

Soil Aggregate Stability: Tillage, Rotations, and Cover Crop Effects



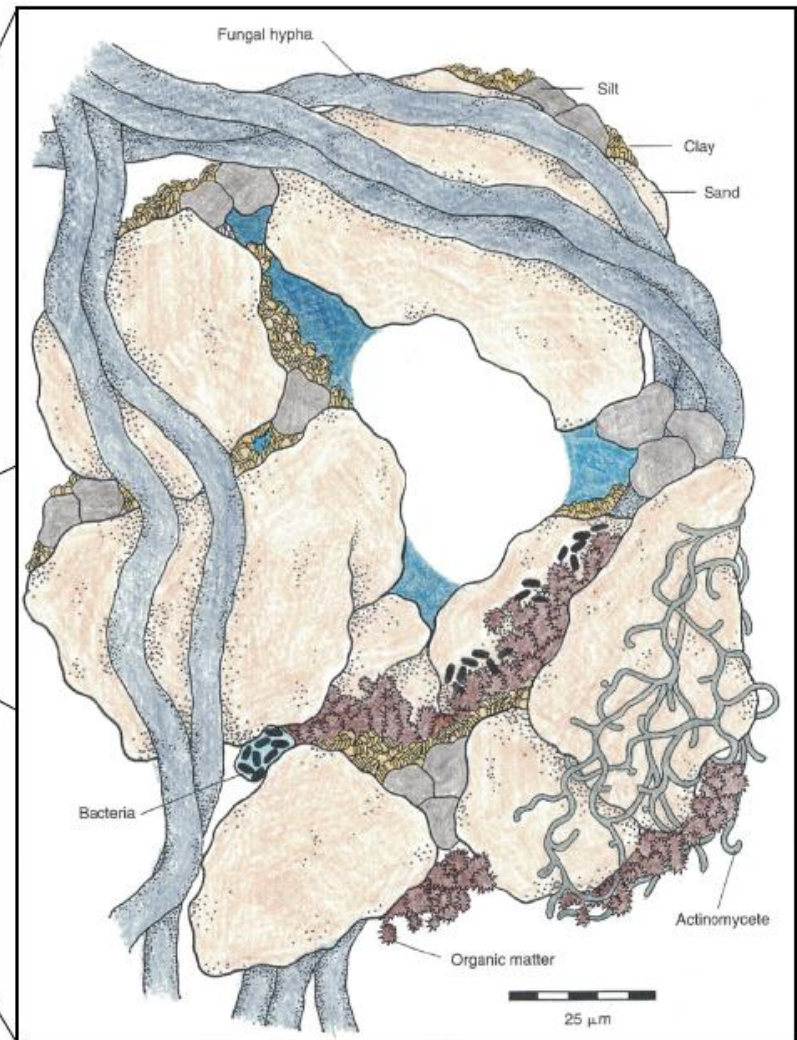
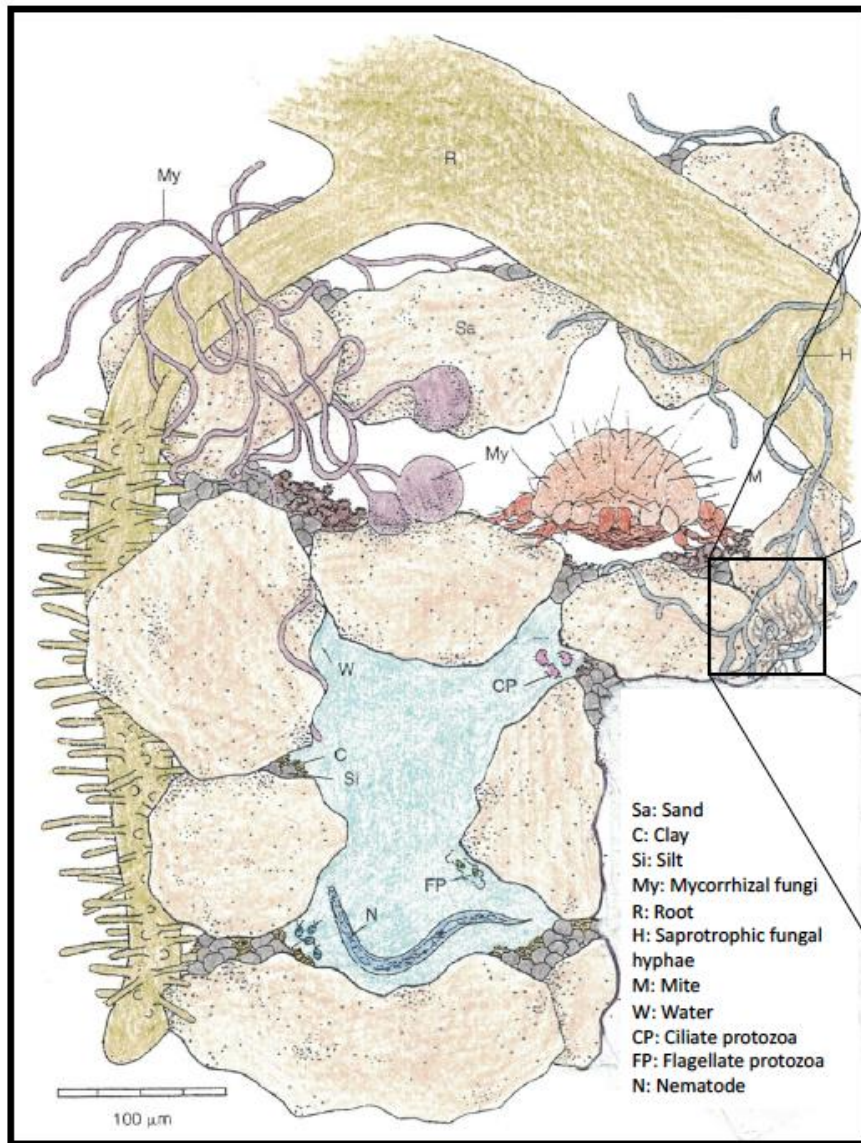
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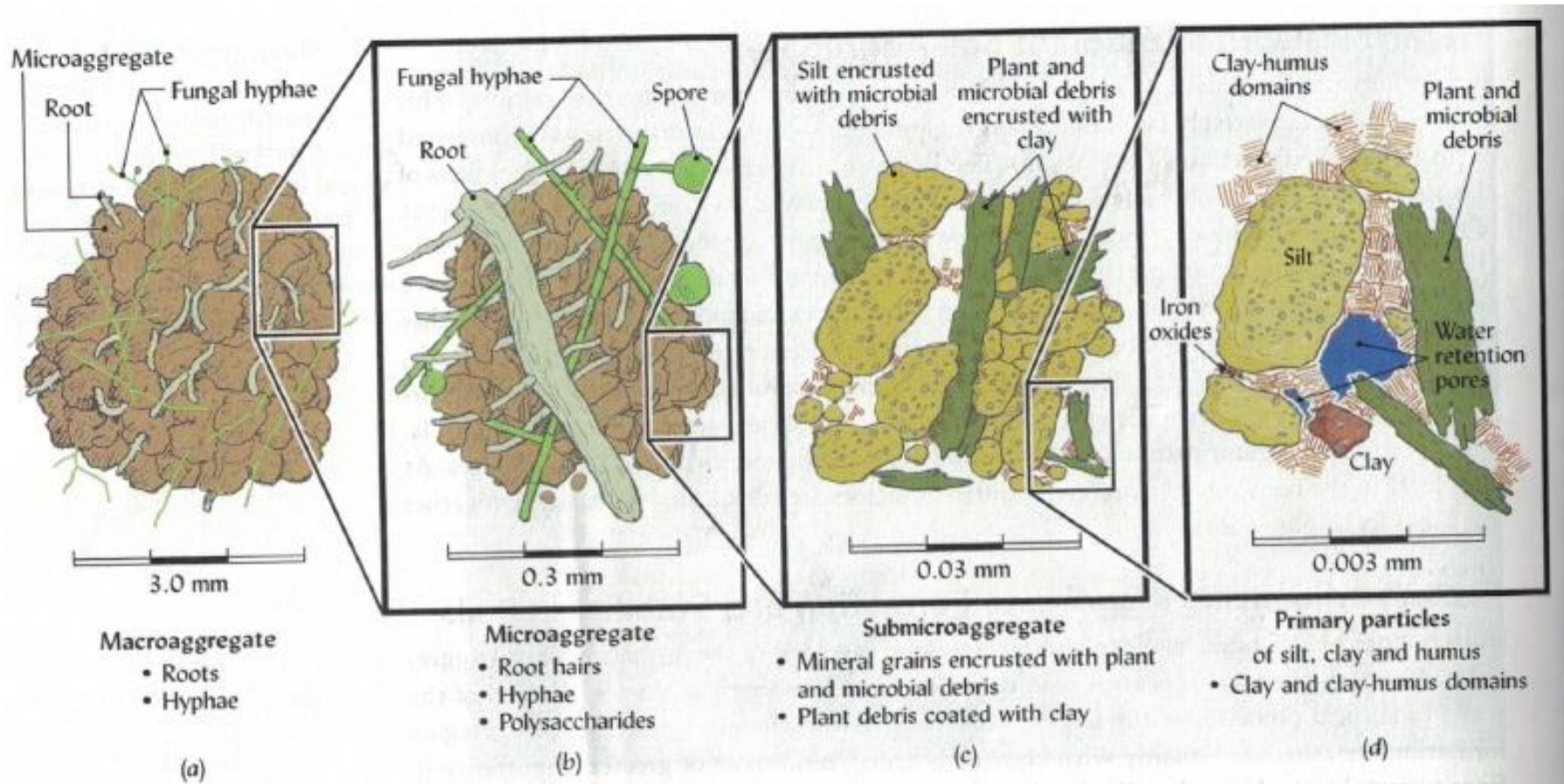
@ckgasch

