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REMARKS ON THE 2ND-ORDER DRAFT OF THE STRATEGIC PLAN
OF THE 9TH PHASE OF IHP (IHP-IX, 2022-2029)

Following the discussion on the 2nd Order Draft of the IHP-IX, I expend my comments as below.

The 2nd Order Draft of IHP IX is clearly better than previous version, especially considering the beginning of the document, however, it looks for me that further work on it has to be done.

1/ First of all, the document is too long and repeating the same ideas (some may say ""buzz words" many times). Yet what lacks is a clear messages to strategic decision makers what to do with increasing water problems. Secondly, to be more clear for decision makers, the document should include characteristics of the Strategy of Success, which possess two components:

I/identification/quantification of threats and

II/identification opportunities especially innovations or ways to generate innovative methods and systemic solutions.

Ecohydrology was mentioned in the document very marginally, and in many aspects omitted, while it should be one of the most important reference points for all IHP-IX actions. This is because in more than 60% of continents the water cycle is ensured/stabilized by terrestrial ecosystems (forests) (UNESCO WWAP NBS) which possess not only a sponge function but act as active compensators through transpiration regulation according to water surplus or deficit. Additionally terrestrial ecosystems are an element which regulate and stabilize carbon, nitrogen and phosphorus cycles by interplay with water availability. They are crucial for reduction of erosion and eutrophication as well as enhancement of inland fisheries, bio-productivity and biodiversity. So as a consequence, the key to achieve sustainable water resources, biological productivity and biodiversity in most of the biosphere is understanding of ECOHYDROLOGICAL PROCESSES.

The understanding of water cycle/ecosystems/biota interplay is not only

fundamental for sustainability of the hydrological mesocycle, but also provide background for developing ecohydrological NBS, which become crucial not only for reduction of non-point source pollutions from agriculture but also for improvement of sewage treatment plants, reduction of urban stormwater impacts and many others.

2/ Concerning the title of the draft document, most relevant to achieve the UN SDG is "Holistic Science for Water Security", which sounds very good to me, as it expresses the understanding that the increasing cumulative global, regional and local impacts of various pressures have been growing so intensively now (Ecological footprint above 1.7), that a narrow, mechanistic sector approach focused on single solutions is not efficient to reverse it and to achieve the UN SDG. Additionally it is an implicit suggestion for narrow-specialised scientists that they should be open for cooperation and share their knowledge with specialist from other disciplines and holistic integrators.

3/In the point of "new water conservation technologies" it is necessary to add "and systemic solutions" if we consequently want to develop holistic approach.

4/Strategic objective: "enhancement of resilience of society" imply that authors do not know the "tragedy of commons" because the only way to ensure society water security and sustainability is by combining the society's involvement in the measures for enhancement of catchment sustainability potential WBSRCE - through the development systemic solutions which in parallel should improve: Water, Biodiversity, Services for society, Resilience to climate changes and other impacts, Culture and Education (unfortunately this idea do not appear in document).

5/ The Authors have been devoting a lot of attention to data collection and sharing, but unfortunately in recent versions it sounds like if we collect a lot of data we will understand how to solve water/sustainability problems in the given catchment. This it totally wrong. It is necessary to build up a hypothetical model which integrates in a hierarchical way key drivers and according to the model (holistic integrating different disciplines of sciences e.g. ecology and hydrology as in the example of ABRC model) it is necessary to select factors to be monitored and timing when the data should be collected and how. This provides opportunities to discover key drivers and new emerging properties of the system on the basis of understanding the diversity of drivers hierarchy of hydrological mesocycle at different types of catchments: Abiotic/Biotic/Social and society/water/biota interplay from molecular to catchment scale. Thus data acquisition should be focused on understanding the interplay between spatial and temporal dynamics, climatic/hydrological processes and their effect on erosion/sedimentation, nutrients/pollutants dynamics in freshwater and costal ecosystems. This will be the basis to analyse ecohydrological processes – water cycle - seasonal ecosystems dynamics interplay from molecular to catchment scale. This will provide info about specifics of the broad ranges of Dual Regulation to be developed for EH NBS and to be use.

