

Emerging Technology for Urban Soil Characterization

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 - Stores water and nutrients
 - Recycles organic litter
 - Provides home for microorganisms



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 - Controls infiltration and runoff
 - Governs water retention and recharge
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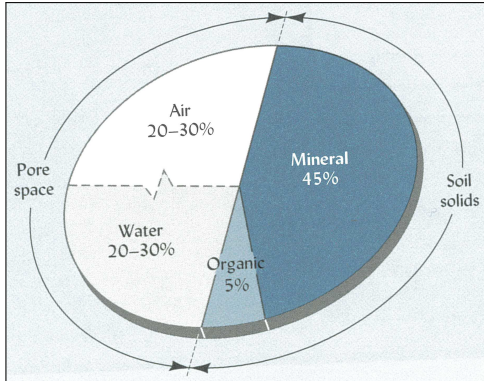


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- Buffers environmental change
 - Recycles waste
 - Filters groundwater
 - Absorbs atmospheric C $\rightarrow$ SOC



(Mis)Conceptualizing the Soil

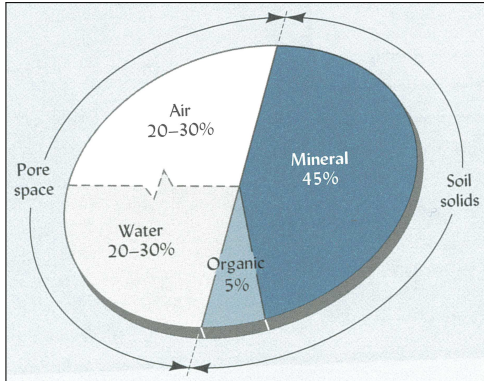


Brady and Weil (2000)

- Composition

- Mineral fine-earth (sand, silt, and clay) and coarse fraction (rock fragments >2 mm)
- Organic matter (living and decaying)
- Pore space (water or air)

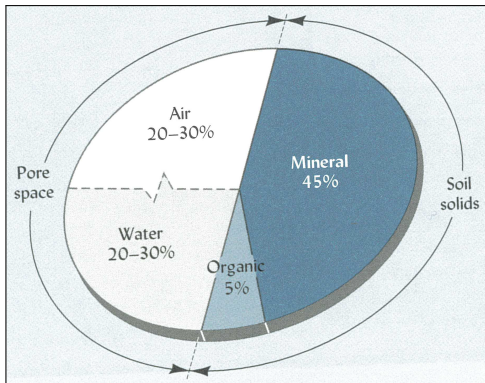
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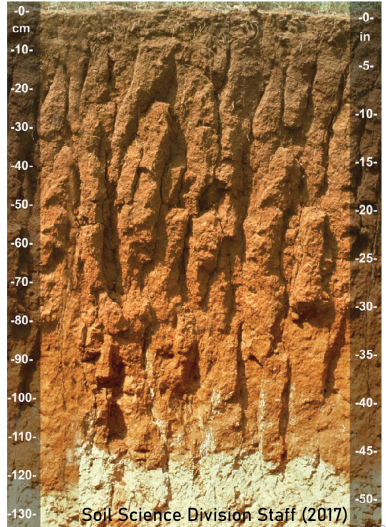
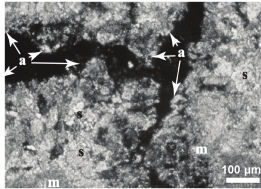
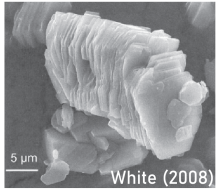
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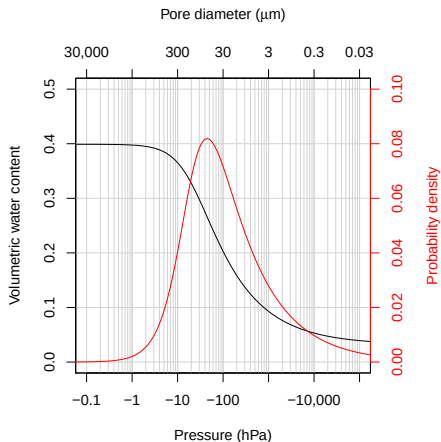
However, the reality is that soil particles are most often arranged into clusters (aggregates and peds). This arrangement is called *soil structure*.