A unit of soil structure generally < 10 mm in diameter and formed by natural forces and substances derived from root exudates and microbial products which cement smaller particles into larger units





Adapted from Sylvia et al., 2005, *Principles and Applications of Soil Microbiology*



Aggregates are characterized by size:

Free particles: < 0.053 mm

Microaggregates: $0.053 - 0.25$ mm

Macroaggregates: $0.25 - 2$ mm



Aggregates are stabilized by:

- Microbial and root polysaccharides and glycoproteins, which act as **cement**
- Fungal hyphae, actinomycete filaments, and roots **bind particles** together like rebar and rope

Functions of aggregates

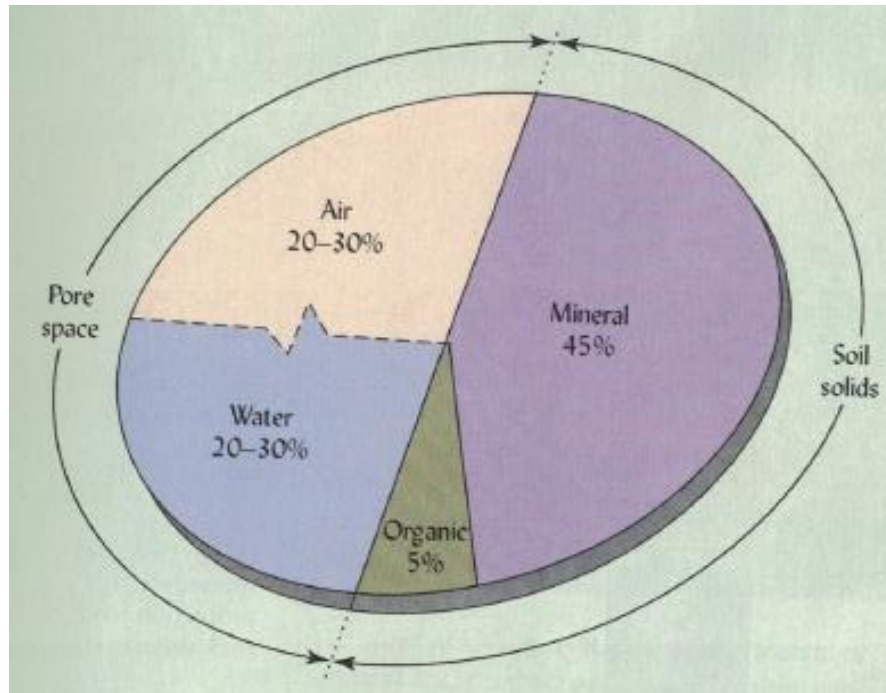
- Soil stabilization

Erosion prevention, trafficability

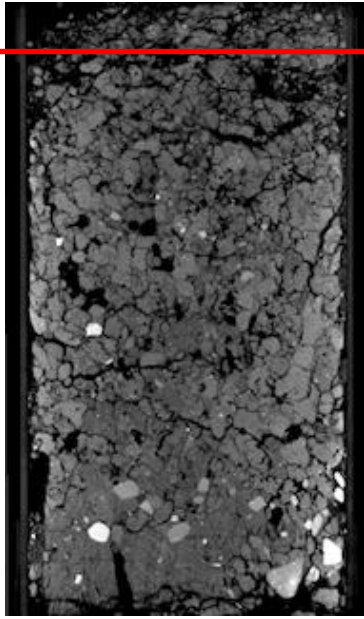


Functions of aggregates

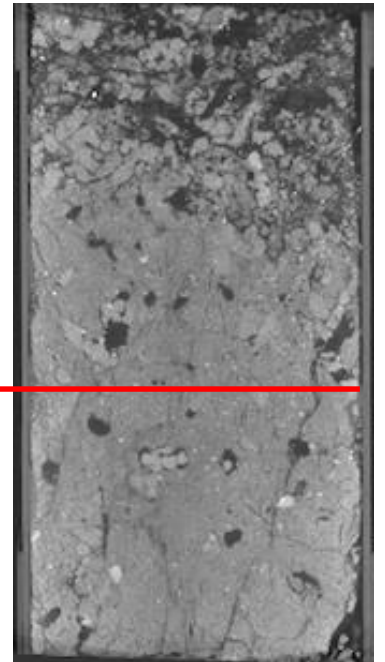
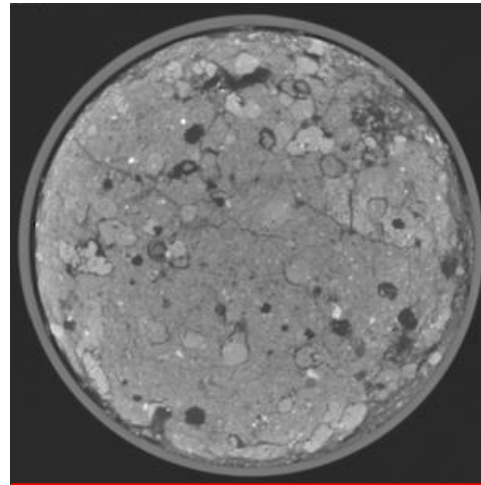
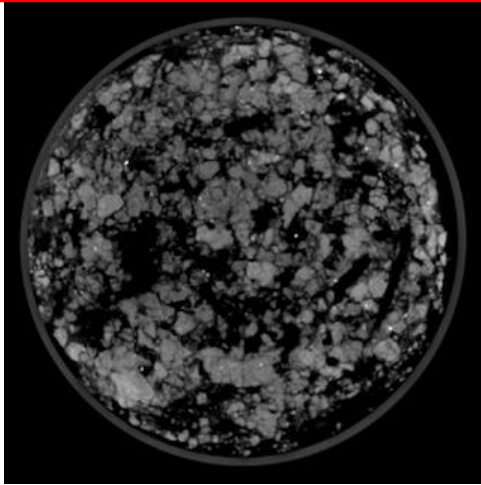
- Soil stabilization *Erosion prevention, trafficability*
- Porosity and pore connectivity *Water and air exchange & storage*



6" (~15 cm)



4" (~10 cm)





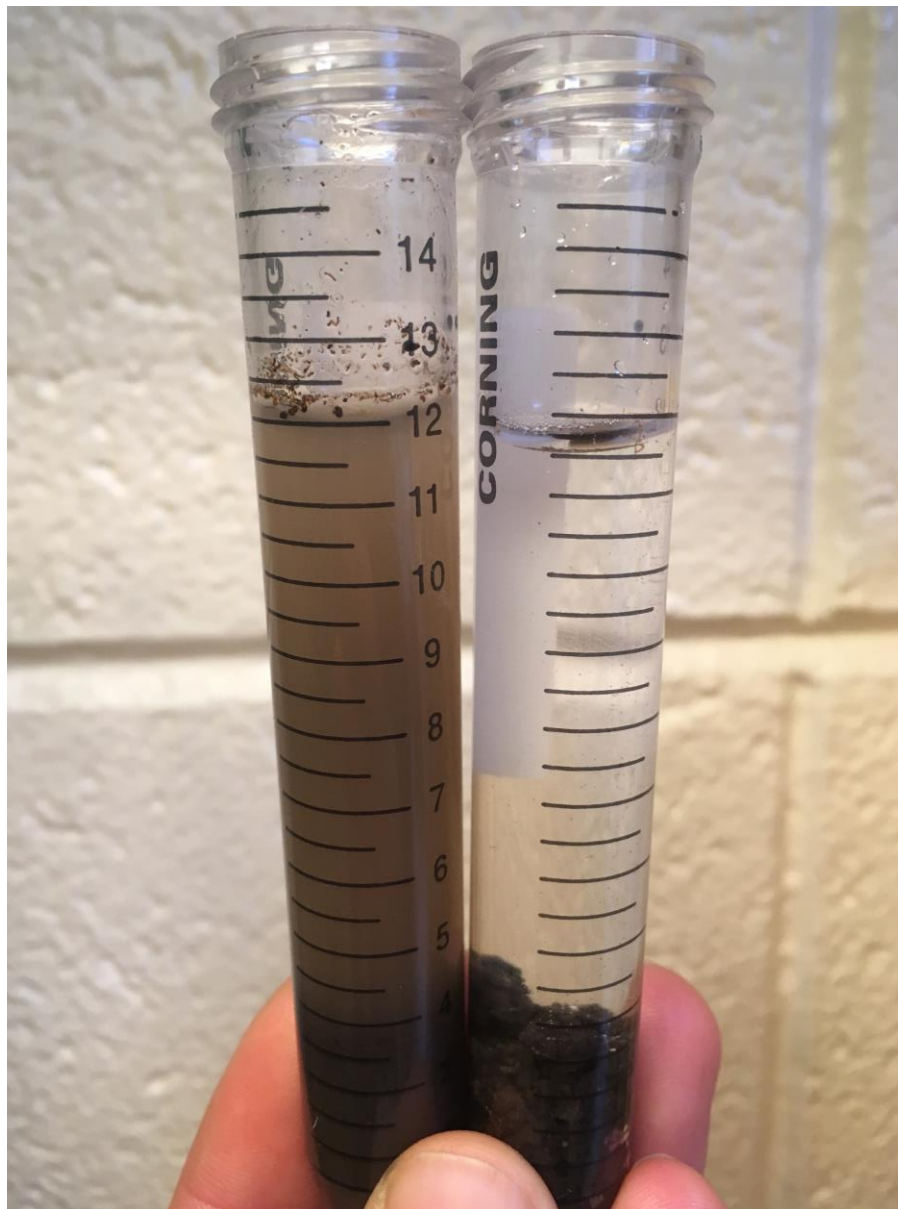


Functions of aggregates

- Soil stabilization *Erosion prevention, trafficability*
- Porosity and pore connectivity *Water and air exchange & storage*
- Organic matter and nutrient storage *Nutrient source, carbon storage*



