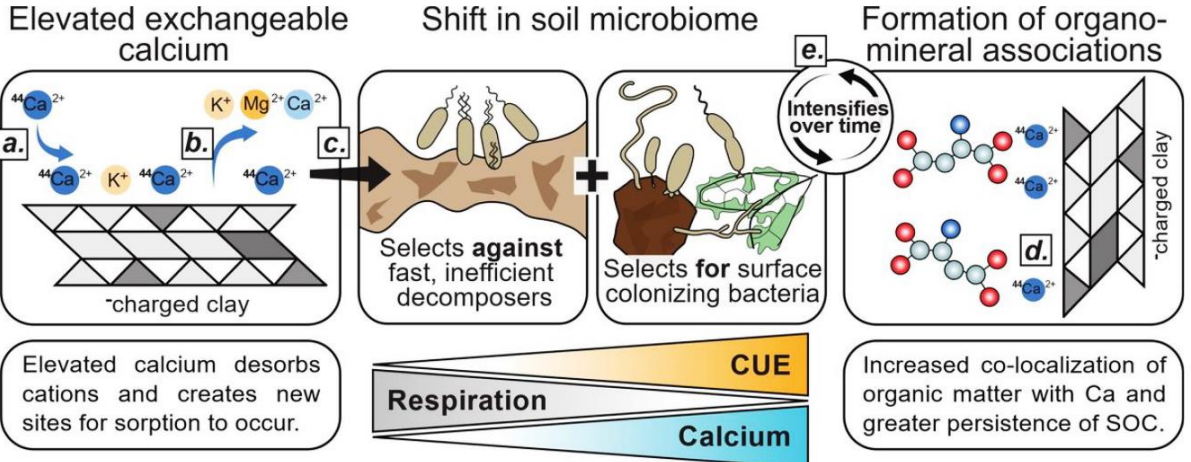
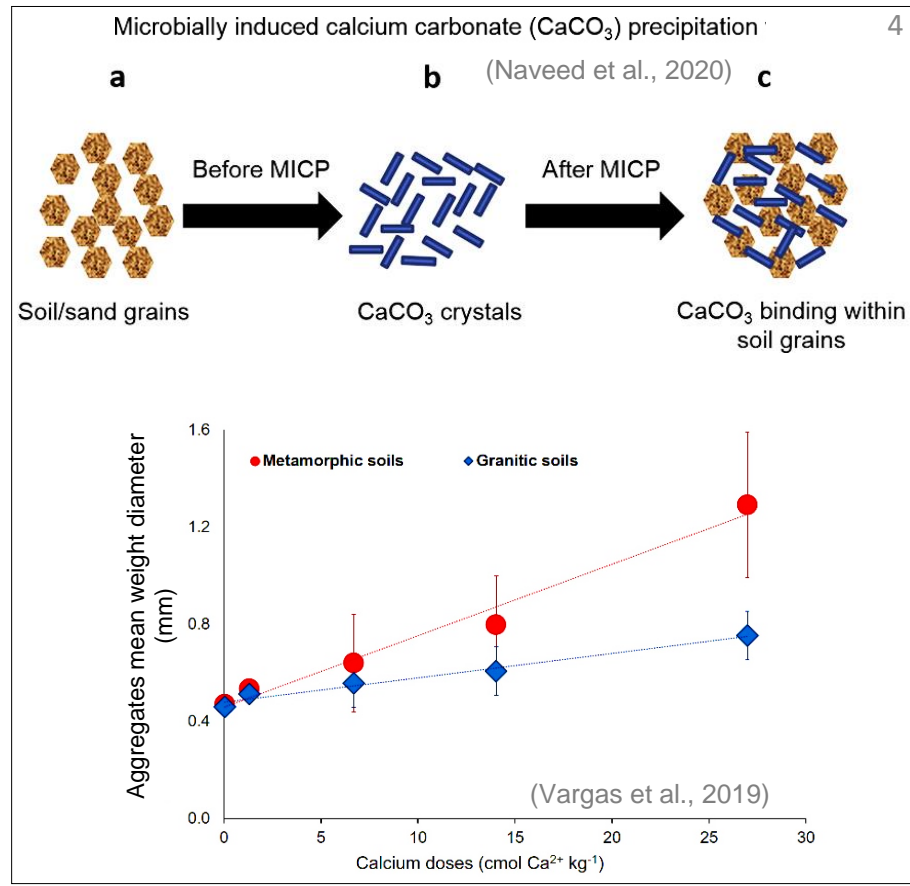
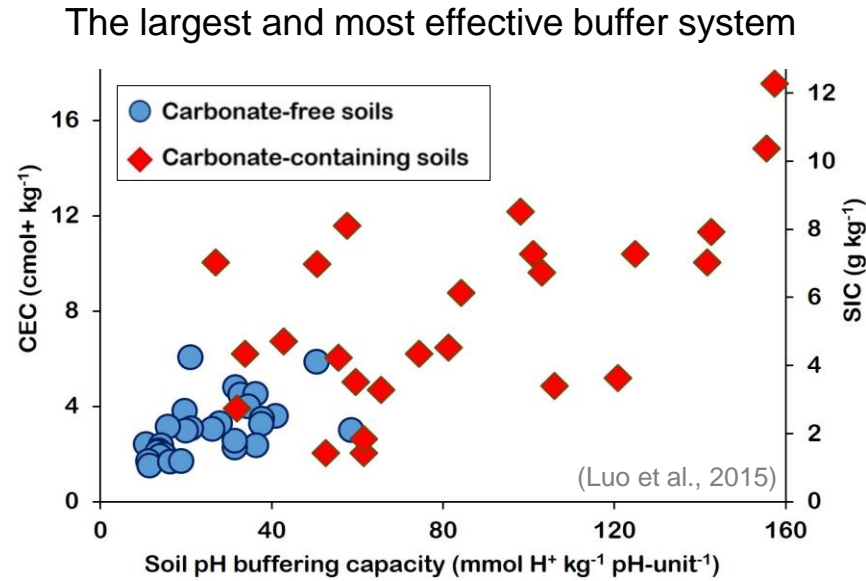


