Output of GLOBAQUA WP7 ECOSYSTEM:
Incorporating ecosystem functioning into river monitoring and assessment

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Ecosystem functioning is an essential component of river ecological status and the basis of important ecosystem services. Although seldom considered in river monitoring and assessment, it has the potential to improve the diagnostic capacity, due to its sensitiveness to multiple environmental stressors. The research objectives of GLOBAQUA WP7 ECOSYSTEM were thus twofold: first, to produce and standardize a set of techniques to measure the main ecosystem processes under different environmental conditions; and second, to understand how river ecosystem functioning responds to multiple stressors, especially drought and pollution. With these objectives in mind we developed the GLOBAQUA toolbox (von Schiller et al. 2017), which compiles methods to measure river ecosystem functioning, assesses their potential use to detect the impacts of different stressors, and describes the spatial and temporal resolution of the information they provide. Field experiments revealed large spatial differences in ecosystem functioning, many of them associated to water scarcity and pollution from urban or industrial effluents. Urban effluents tended to accelerate ecosystem functioning with negative environmental effects. These effects were stronger in situations of water scarcity, when the diluting capacity of receiving water bodies was reduced. On the other hand, reconstruction of 20 years of river metabolism from continuous data on oxygen concentration showed that Ebro River ecosystem functioning changed historically as a consequence of climate drivers and of changes in reservoir management. Altogether, these findings show that multiple stressors drive large spatial and temporal variability in ecosystem functioning, which is affected by multiple stressors, and hence difficult to forecast. Under these circumstances, it is essential to routinely monitor at least a small subset of functional variables. Similarly, water scarcity reduces the rates of most biological processes and thus impairs ecosystem functioning. We conclude that 1) ecosystem functioning should be taken into account when making decisions on water allocation, for instance, for environmental flows, and 2) managers should implement continuous measurements of water quality variables that can be used to measure river metabolism, thus allowing detection of historical trends in ecosystem functioning and related ecosystem services as well as early warning signals.

References

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