Pulverized

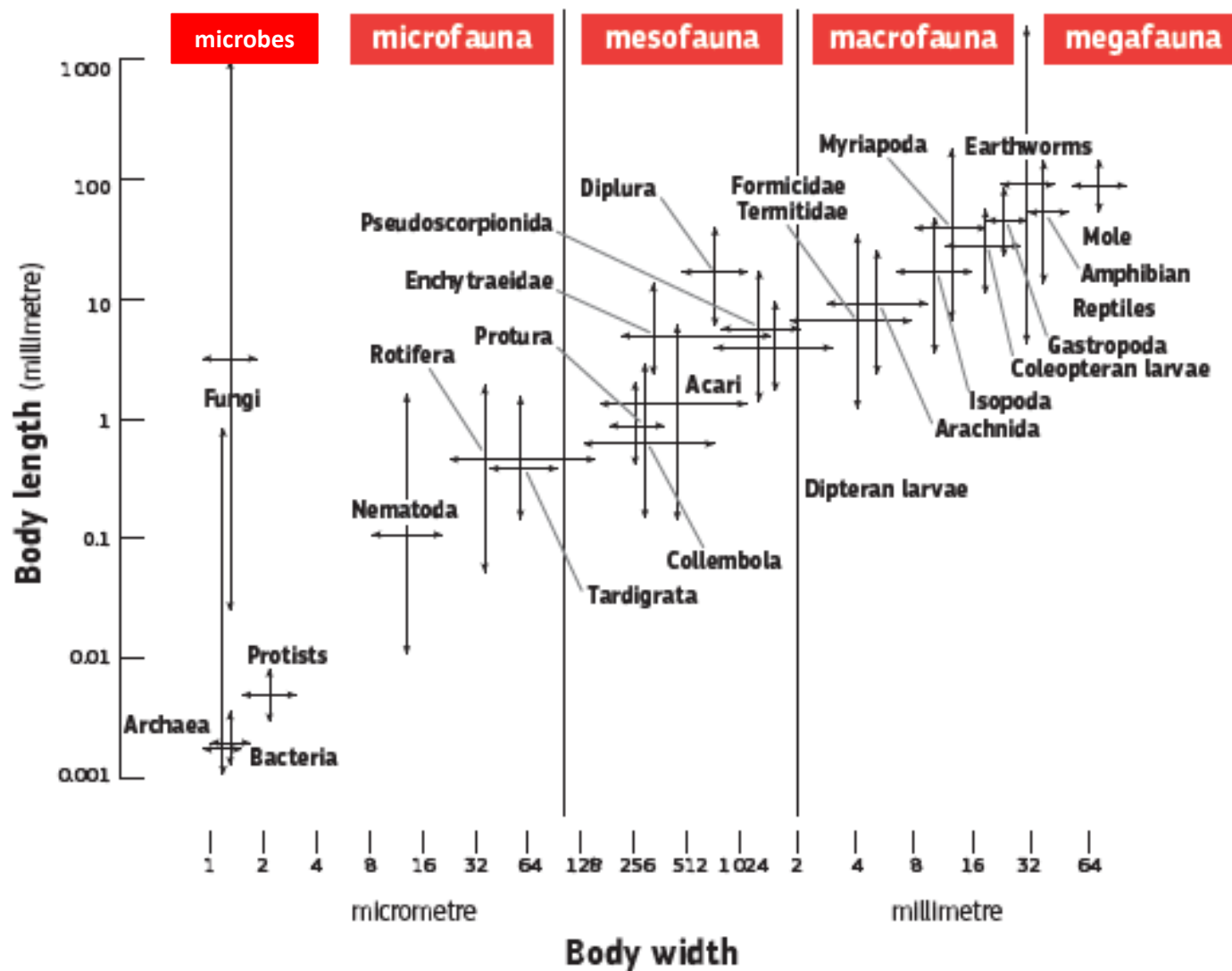


Intact

Functions of aggregates

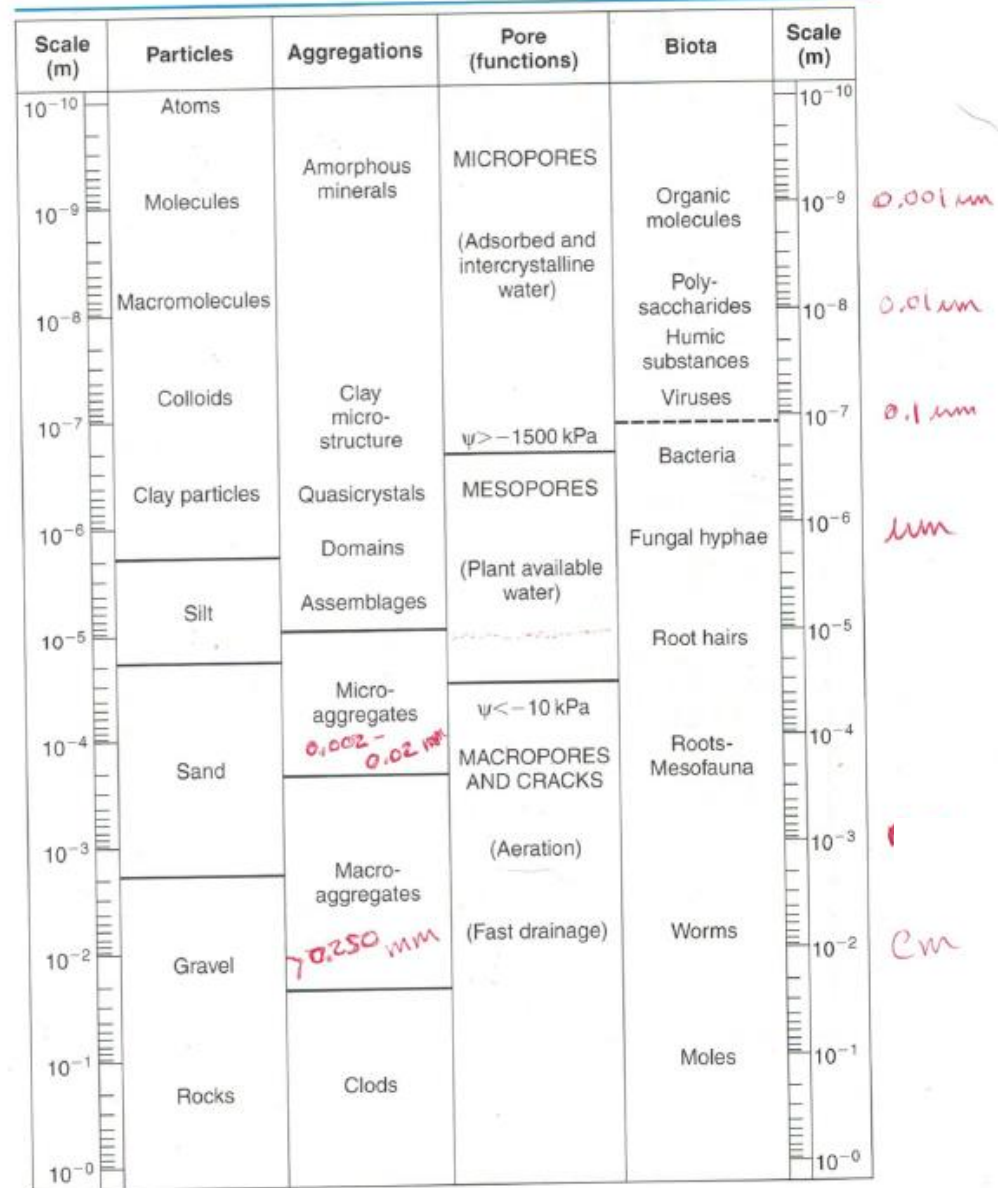
- Soil stabilization *Erosion prevention, trafficability*
- Porosity and pore connectivity *Water and air exchange & storage*
- Organic matter and nutrient storage *Nutrient source, carbon storage*
- Creation of microscale heterogeneity *Soil habitat diversity*





Practical considerations of aggregates

- Soil texture influences aggregation
- Aggregates are round, not blocky or angular
- Physical disturbance breaks down aggregates
- Soils should have a variety of aggregate sizes



