How to best apply information technology to realize a transdisciplinary water-soil-waste NEXUS approach.

Contribution to section X2: New and refined approaches supporting the implementation of a NEXUS approach.

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The amount of soil and hydrological data in terms of characteristics, parameters, models and results of proximal and remote monitoring methods is staggering. That provides opportunities for relevant studies but also risks for getting completely lost: only trees no forest!

Expanding databases , new models and a continuous flow of remote sensing and monitoring data can become suffocating : lots of trees, where is the forest?

The sorcerer's apprentice

GLOBAL SOIL DATABASES BEING DEVELOPED:

Arrouays, D., Grundy, M.G., Hartemink, A.E., Hempel, J.W., Heuvelink, G.B.M., Young Hong, S., Lagacherie, P., Lelyk, G., Mc Bratney, A.B., Mc Kenzie, N.J., Mendonca-Santos, M., Minashy, B., Montanarella, L., Odeh, I.O.A., Sanchez, P.A., Thompson, J.A., Zhang, G.L. 2014. **Global Soil Map**: Toward a fine-resolution grid of soil properties. Advances in Agronomy 125: 93-134.

Hengl, T., J. Mendes de Jesus, R.A. McMillan, N.H. Batjes, G.B.M. Heuvelink, E. Ribeiro, et al. 2014. **Soil Grids 1km:** Global soil information based on automated mapping. PLoS One 9(8):e105992. (12):e114788.doi:10.1371/journal.pone.0105992

Stoorvogel, J. J., Bakkenes, M., Temme, A. J. A. M., Batjes, N. H., and ten Brink, B. J. E. (2017) **S-World**: A Global Soil Map for Environmental Modelling. Land Degrad. Develop., 28: 22–33. doi: 10.1002/ldr.2656.

The following quote from Droogers and Bouma, 2014, is relevant in the context of considering hydrological modeling:

„The number of pages on the Internet including "hydrological model" is over 5.8 million (using Google in January 2014). Using the same search engine with "water resources model" returns 150 million pages. The number of existing hydrological simulation models is probably in the tens of thousands.


NEW YORK

SO: if we don’ t define goals we run the risk to get lost, the more so since the scientific soil, water and waste communities operate rather independantly.

Now we have the UN Sustainable Development Goals (2015)

The Brundtland report:"Our Common Future"of 1988, introducing the concept of sustainable development, was made more specific by the 17 UN Sustainable Development Goals (SDGs) (sept.2015)

Of the 17 SDG's, at least five have a direct relationship with soils:

2. End hunger, achieve food security and improve nutrition and promote sustainable agriculture FOOD

3. Ensure healthy lives and promote well being for all at all ages. HEALTH

6. Ensure availability and sustainable management of water and sanitation for all. WATER

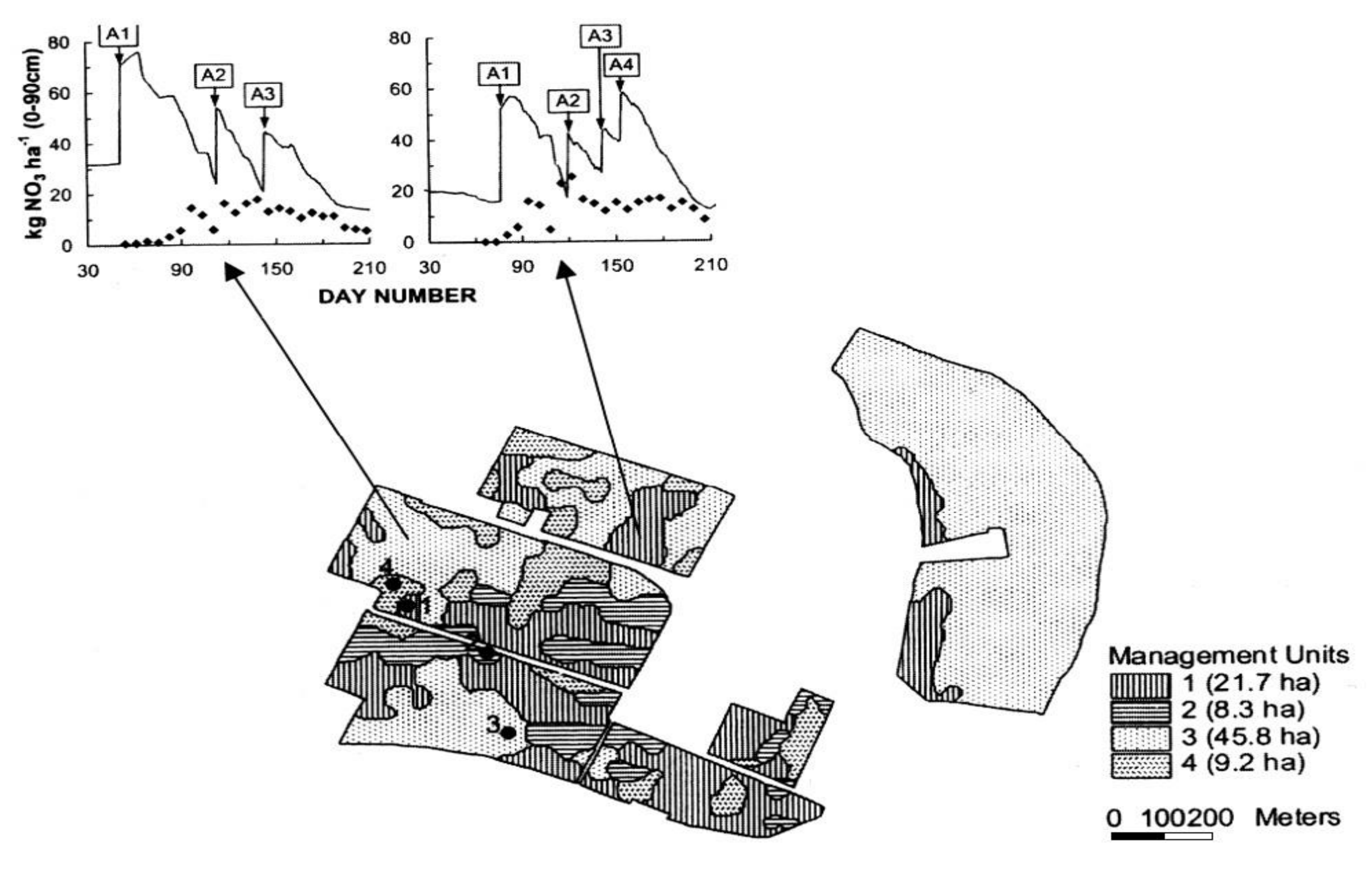
13. Take urgent action to combat climate change and its impacts. CLIMATE

15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably managed forests, combat desertification and halt and reverse land degradation and halt biodiversity loss. ECOSYSTEMS

The water-soil-waste NEXUS is highly relevant for SDG 2 (Food: irrigation with wastewater); SDG 6(water), SDG 13 (climate by increasing the organic matter content of soils -4per1000!- for climate mitigation) and SDG 15 (ecosystems by improving growth conditions, not only for crops but also natural vegetation).

Innovative, integrative management for land-use systems can aim for several SDG's at the same time. Precision agriculture shows the way!

Integrate the new possibilities of ICT: precision agriculture!




UNITED NATIONS UNIVERSITY
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Institute for Integrated Management of Material Fluxes and of Resources
SAFE USE OF WASTEWATER IN AGRICULTURE: GOOD PRACTICE EXAMPLES
Hiroshan Hettiarachchi
Reza Ardakanian, Editors

But we have a problem as the water-soil-waste NEXUS chain is incomplete when considering current wastewater management in the real world:

1. Much data on chemical waste composition and health aspects
2. Hardly any data on soil water regimes and soil properties
3. Ineffective or non-existing rules and regulations.
4. Lack of insight on psychological barriers

The same applies to compost addition to soils but here a comparable practical no-nonsense report is still lacking.

The report mentions that in some areas where treated wastewater is used for irrigation, some wells show good water quality, others don’t. The reason is unclear but can be explained by analysing flow patterns in the soil.

Conclusions:

- The ICT revolution has dramatically increased the amount of data, methods and models to characterize the water-soil-waste NEXUS
- Setting clear goals, based on the SDG's, can and should guide research activities
- The soil and hydrology disciplines, stakeholders and policy makers need to become more aware of the potential of waste application for meeting at least SDG's 2(food) and 6 (water).
- The NEXUS focus can only work when the three constituting disciplines are in balance.