Introduction to Soil Science

A week-long short course for <u>anyone</u> curious and interested!
Drop in or take it for 2 credits!

Lecturer: Prof. Dani Or
Desert Research Institute
Caltech Moore Scholar 2022-2023

Time: Sept. 19th - 23rd, 2022 (mornings)

	9/19	9/20	9/21	9/22	9/23
9:00-10:15	Introduction	Lecture 2	Lecture 4	Lecture 6	Lecture 8
10:15-10:30	Coffee break				
10:30-11:45	Lecture 1	Lecture 3	Lecture 5	Lecture 7	Lecture 9

Course Number: ESE200 or Ge197 (If you want to take it for credit)

Sign up link: TBD

Location: TBD (use the sign up link to stay informed)

Topics covered: see next page for course syllabus

Lecture 1: **The role of soil in the biosphere -** soil ecosystem services, soil formation time scales and factors, soil constituents and their arrangement (soil texture and structure)**,** the soil colloidal fraction; definitions and climatic/regional perspective.

Lecture 2: **Soil water balance, water content and measurement methods -** Definitions; measurement methods - gravimetric, heat dissipation, dielectric methods; links to remote sensing; estimates of soil water storage and plant available water, water balance across scales.

Lecture 3: **Water potential - how water is held in soil?** The energy state of soil water; water potential and its components; properties of water; capillarity in porous media; soil water characteristic curves models and measurements, water configuration at small scales, parameterization for regional and global applications – PTFs, CoGTF and data bases.

Lecture 4: **Water Flow in unsaturated soil, infiltration-runoff -** Buckingham-Darcy and hydraulic conductivity, Richardson-Richards Eq., parameterization, infiltration, time to ponding and runoff, time compression, infiltration/runoff vegetated landscapes with soil structure.

***Lecture 5*:** **Soil evaporation (as part of land-atmosphere interactions)** Radiation and energy balance, ET and its components E and T. Focus on E- dynamics and resistances to evaporation. Evaporation and rainfall partitioning (arid regions).

Lectures 6-7: **Soil biophysical processes** - microbial life in soil, aqueous-phase connectivity, counting niches, cell motion, microgeography, large scale – biomes.
Bioturbation by earthworms and roots – mechanics and energetics. Consequences for soil reinforcement, soil structure development – aggregation to biopores. Impacts on large-scale hydrology, biogeochemical fluxes.

Lecture 8: **The role of soil processes in global carbon cycle -** Overview of above and below-ground biological activity (canopies, plant roots, microbial processes, etc.), transpiration and GPP vs. respiration, rates of SOC accumulation, turnover times, land use changes and SOC dynamics.

Lecture 9: **Measurement of soil processes (group lecture) –** soil texture, bulk density, water content (dielectric, links to remote sensing), water potential (tensiometer, heat dissipation, psychrometers), hydraulic conductivity, water diffusivity, thermal conductivity, fluxes – lysimeters, eddy covariance, soil chambers for CO2 fluxes (other measurements?).