Management and Aggregates

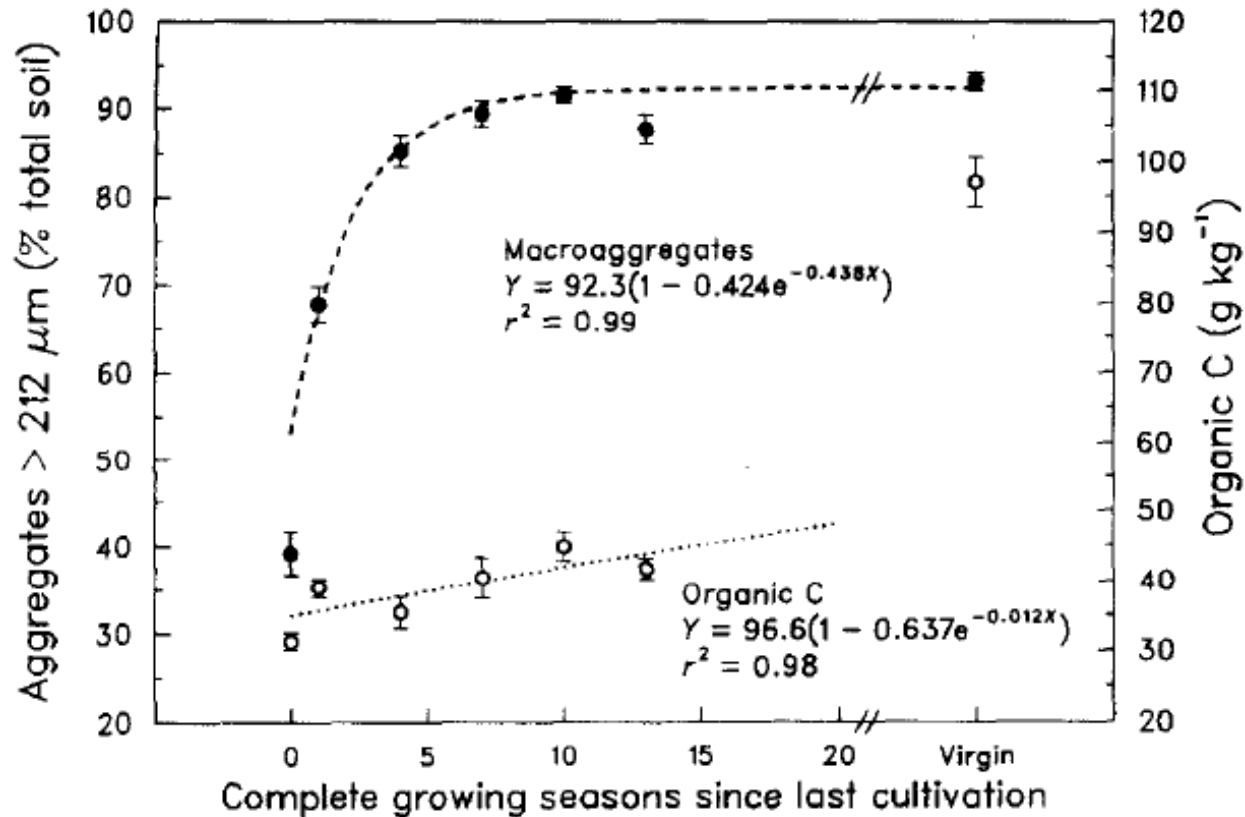
