



ΠΕΔΟΜΕΤΡΟΝ

Newsletter of the Pedometrics Commission of the IUSS

Issue 44, June 2019

From the Chair

Dear colleagues,

Welcome to the 44st issue of Pedometron. Summer has returned to Europe and along with it a new issue of the Pedometron. Just in time, before many of our colleagues leave their office to enjoy a well-deserved summer break. Only few weeks ago, we had Pedometrics 2019 in Guelph, Canada. It was great to see that so many of you attended this conference. The planning of Pedometrics 2021 has already started. Dr. Wirastuti Widyatmanti from Universitas Gadjah Mada, Indonesia and colleagues, kindly agreed to host the 2021 conference at Bali. She presented her plans during the Pedometrics Business meeting and it looks very promising.

In this issue we prepared for you the regular items, including the Pedometrics Comic, Poetry, Pedomathemagica and 'What's new in R'. An important contribution in this issue is the 'In Memoriam' written by Richard Webster for John Gower, who passed away in May this year, at the age of 89. He was a mathematician whose influence on pedometrics has been profound.

It is good to see that the Pedometrics community is such an active community, resultingly we are organizing scientific workshops and sessions at many conferences. Aside from Pedometrics2019, we had SoilMapping2019 in Santiago, Chili. Here, the IUSS Pedometrics working groups Digital Soil Mapping and GlobalSoilMap combined their biannual meeting. In April, we had various sessions at the General Assembly of the European Geosciences Union.

From discussions we had during the workshops, we see that there is an increase in the use of machine learning for producing soil maps. Along with that, we start to critically review the use of such techniques. At Pedometrics, we opened the discussion by presenting our case on mapping soil carbon using pseudo-covariates. In this Pedometron, Alex McBratney and Budiman Minasny have made a contribution to the discussion with an article 'Pedometrics is soil data science +++'.

In the last issue, Gerard Heuvelink introduced the PM10 Challenges, in which he proposed to prioritize our research agenda. In this issue, we welcomed the contributions from our peers to discuss the agenda and complement it with new challenges. You will find contributions to the PM10 Challenges from Johan Bouma, Philippe Lagacherie, Zamir Libohova and Lin Yang.

We further introduce an inventory on how young scientists were trained in Pedometrics during their under- and graduate studies. We hope that with this inventory we can get a better insight on what students need during their studies and strengthen the university *curricula* on Pedometrics and soil science in general. Also, it is a great way to get to know the young pedometricians. It was not easy to find young scientists willing to contribute. So, hereby I invite all young pedometricians to make a contribution for the next Pedometron.

That is all for now! Happy reading and be inspired!

Titia Mulder
June, Wageningen, The Netherlands

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Soil Genesis on Canvas

Soil Genesis on Canvas

By Thomas Scholten

Art and Science are two domains that share a large portion of creativity. New findings, perspectives and theories less develop in everyday life. In fact, new and sparkling ideas and the irrepensible will to pursue them and make them understandable to others are born in curious, creative and unusual environments. So seen, artists and scientists are twins in their approach to discover the world. And they have the chance to impregnate each other.

In my case it was Alex Toland* who came across with dialogues on Soil and Art. She introduced me to Ulrike Arnold who is a German artist and studied fine arts at the Düsseldorf academy in Professor Klaus Rinke's class. She specialized in earth paintings and uses soil, minerals and sediments as resources for her paintings. In recent years, she integrated a cosmic component to her painting adding material from meteorites like nickel, iron and chondrules.



Figure 1. Soil Genesis on Canvas – a great experience. Ulrike Arnold and Thomas Scholten in dialogue with Bettina Dornberg, journalist, and Christoph Berdi, photographer, both from Cologne, Germany (Photo: Christoph Berdi).

Those of you who are familiar with soil genesis and the everlasting discussion about soil formation in space and time know that sometimes lively debates on soil forming processes can reach cosmological dimensions. And you realize it's obvious that soil genesis on canvas can synthesize both cosmos and nature and Art and Soil science in a wonderful way. Another aspect that interestingly is at the crossroads of art and soil is dedicated to extraterrestrial material. Said that, Ulrike helped me to discover new perspectives and strengthen conceptual approaches for a better understanding of nature and humans.

Soil Genesis on Canvas



Figure 2. Can you hear the fine sand, mica...? Finger test of soil texture, an intuitively and naively way to explore soils (Photo: Christoph Berdi).

An obvious link between Art and Soil is color. In science, soil color is something that can often be deceptive. It's the thing our eyes recognize, as a reflection. That makes it dangerous. Sometimes the color reflects the soil's content, but sometimes it doesn't. For example, the grey could be a mineral, but it isn't necessarily. If you have strong reddish colors in the soils, then those soils have typically undergone a lot of weathering, and have been eroded very intensively and/or for a very long time. That is, the color in the soil, if it is very strong, is in some ways a description of the amount of energy that has gone into it. But what about the absence of color? In cave paintings, there is no green. Did the green rot away, or was it perhaps not used for religious reasons?



Figure 3. Red from Australia and gray from Brazil, what do colors reflect (Photo: Christoph Berdi)?

Soil Genesis on Canvas



Figure 4. Weathering, erosion, sedimentation and the formation of soil horizons, which perspective fits best math and stats or searching, looking, watching (Photo: Christoph Berdi)?

We human beings do a lot of things intuitively, but I think that there are often very pragmatic and simple reasons behind what we do. The same is true for soil genesis where it often seems difficult to understand the system and the reasons behind the formation of the beautiful soil profiles we have around the world. A simple example is the ubiquitous element iron. Iron is bound in the rock. It is released through weathering and combines with oxygen, resulting in wonderful iron oxides. Going back in time, many rocks that are this color are nothing less than soils which might have formed millions of years ago, were then eroded, then solidified again to form rock. In general,



Figure 5. Beyond our world of experience - extra-terrestrial material from black meteorites (Photo: Christoph Berdi)?

Soil Genesis on Canvas

a simple story with bedrock as a function of soil. Does it hold when we go deeper into chemistry? The main elements that we have in the Earth's crust are silicon, oxygen, iron, aluminum and then a bit of calcium, magnesium, potassium and sodium. The remaining elements of the periodic table account for less than one percent of the total volume. Making soil from the major elements is like when you used to play with Lego pieces and tended to have an abundance of primary colors: most soils are made up of these main elements, which are abundant across the planet.

This is still a very generic view on soil genesis. One thing missing alongside earth pigments as a proxy for soil formation and a connective element of Art and Soil is some meteorite dust, something unearthly. What is it with meteorites? They fall to earth, after all. Shall we add that as a compositional element to soil genesis, now? Elements from other planets and cosmic bodies? These are just iron too? The cosmic place of our planet is important, isn't it? The Earth and its neighbors are connected though similar origins. This material is extraterrestrial and beyond our world of experience. However, if we put our painting containing iron-rich black meteorite dust in the open air, in 10,000 years these swaths of black meteorite dust will turn red.

Well you can see, there are many crossroads of Soil science and Art and public outreach and I hope you enjoy to see soil scientific findings from another perspective and let it impregnate one's soul.

* Toland, A., Noller, J. S., Wessolek, G. (eds.): *Field to Palette: Dialogues on Soil and Art in the Anthropocene*, 137-148 (2018). CRC Press, ISBN 978-1-138-58509-6.