ADVANCING A NEXUS APPROACH TO THE SUSTAINABLE MANAGEMENT OF WATER, SOIL AND WASTE

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The NEXUS is there but needs refinement, defining a „niche“ for UNU-Flores.

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Nexus approach to the sustainable management of water, soil and waste. WSW)

Before discussing particulars of research and education, the overall “niche” of UNU-FLORES needs our attention: we don’t need more traditional research on WSW!

If you don’t know where you are going, any road will lead you there!

Guidance by, amongst others:
(i) UNEP (2011) A Green Economy (water and waste among ten key sectors);
(ii) running discussions on the UN Sustainable Development Goals, and:
(iii) the Planetary Boundaries by Rockstrom et al (2009).
Nexus approach to the sustainable management of water, soil and waste.

Session III. Questions 1 and 3. (J.Bouma)

3. *Is the Nexus concept “mature” and developed enough to be covered in study programs?*

3.1. YES: After 100 years of research, it better be! But consider it a dynamic, developing item continually being improved by research.

3.2. Yes, but integrate soil and water studies: a challenge! They operate rather seperately now (two silo’s). *Then* add the waste and consider biochemical changes in a dynamic soil/water system. Introduce hydropedology; focus first on hard science.

Example: Purification depends on traveltimes in the soil: lower application rates mean longer travel times in finer pores, thus more contact and better filtration and purification.

Fig. 3—Removal of poliovirus (added to septic tank effluent) in sand-columns at two different flow regimes (after Green & Cliver, 1974).
Purification of wastewater in structured soils is complicated: rapid movement occurs when water flows through the cracks around the structural elements at higher application rates: little purification. It’s perfect when water flows through the fine-porous structural elements, at lower application rates.
Example: Removal of fecal bacteria in structured silt loam soil: effects of flow through and around the peds (column=60cm). 
Ps.A = *psuedomonas aerogenosa*; FC = *fecal coliform*; FS = *fecal streptococcus*
The two flow experiments are a good demonstration of the WSW-NEXUS. The question was: *how well can soil purify liquid waste?* The possible answer from the soil silo: static relations with texture, %orgmatter and Cation Exchange Capacity. No idea about flow regime and microbiology. From the hydrology silo: infiltration rate, calculated travel time using moisture retention data; no idea about microbiology and soil structure; from the microbiology silo: measurements in in- and outflow. No idea about flow regimes in porous media. Only the WSW-NEXUS provides the answer! Every soil is different! Advice: show such examples when promoting WSW-NEXUS. But don’t make the WSW-NEXUS a bigger silo! These results were the basis for developing innovative soil disposal systems of septic tank effluent in the USA, considering socio economic and policy aspects. See:

3.3 “Management” means involvement of stakeholders and socio-economic aspects. How to deal with “wicked” problems, that don’t allow simple answers but only a series of options, each one with tradeoffs among economic, social and environmental considerations. See:


3.4. Select a case study; identify stakeholders and their opinions (takes time!) set goals and work towards solutions, start with what we know, then define gaps in our knowledge and focus new research on those gaps: the “step-by-step” approach. Working with case studies means defining problems and setting goals. It avoids generalities, forces students to follow a line of practical reasoning and avoids abstract unconnected research.

The Bouma et al (2011) study, based on a 60 million euro program on sustainable agriculture, started with 60 bottom-up proposals (of which only 30 were approved, because many were of low quality) and resulted in the end in only 12 projects with specific results, valuable for society. Crucial in these projects was the role of persistent entrepreneurs and, what we have called, knowledge brokers: scientists with a high social intelligence that can insert the right type of knowledge at the right time and place to the right person in the right way! And that during the entire project period of often more than ten years! The scientific community does not educate such people, nor do they award this type of effort which is very much needed, in my view, for science to be more effective in future.

UNU-FLORES would really fill a “niche”, in my view, if they would educate such people by designing an effective tailor-made education and research program.
Question 1. Which are the research topics to be addressed?

UN-FLORES needs to fill a specific “niche”. Look for it. Don’t repeat what too many others are doing already. Follow the line of reasoning, as discussed. Examples of major themes:

1.1. Hard science: Retention times of effluents in different natural soils as \( f(\text{management}) \) and the associated integrated physical / chemical / biological soil processes.

1.2. Soft and Hard science: Put selected case studies in a socio/economic context, define the problem, goals and stakeholders and explore solutions to “wicked” problems of the case studies in terms of options. Focus not only on the developing world: major changes are needed in the so-called developed world.

1.3. Hard and Soft: redefine our research paradigm by exploring use of the “step-by-step” research approach, starting with available knowledge, defining knowledge gaps thus defining new research. Avoid short projects.