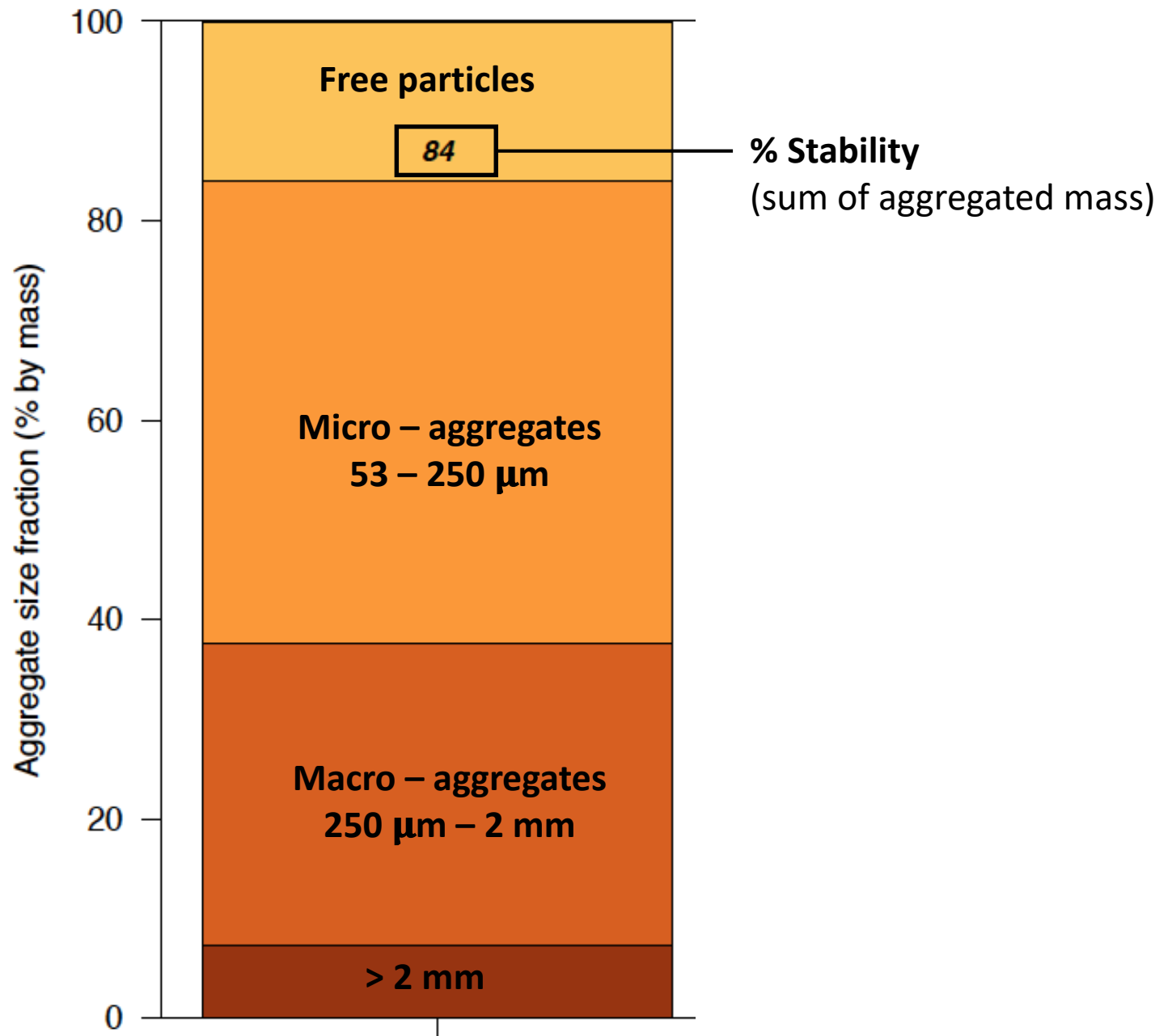
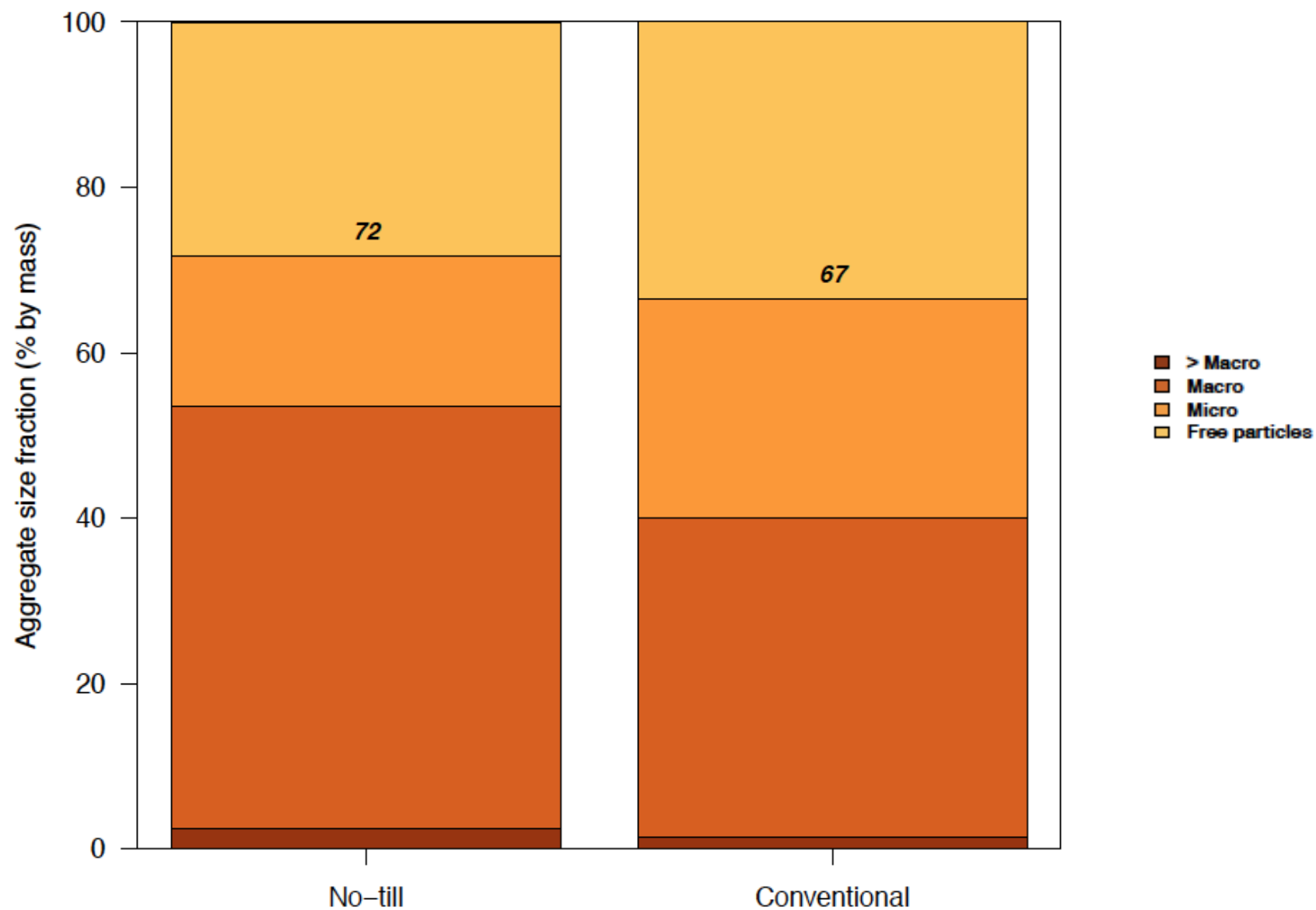


