Handbook on intermittent rivers & ephemeral stream for water managers

Abstract:

Intermittent rivers and ephemeral streams (IRES) are those in which water sometimes stops flowing, and many dry. IRES are widespread across the Europe and worldwide, and their extent is increasing due to climate change and rising water demands. The purpose of this handbook is to help water managers to understand the natural processes in IRES and their importance for both biodiversity and people, thus supporting improvements to their monitoring and management.

It is only in recent decades that scientists, including biogeochemists, ecologists and hydrologists, have collaborated to advance our understanding of IRES. The transfer of this knowledge from scientists to water managers is now needed, to support effective ecological status assessment, protection and restoration. To this end, this SMIRES handbook will allow managers to develop a better understanding of IRES, thus supporting the development of tools needed for their effective management.

Under the 3rd planning cycle of the Water Framework Directive (WFD), EU water authorities are required to revise and publish their River Basin Management Plans (RBMPs) by 21 December 2021. These RBMP will include assessment of the ecological status/potential of all water bodies and the definition and description of suitable measures to protect and/or enhance them, in order to reach the environmental objectives of the Directive.

Most methods currently used in IRES were developed for permanent rivers, and their ability to reliably detect human impacts is uncertain. Due to the particular ecohydrological characteristics of IRES, their prevalence, and future climate change scenarios, we need to test, evaluate and adapt these current biomonitoring methods. Where they are found to be ineffective, we need to develop new tools to promote the effective and reliable assessment of IRES ecological status, thus supporting the adoption of appropriate and effective measures to reach good ecological status.

This handbook begins with an introductory chapter?, followed by three thematic chapters that consider how to gather information to better describe and understand physical and biological processes in IRES. Instream habitats comprise flowing, ponded and dry patches that shift in space and time and support biodiverse communities of aquatic, semi-aquatic and terrestrial species. A later chapter presents real European case studies implemented to improve the management of IRES.

IRES flow regimes are characterized by a zero-flow period (with variable length and frequency), and connectivity between habitats should define the baseline to define biologically based classification of temporary streams.

Hydrological information can be provided by gauging stations that measure river discharge – the traditional tool for hydrologists – as well as visual observations, field loggers and aerial photographs. These qualitative data can capture information on the regional extent of flow intermittence and its severity.

Flow regime metrics and classifications developed from these data must be operational and useful for describing hydrological alterations and habitats.

Shifts between flowing, ponded and dry states influence abiotic and biotic processes in IRES, and thus variability in water physico-chemistry in space and time. For instance, first-flush events during the rewetting phase have particularly high concentrations of nutrients and organic matter.

The assessment of physico-chemical aspects of ecological status requires adaptation of water quality standards and monitoring strategies to the hydrological temporal dynamics of IRES.

Aquatic, semiaquatic and terrestrial species have the potential to act as biomonitors of ecological quality. Best practice currently involves the use of evaluated or specifically developed biotic indices that consider the aquatic macroinvertebrate communities present during wet phases in IRES with long flowing phases.

In contrast, terrestrial communities remain unexplored as biomonitors of dry-phase quality, and future ecological quality assessments may be improved by encompassing both aquatic and terrestrial biotas.

IRES widely neglected for several reasons. First, social perceptions of European IRES is often negative or unnoticeable, especially during ponded and dry phases, when IRES are regarded as supporting no biodiversity and are often subjected to severe impacts (overpumping in pools, waste dumping or circulation with vehicles). Second, ecosystem services provided by IRES include provisioning services (genetic resources, freshwater and raw materials), regulation services (climate or nutrient cycling) and cultural services. However, use of available services depends heavily on environmental and socio-cultural context and thus not well-known. A local analysis of these ecosystem services and sharing of this knowledge can help to raise people's awareness, thus creating support for restoration projects or protection measures, such as the design and implementation of environmental flows.

The final chapter describes eight real case studies from different countries. These case studies illustrate different approaches to managing IRES, informed by the knowledge presented in this handbook. These examples do not claim to be exemplary practices suitable for widespread use, but instead give insights into what could be done, how approaches could be improved, and what should be avoided in specific contexts. The case studies encompass habitat restoration, reduction of erosion, flood prevention, drought mitigation, and raising of groundwater levels. All case studies clearly demonstrate the importance of increasing people's awareness of the biodiversity and ecosystem services associated with IRES, and of involving local stakeholders in restoration projects. to the importance of project monitoring is also emphasized, to assess project performance and thus support the success of other future initiatives.