Studying the evolutionary dynamics of the interaction between water and man in the past in order to plan for the future

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Background

Global change is altering the long-term evolutionary trajectories of socio-ecological systems, testing their capacity for resilience and adaptation. Against a backdrop of significant uncertainty linked to the interweaving of human and ecological vulnerabilities, planning policies involve choosing between different socio-ecological transition scenarios. These choices involve adapting to the local historical ways of living, while at the same time reinventing them. The study of socio-ecological trajectories falls within the scope of sustainability science: it is interdisciplinary, combining the knowledge of geographers, hydro(geo)logists, sociologists and ecologists, and building bridges with other disciplines such as urban planning. Firmly rooted in an understanding of the problems faced by local residents, it invites us to revisit the history of territories to shed new light on current controversies.

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Further reading

Haberl H. et al., 2006 – From LTER to LTSER: Conceptualizing the Socioeconomic Dimension of Long-Term Socioecological Research. *Ecology and Society*, 11 (2). http://www.jstor.org/stable/26266031

Rodrigues A. et al., 2019 – Unshifting the baseline: a framework for documenting historical population changes and assessing long-term anthropogenic impacts. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 374 (1788) : 20190200, 10.1098/rstb.2019.0220, hal-02344852.

Scientific lock: the question of the choice and relevance of the study baseline

Among the socio-ecological trajectories, the study of hydro-social evolutionary dynamics explores the interactions between human societies and water, and more specifically the role that water has played and continues to play in land use planning: water as a "resource", water as a "living environment", water as a "vector" for nutrients and contaminants, water as a "risk", etc. Studying the impact of global change on a local scale means analysing and documenting the spatial and temporal diversity of the hydro-social trajectories at work, through the interplay of scales (spatial interlocking) and impermanent frames of reference (temporal interlocking). This raises the question of the baseline from which to observe these evolutionary dynamics. Baselines are spatialised points of view providing a relevant basis for observing and modelling spatial and temporal changes in interactions with water. This question of the baseline is central, because it explicitly examines the biased loss of perception of change that occurs when each generation redefines what is "normal" or "natural" (the concept of a shifting baseline or "ecological amnesia"; Rodrigues et al., 2019). The study of hydro-social trajectories therefore calls for an examination of the choice and use of spatio-temporal baselines. This means developing a method for sizing and locating a sample of sites in a given study area.

Proposing a methodological approach to identify a study baseline

The methodological approach combines sampling methods from hydrology and sociology, and proposes three stages for identifying these "baseline" sites:

– surveys of a sample of local experts: geologists, hydrologists, historians, geographers, anthropologists and others, most of whom live in the study area. Their expertise and local practices help to identify "baseline" sites, because they are features of the way in which hydro-social interactions have evolved;

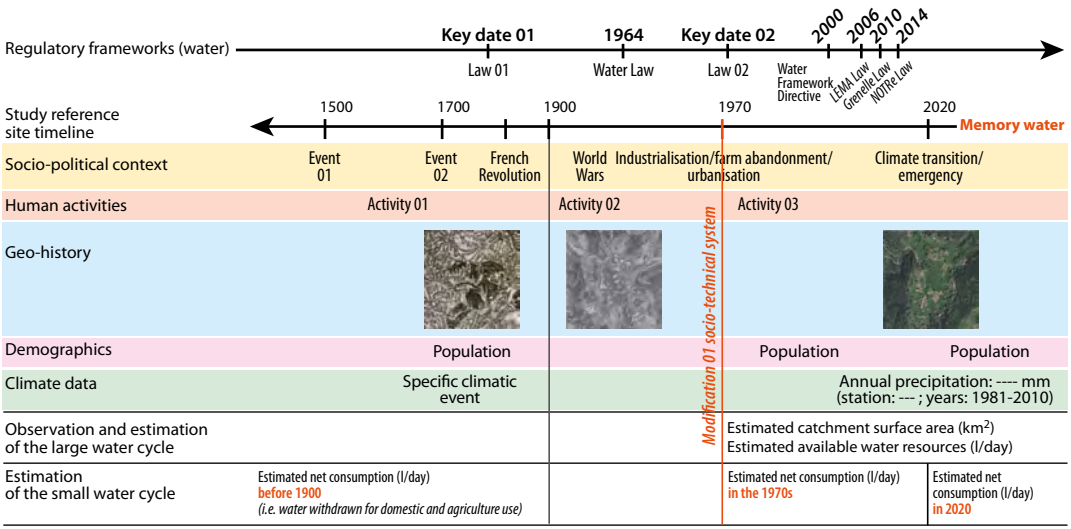
– a hydrological and hydrogeological observation and characterisation of the "baseline" sites cited during the exploratory surveys, which, through an initial analysis of the small and large water cycles, give an idea of how the environment functions;

– a study of socio-environmental controversies (river pollution, depletion of water resources, etc.) in the study area, revealing the problems experienced by local residents today, and the way in which the history of socio-hydrological interactions resurfaces in these controversies to shed light on the various transition scenarios.

Using new tools to study these "baseline" sites

The chrono-systemic timeline is a working tool used in the field of Long-Term Socioecological Research (Haberl et al., 2006). It is an interdisciplinary tool that combines qualitative and quantitative data with historical, ecological,

demographic, climatological and other related knowledge. It is also a transdisciplinary tool that can be used to support discussions with local residents on hydro-social trajectories. The figure below shows the work involved in constructing a chrono-systemic timeline for a baseline study site. This timeline highlights the hydro-social trajectory of a given baseline with a succession of socio-technical developments (for example, major hydrological changes such as the introduction of drinking water supplies or collective wastewater treatment). An analysis from the point of view of local residents provides an understanding of the role of these various developments in the transformation of types of housing and ways of living, with the aim of shedding light on future development scenarios.



This data can be used to produce a **simplified water balance over several periods** and to understand and quantify the uses made of water ressources in the reference location.

This approach can, for example, lead to a rethinking of modernisation through the prism of water and review of the boundaries of the spatial reference system.

An example of a hydro-social chrono-systemic timeline under construction.

KEY POINTS

To know where we are going, we need to know where we have been! This methodological approach, which focuses on identifying "baseline sites", is designed to provide a knowledge base that is fundamental to decision-making. By examining the relevance of choosing a (spatial and temporal) baseline from which to view changes and developments over the long term, this approach also raises questions about the sustainability of development choices.

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