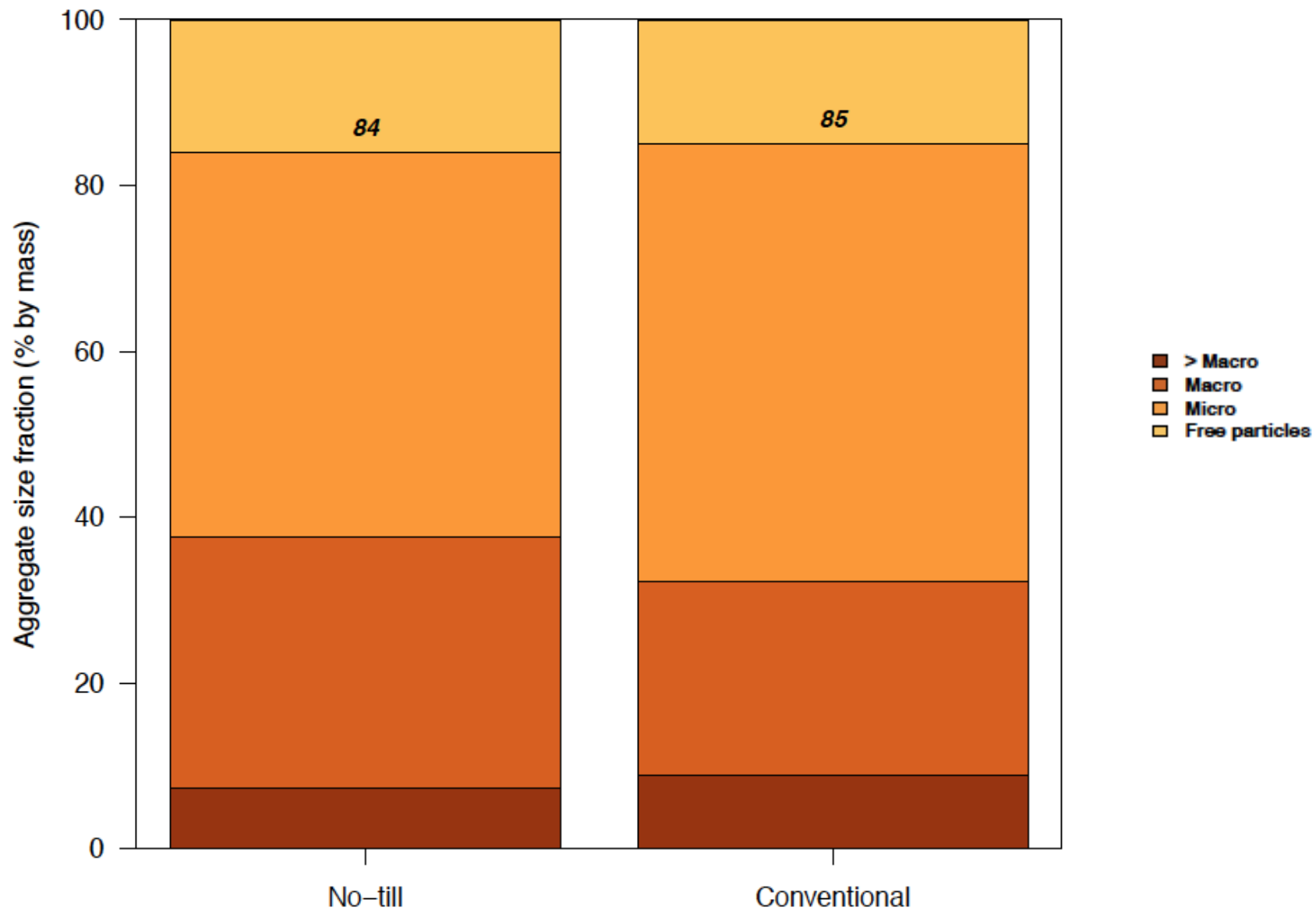
Fig. 1. Changes in percentage of macroaggregates and accumulation of whole-soil organic C with time since cultivation. Error bars indicate standard errors ($n = 10$).