Significant contribution of SIC in atmospheric  $\text{CO}_2$ ?

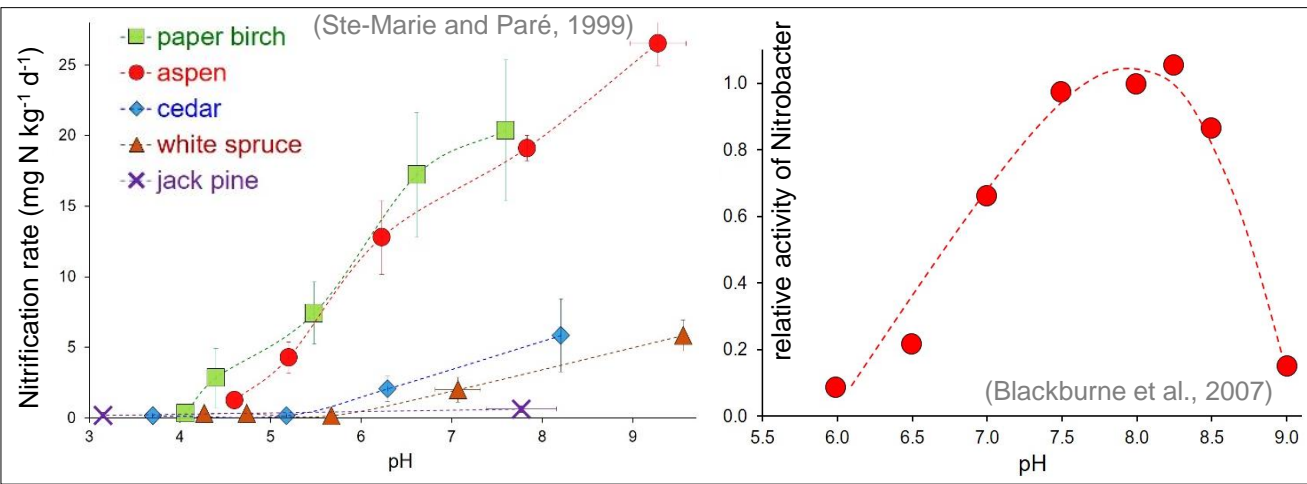
- $\text{Ca}^{2+}/\text{CaCO}_3$  addition to the soil
- Type and amount of fertilizers
- Amount and quality of irrigation

# SIC and ecosystem services

- ❖ Acid buffering capacity
- ❖ Soil aggregation
- ❖ SOM stability
- ❖ Organisms activity
- ❖ Ecosystem stability