Soil Structure



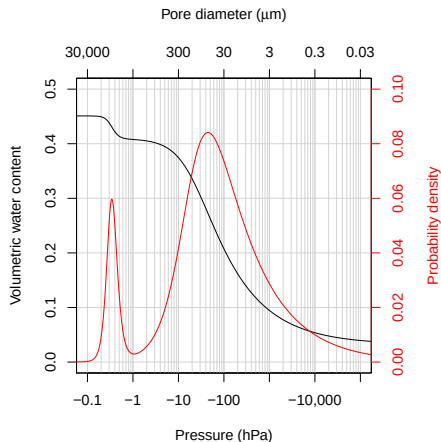
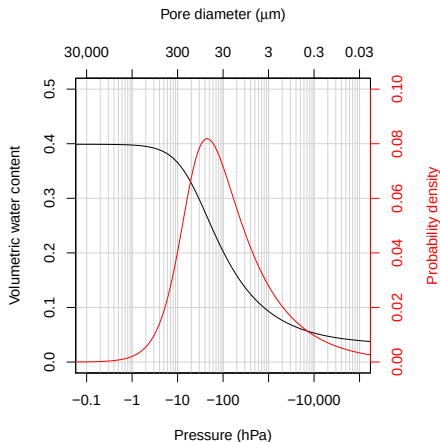
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- Infiltration, water flux, and groundwater recharge rates



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Q = volumetric discharge

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ΔP = pressure difference

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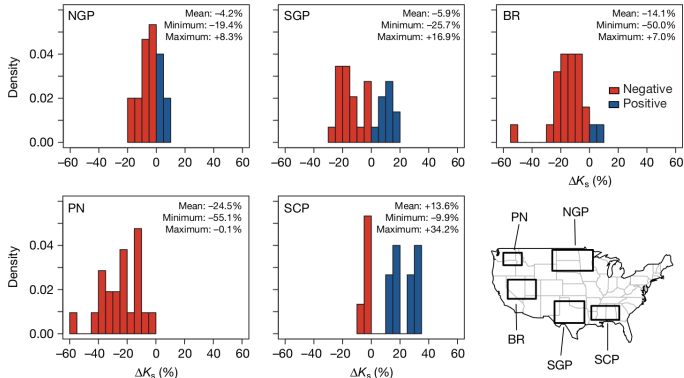
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- Soil biogeochemistry
 - Anoxic or suboxic domains control redox reactions including denitrification, heavy metal toxicity, carbon mineralization
 - Aggregates affect accessibility of organic matter to microorganisms
 - Water flux controls contaminant transport

Urban Soils and Climate Change

- Soil structure appears to be changing in response to climate on a timescale of years to decades with negative hydrological implications for areas projected to receive more yearly rainfall



Current Methods in Characterizing Soil Structure

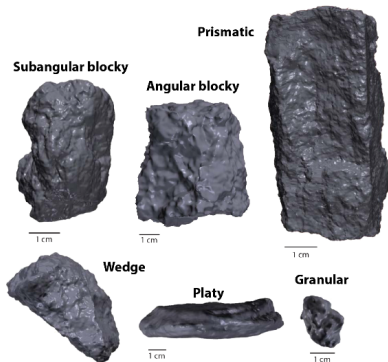
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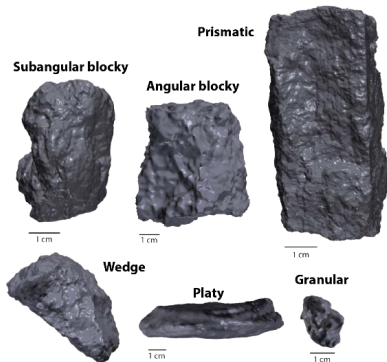
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Size Class	Code		Criteria: structural unit size ¹ (mm)		
	Conv.	NASIS	Granular, Platy ² , (Thickness)	Columnar, Prismatic, Wedge ³ (Diameter)	Angular & Subangular Blocky and Lenticular (Diameter)
Very Fine (Very Thin) ²	vf (vn)	VF (VN)	< 1	< 10	< 5
Fine (Thin) ²	f (tn)	F (TN)	1 to < 2	10 to < 20	5 to < 10
Medium (Medium)	m (m)	M (M)	2 to < 5	20 to < 50	10 to < 20
Coarse (Thick) ²	co (tk)	CO (TK)	5 to < 10	50 to < 100	20 to < 50
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Extremely Coarse	ec (—)	EC (—)	—	≥ 500	—

