

How Do We Achieve Ecosystem-Based Sediment Management?

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Introduction: Whilst European ecosystem-based directives and policies span different environments, water, particles the contaminants associated with them move between and link these environments. Effective management of aquatic ecosystems to achieve the European goals of Good Ecological Status (GEcS) in all waters and Good Environmental Status (GENS) of the seas must include an understanding of how natural and anthropogenic disturbances affect the health and functioning of these critical media and associated communities. To achieve these goals, it is important to remember that toxicity alone does not drive risk in sediments; a broad range of stressors can impact benthic, pelagic and other communities, impacting ecological or ecosystem status. The sediment Ecological Risk Assessment paradigm must be expanded to address this, and the role of sediment management in the management of overall ecosystem “health” must be addressed.

Methods: European and international policy, guidance and literature on ecosystem-based management, ecosystem health, risk assessment and and sediment management were reviewed.

Discussion: Sediment benthic communities play critical roles in aquatic and global ecosystem function. Many human activities have both intended and unintended impacts on soil and sediment dynamics, as well as on the many systems with which they interact. Indicators of benthic ecosystem status being used in Europe are currently based on structure, but benthic community structure is dynamic and sensitive to a variety of natural and anthropogenic factors, and thus provides little insight into causality. Even if measures are carried out to ‘remediate’ systems, structures may never return to their ‘original’ status. In order to evaluate whether altered ecosystems are nonetheless “healthy” or at least recovering, a more meaningful measure of may be the evaluation of community function. However, while methods for evaluating and/or managing the effects of hazardous substances are well established, the way in which the impacts to GEcS and GENS from non-conventional pressures are assessed and managed is far from clear, as the science to establish links between, for example, morphological change and ecological function is weak. If we are to successfully address the role of sediments in the evaluation and maintenance of GEcS and GENS, it is

important that we expand our current tools for evaluating ecological risk (primarily focused on contaminants) to these broader risk factors. Thus, there is clearly a need for the development of ecological measures and technology that can evaluate the environmental status of sediments and benthic (and pelagic) ecosystems, and the potential impacts of both proposed developments and measures carried out to mitigate the impacts of past and projected activities. European management is starting to concentrate less on pollution per se and more on the combined effects of multiple stressors at the ecosystem level with a view to ensuring their protection, restoration, and long-term viability. As sediments provide the substrate for benthic and plant communities critical to aquatic food webs, and as suspended sediment can affect the functional health of pelagic and shore ecosystems, sediment status, dynamics, stability and type are all critical factors of ecosystem health, whether or not contaminants are part of the picture. It is clear that we cannot meet ecological objectives if we only address contaminants in aquatic systems. Further, there is a need for the development of clear conceptual frameworks that help define the myriad roles of sediment in ecosystem health to better define how sediment management, from sources to the sea, will help Europe achieve its objectives of sustainable and healthy waters. This presentation will address some of the conceptual, scientific and communication tools being used to assess and manage sediments in support of ecosystem-based objectives.