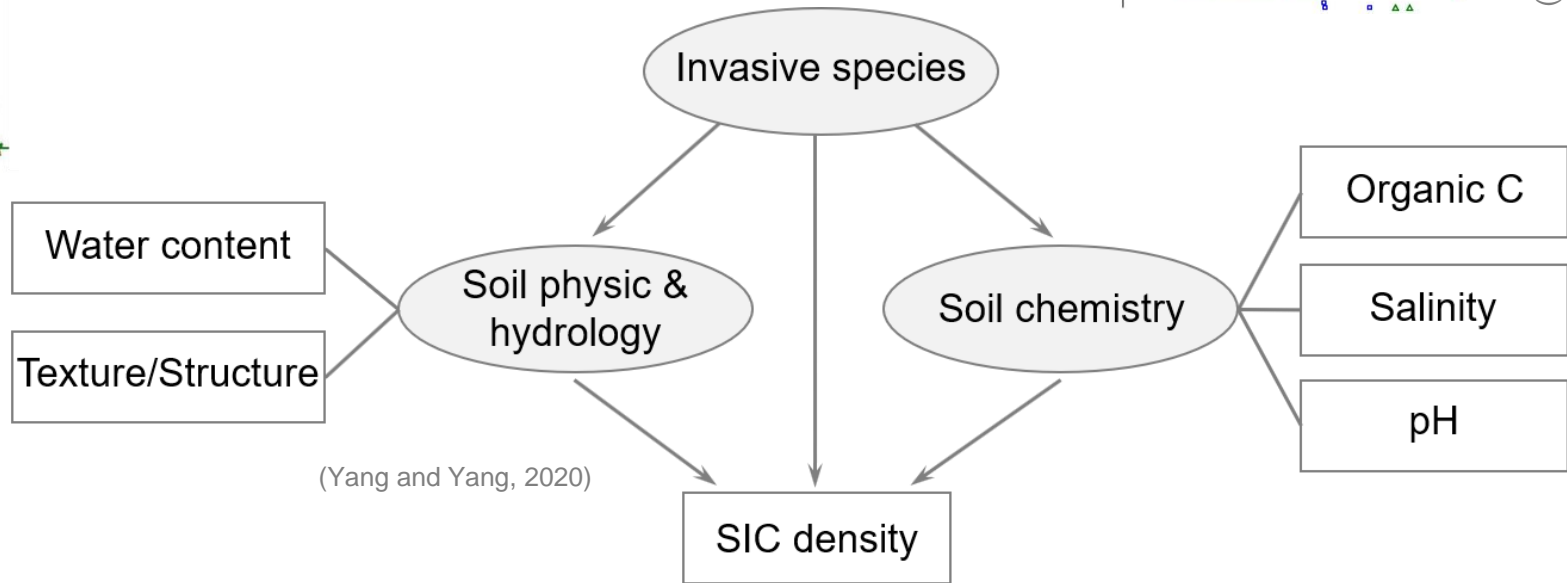
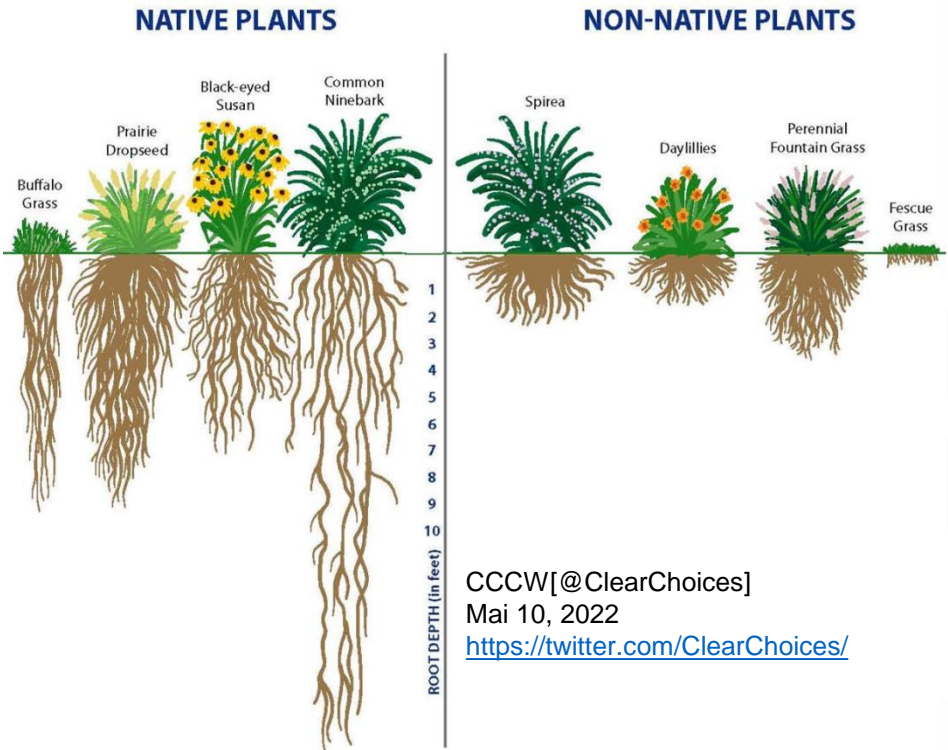
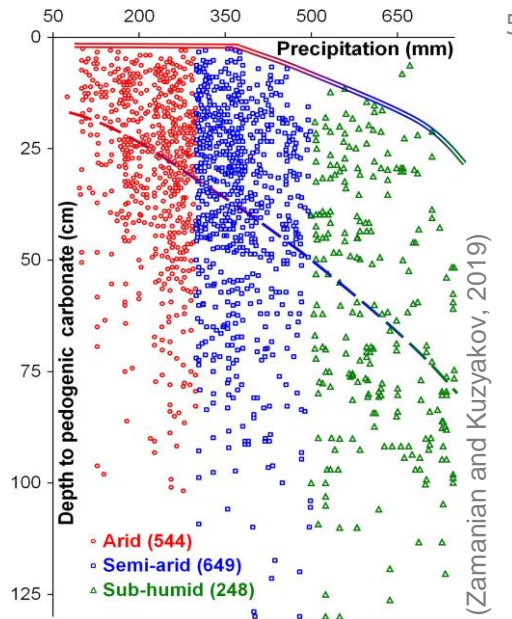
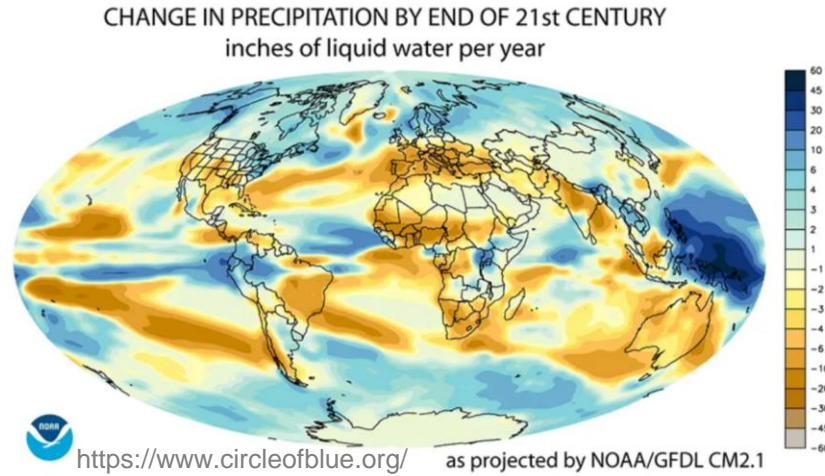
(Shabtai et al., 2023)