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- Imaging approaches

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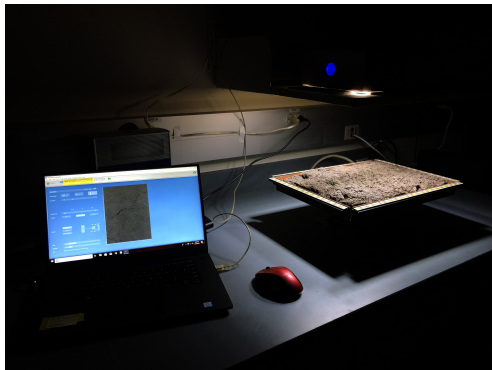
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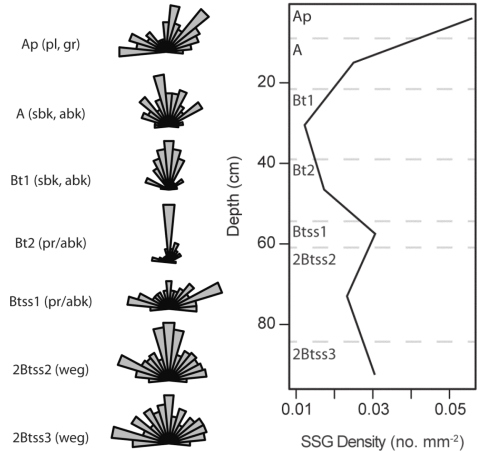
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- Despite these problems, several technologies are emerging that appear to overcome previous limitations
 - Multistripe Laser Triangulation
 - Hyperspectral Imaging

Multistriple Laser Triangulation

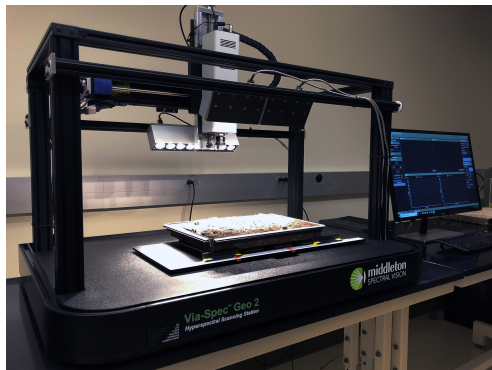


Multistripe Laser Triangulation

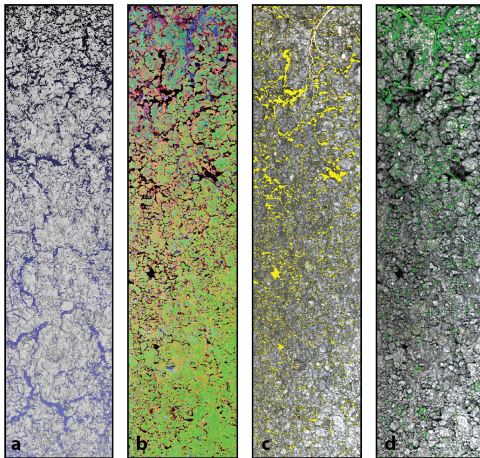
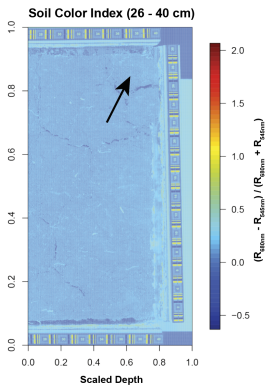
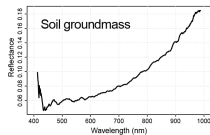


Ect et al. (2013)

Hyperspectral Imaging

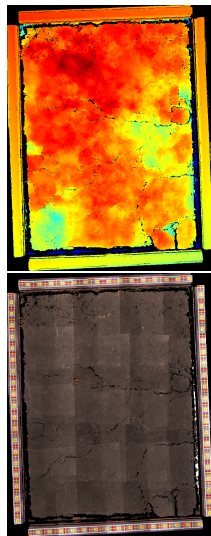


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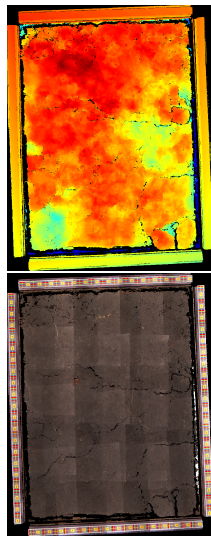
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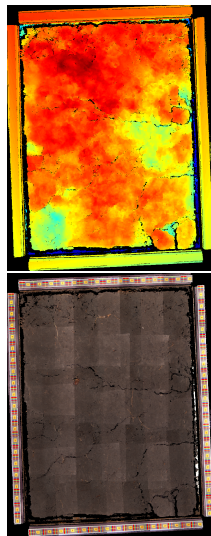
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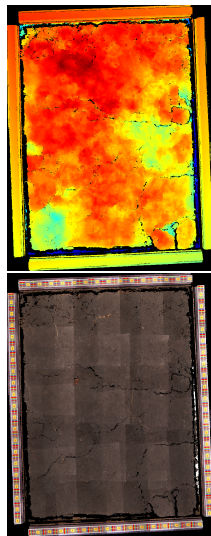
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MLT and HSI provide new exciting opportunities to study and characterize soil structure at field scales