6/ As far as some decision makers might be not sure what holistic approach for catchment management precisely means, so this document should also contain examples, encouragement and framework guidelines for decision makers how to develop in given catchment a holistic analysis of processes for development and implementation of innovative low-cost, high-efficiency solutions, especially how to harmonize hydrotechnical solutions with EH NBS. For example:

1/ Climate/precipitation patterns determine availability of water resources for broad spectrum of users and environmental flow (cooperation with WMO)

II/ Geomorphology, ground water resources and recharge potential e.g. karstic vs. non-permeable basalt rocks which determine vulnerability to climate changes and stabilization of river flow

III/ Distribution of different types of ecosystems which are to various extent effecting water mezcycle in the catchment e.g. pristine (conservation) vs. "Novel ecosystems" - degraded and reduced sustainability potential - modified by Man - agroecosystem (major generator of non-point source pollutions, pesticides, antibiotics from animal farms pollution)

IV/ Urbanization, spatial distribution of sewage treatment plants – point source pollution in the catchment, creating a sustainable City of the Future, City as a sponge for sustainable stormwater management, - reduction of nutrients and chemical pollutants loads to rivers and lakes (cooperation with UNDP, UN Habitat).

V/ Identification of potential catchment areas, river stretches, lakes and reservoirs for creating "Intelligent ecosystems WBSRCE" and implementing broad scope of hybrid and ecohydrological NBS. The Novel ecosystem should be converted into "Intelligent ecosystems" -WBSRCE (Zalewski 2017, Levia at al 2020) (cooperation with MAB and FAO).

Such catchment characteristics based on Ecohydrology principles can be a supporting reference point for comparative analysis of measures and assessment of efficiency of measures which will be developed during IHP-IX, but also an important step for rising decision makers and society's consciousness, for the urgent need of development and implementation of holistic transdisciplinary approach and social participatory altitudes, to reverse degradation of freshwater and costal ecosystems due to cumulation of broad spectrum of impacts.

7/ Finally this document still sounds like "box of chocolates". I am sorry but it looks like the authors do not have empirical experience in catchment scale holistic research and problem solving, thus they do not have a clear picture of problems and how to solve them by innovative ways which have been in progress as a result of subsequent IHP former stages.

There is no doubt that the reference point for IHP IX should be the UN SDG and Green Deal. Considering the increasing importance of IHP IX for Governments of Member Countries it is necessary to focus strategies in cost-efficient and low-energy-consuming solutions which possess the potential not only to 1) reduce pressure on the environment and threats for water cycle but also to 2) further enhance the catchment sustainability potential WBSRCE.

WHY EH NBS are so important for achieving SDG? EH NBS are low-cost advanced solutions for reduction of impact e.g 1 kg of nitrogen or phosphorus load to aquatic ecosystems reduced by means of EH NBS are of an order of magnitude less expensive that those provided by sewage treatment plant. Of course this is not a proposition to close sewage treatment plants, but to develop implantation of EH NBS for reduction non-point source pollutions, which have been neglected in most of the catchment management strategies. Also EH NBS are recently applied for improvement of inefficient waste water treatment plant as we have done at Pilica river catchment. Understanding ecosystem/water interplay is a starting point not only for reduction of costs, but also to optimize integration measures in the catchment for synergy and especially if translated by education rise in society's consciousness:

1/ Development of low-cost, hight-efficiency solutions based on EH NBS and hybrid systems (EH NBS + Hydroengineering e.g EHREC LIFE+ EC Project Best of the best 2018).

2/ Integrative, holistic, process-oriented thinking science as key to develop innovation, systemic solution and enhancement of WBSRCE.

3/ Rising consciousness of decision makers and society about the generated highly complexed impacts and processes, to which they are exposed to. The need for education promoting holistic understanding of processes – sound Citizen science and participatory development innovative solutions.

Overall the draft document although showing great progress in thought it still needs to send a clear message and an action plan to decision makers and include the aspects of rising society's ecological consciousness by encouraging involvement in catchment management and Citizen Science.

The above comments result from my my 40 years of experience in research and advisory activity at different ecosystems in all continents, and I hope that this will be considered as constructive criticism for improvement in achieving global regional and local sustainability.

Sincerely

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