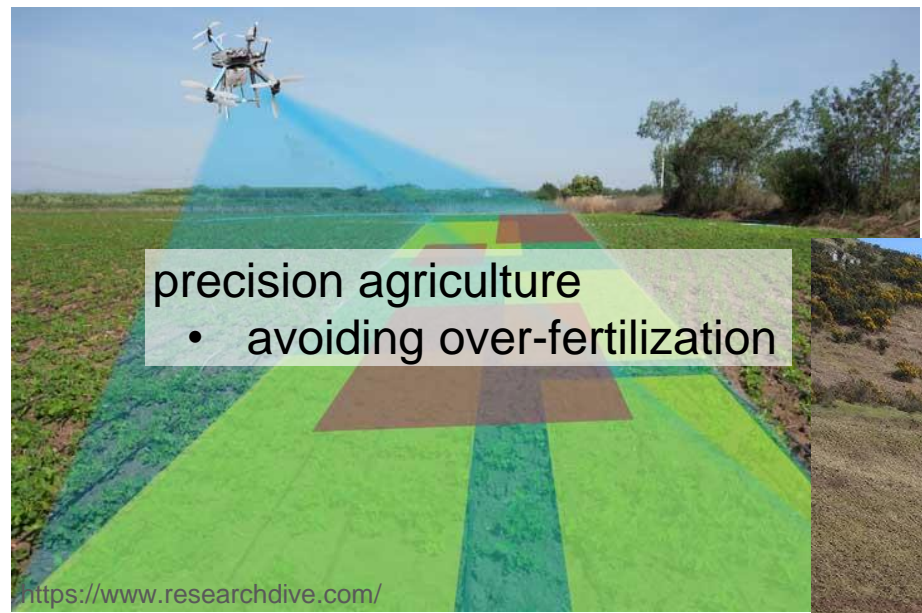
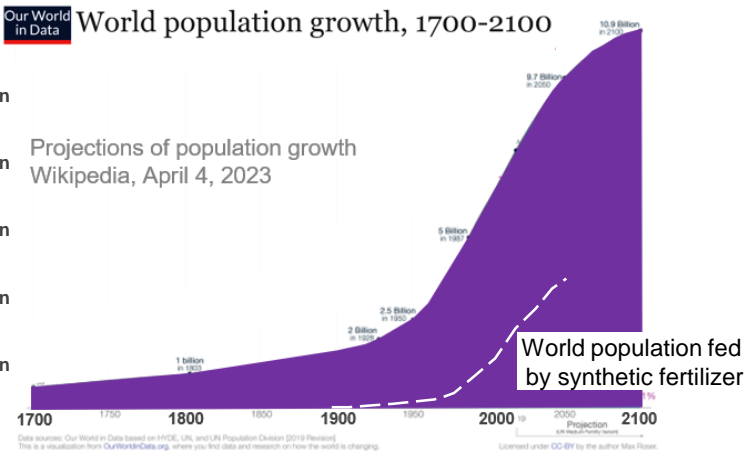
# SIC and climate change