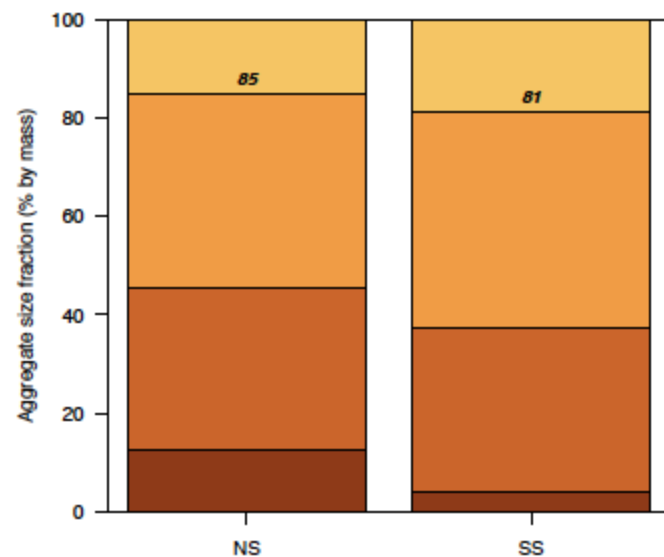
Dwight (0–6 in.)



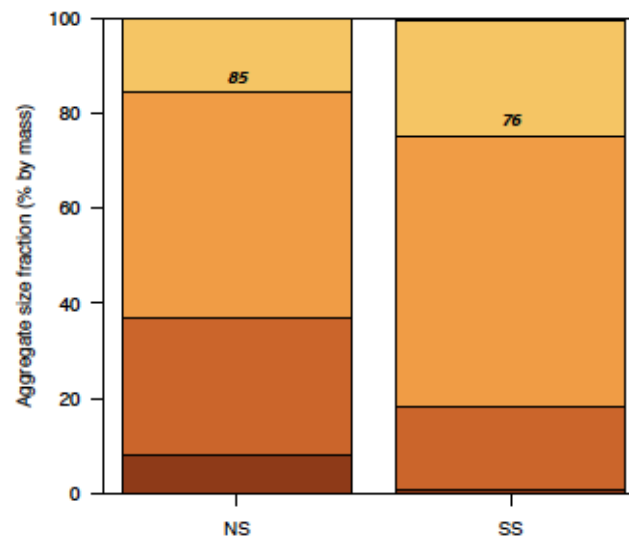
Jamestown (0–6 in.)



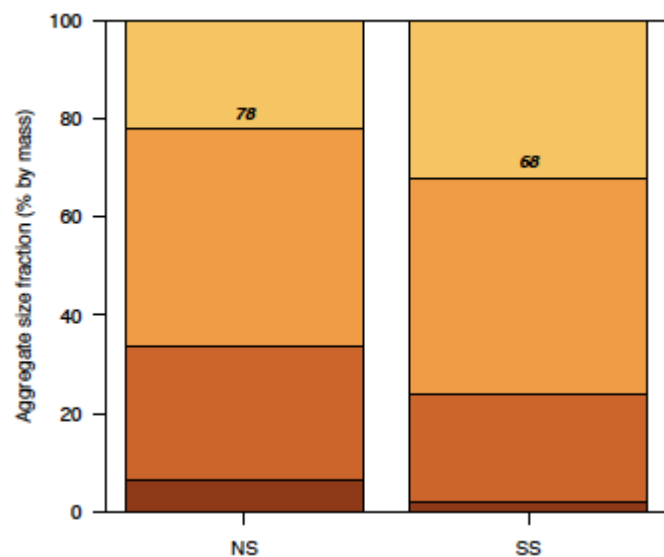
Aneta (0–6 in.)



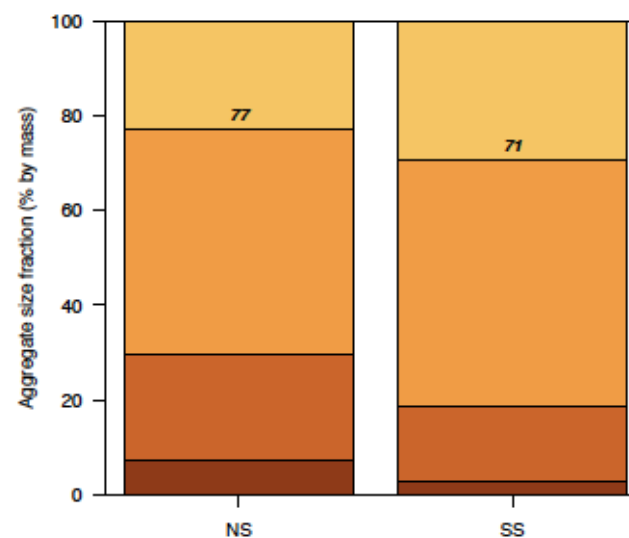
Eldridge (0–6 in.)



