Resources: Soil as a Frontier of Knowledge

Call it "dirt" around a some soil scientists and they will bristle and likely admonish you to call it "soil" to acknowledge that more is happening underfoot than we can see. So just what is down there in the dirt, er, soil that we are learning through research? Soil is partly a collection of mineral particles--where did they come from and how did they get here? Soil is also filled with life, largely microbial but some larger like earthworms and arthropods--to what extent to they shape soil and are they perhaps just as much a part of soil as the minerals? Soil is also a landscape, an expanse of biologically active land on which we grow food, build our houses and cities, and live our lives--how does that landscape shape our world and how do we shape it? Soil holds a place in our imagination and our political thought--how are we shaped by how we think and talk about soil? All of these questions are fertile ground (pun intended) for research and scientific exploration, making soil a knowledge frontier.

Want to know more about conference framing? Check out this 12-page summary by Jim Dontje.

Relevant Speakers: Rattan Lal, Claire Chenu, Jack Gilbert, Suzanne Simard, Frank Uekotter

Readings and Videos
This handout presents some of the work our speakers have written or presented about soil research on the frontier of knowledge, as well as a few general resources relevant to the topic. For more conference-related resources, go to our conference database.

The Smithsonian Institution's online soil exhibit.

A lexicon of soil forming process--the fundamentals of soil science.

A K-12 teacher resource website from the Soil Science Society of America

A Land Stewardship Project pocket guide on Soil Health, Water & Climate Change (or use this link for an web version of the same document

By Rattan Lal
Video of a 2015 presentation in Austria titled "Solutions Underfoot: The Power of Soils" focusing on how soils can help manage carbon globally. 49 min.

By Claire Chenu
Effects of habitat constraints on soil microbial community function
Naoise Nunan, Julie Leloup, Léo S. Ruamps, Valérie Pouteau & Claire Chenu
Scientific Reports volume 7, Article number: 4280 (2017)
https://www.nature.com/articles/s41598-017-04485-z

Video of a live presentation titled "How to manage soil carbon, the link with agriculture and society" https://learning.climate-kic.org/resources/spark/soils-matter-for-climate (Chenu begins at 33:39 and lasts till 1:12:39)

By Jack Gilbert

"A communal catalogue reveals Earth's multiscale microbial diversity" Luke R. Thompson et. al. (including Jack Gilbert). *Nature* volume 551, pages 457–463 (23 November 2017) doi:10.1038/nature24621 https://www.nature.com/articles/nature24621

"Reconstructing the Microbial Diversity and Function of Pre-Agricultural Tallgrass Prairie Soils in the United States" Noah Fierer et. al. (including Jack Gilbert), Science 01 Nov 2013: Vol. 342, Issue 6158, pp. 621-624 DOI: 10.1126/science.1243768 http://science.sciencemag.org/content/342/6158/621

Dirt Is Good: The Advantage of Germs for Your Child's Developing Immune System Jack Gilbert and Rob Knight with Sandra Blakeslee. St. Martin's Press. 2017.

By Suzanne Simard

Intelligent Trees - The Documentary. 2016. Available on Amazon and Vimeo, Trailer: https://www.intelligent-trees.com/

"How trees talk to each other". TED talk by Suzanne Simard. June 2016. 18 min.

"Mycorrhizal networks facilitate tree communication, learning and memory" Simard, S.W. (2018). Springer*In: Baluska, F., Gagliano, M., and Witzany, G. (eds.), Memory and Learning in Plants.*

"Change in soil fungal community structure driven by a decline in ectomycorrhizal fungi following a mountain pine beetle (Dendroctonus ponderosae) outbreak". Pec GJ, Karst J, Taylor DL, Cigan PW, Erbilgin N, Cooke JEK, Simard SW and Cahill Jr. JF (2017). *New Phytologist, 213: 864-873.*

"Shroomroot – an action-based digital game to enhance postsecondary teaching and learning about mycorrhizae" Maddison, J.A., Kržic, M., Simard, S.W., Adderly, C., and Khan, S. (2018). *American Biology Teacher, 80(1): 11-20. DOI: 10.1525/abt.2018.80.1.11*

" Twenty years of ecosystem response after clearcutting and slashburning in conifer forests of central British Columbia, Canada" Chandler JR, Haeussler S, Hamilton EH, Feller M, Bradfield G, and Simard SW (2017). Public Library of Science *PLoS ONE 12(2): e0172667.*

By Frank Uekotter

"Farming and Not Knowing. Agnotology Meets Environmental History," In *New Natures. Joining Environmental History with Science and Technology Studies,* Dolly Jørgensen, Finn Arne Jørgensen, Sara B. Pritchard (eds.). Pittsburgh, 2013: 37-50.

"The Meaning of Moving Sand: Towards a Dust Bowl Mythology." Global Environment 8 (2015): 349-379.

"Ignorance is Strength: Science-based Agriculture and the Merits of Incomplete Knowledge" In Managing the Unknown: Essays on Environmental Ignorance, Frank Uekotter and Uwe Lubken, eds.2014