- ❖ Changes in soil water content
- ❖ Changes in vegetation community and net primary production

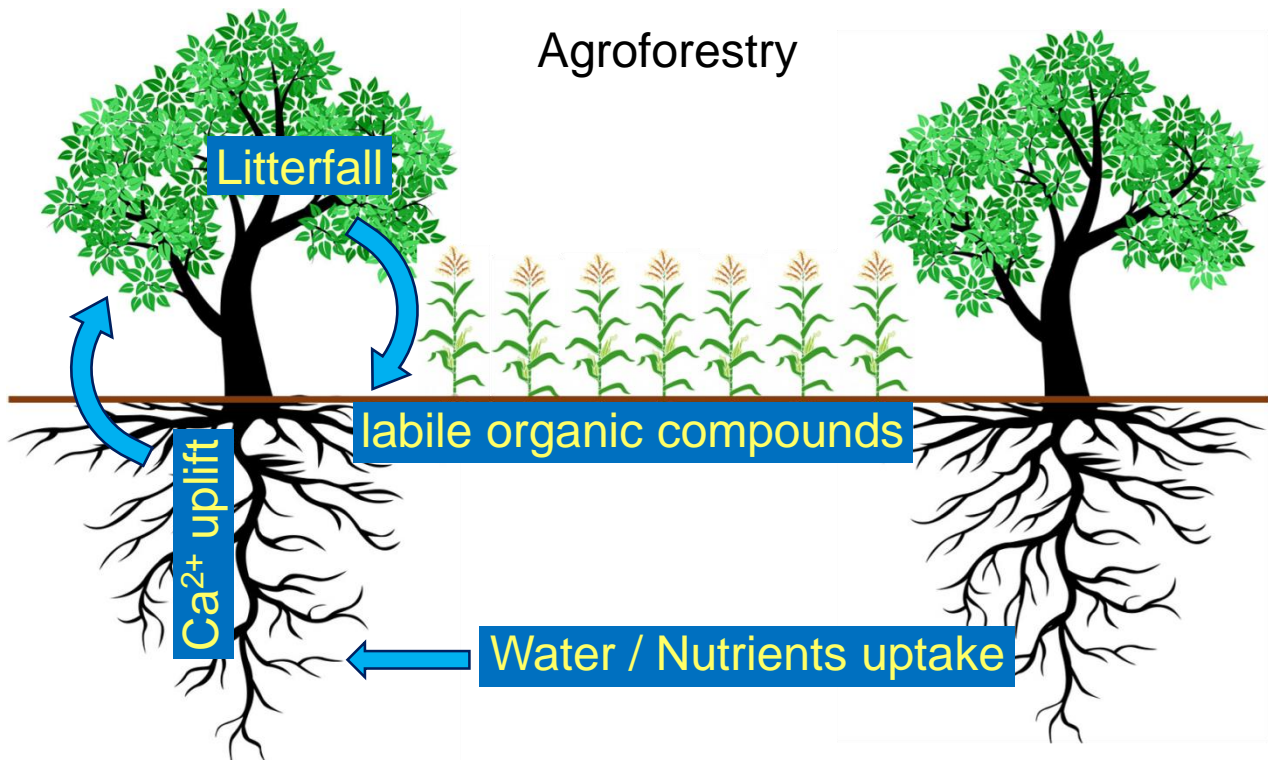


**‘Substantial stock of soil C may be cycling unknowingly’** (Wilsey et al., 2020)

# SIC: best management practices



## Agroforestry



- ❖ SIC is a dynamic C pool
- ❖ SIC losses are irrecoverable
- ❖ SIC becomes more important than SOC !

Thank you!