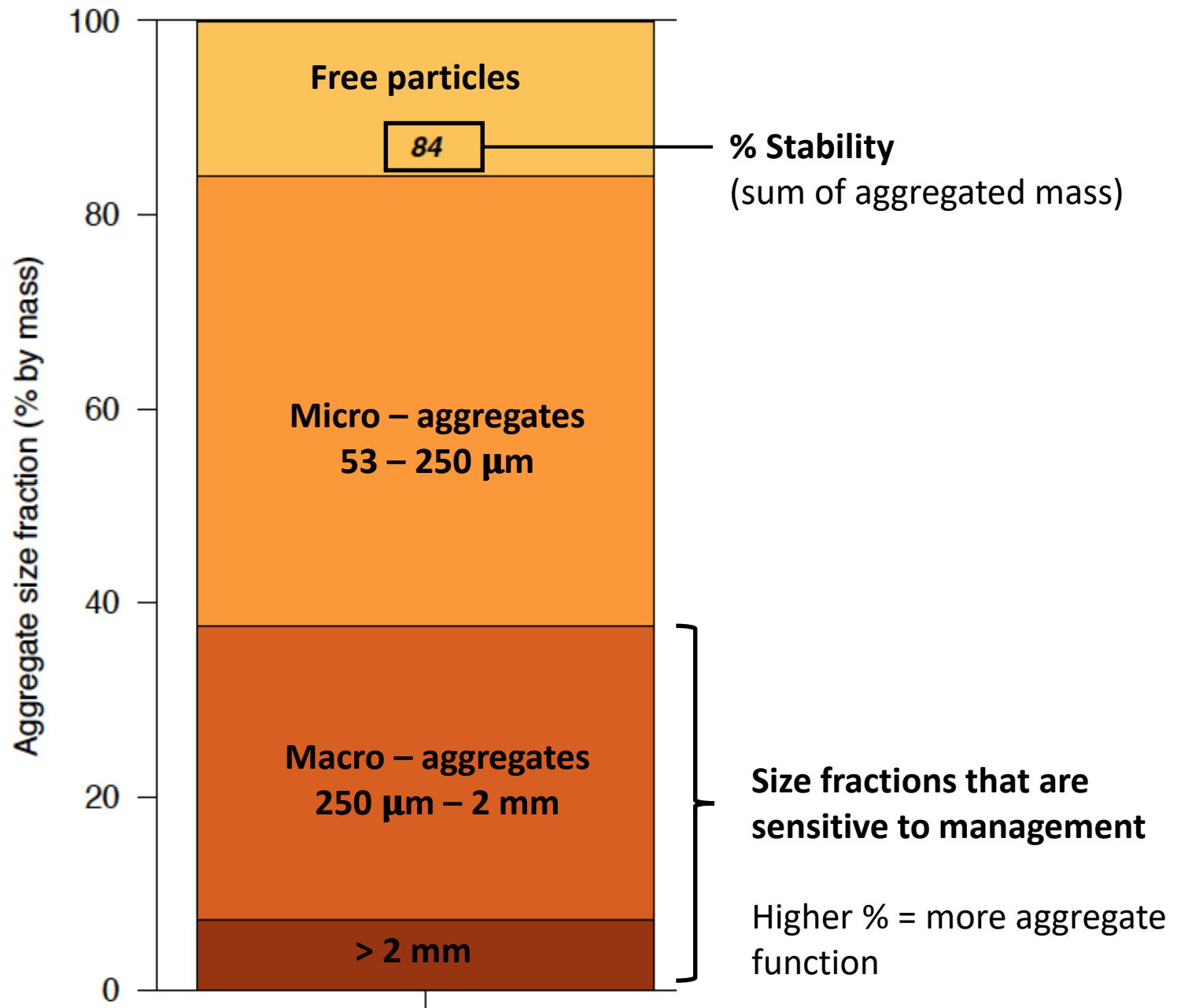
Northwood (0–6 in.)



Midway (0–6 in.)



- > Macro
- Macro
- Micro
- Free particles



Management & Factors	Aggregate formation and stability
Tillage	↓↓↓
Roots	↑↑↑
Rotational diversity	↑↑
Earthworms	↑
Salinity & Inundation	↓
Coarse mineral particles	↓↓
Organic matter	↑↑

Measuring Aggregates: In the field

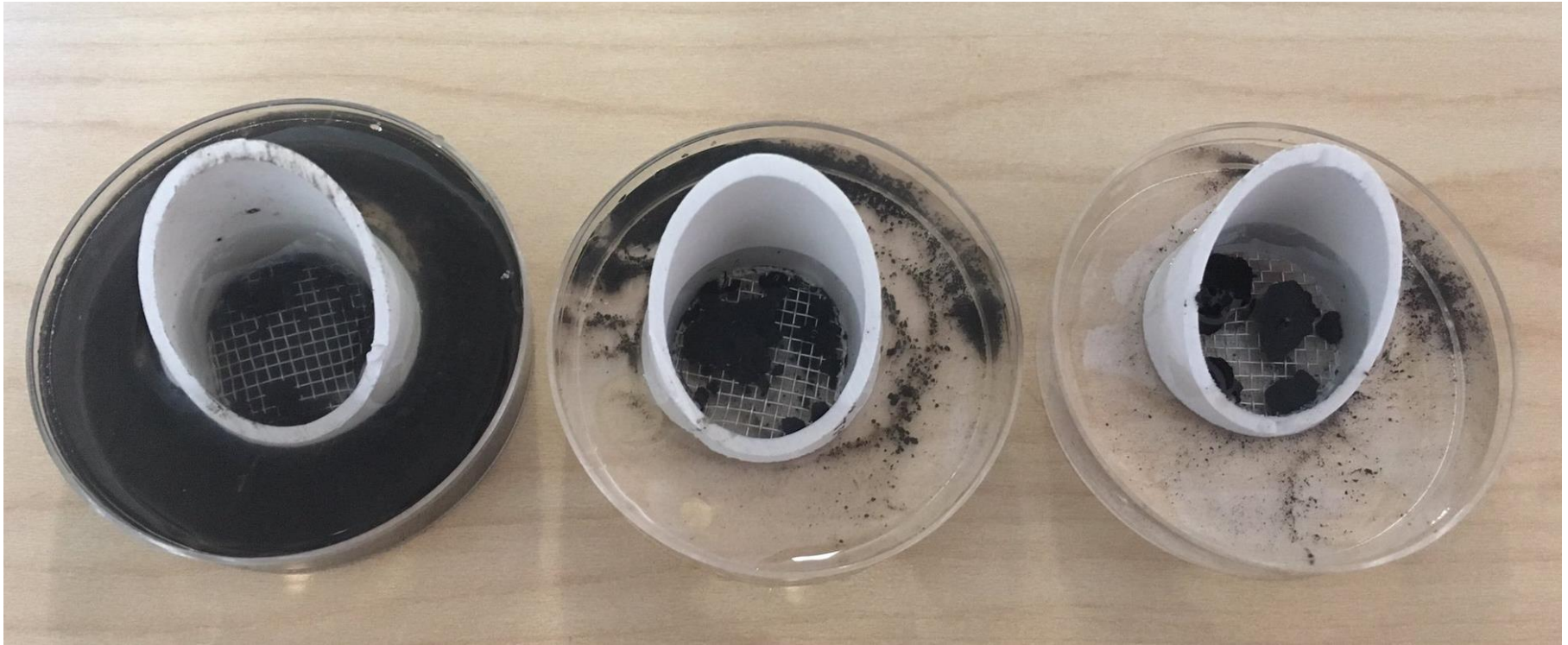
- Spade test
- Appearance
- Crumbly structure



Sampling Aggregates

- Spade or wide probe
- Soils near field capacity
- Top 6" or rooting zone
- Not necessary every year

Measuring Aggregates: The slake test

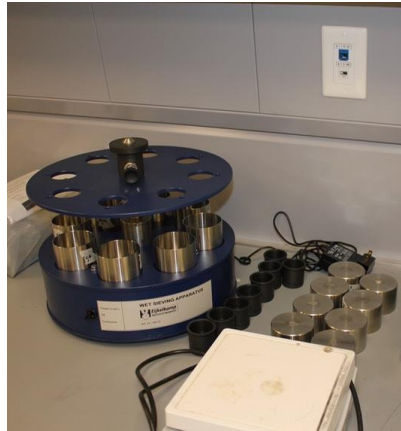


Measuring Aggregates: In the lab

Manual wet sieving



Benchtop wet sieving



Cornell Soil Health



Wood's End VAST



SHARE farm (0–6 in.)

