DANUBIUS-PP

Preparatory Phase for the pan-European Research Infrastructure DANUBIUS–RI "The International Centre for advanced studies on river-sea systems"

DANUBIUS-RI professional training program module

Deliverable 9.6

European Commission

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 739562

Project Full title	Preparatory Phase for the pan-European Research Infrastructure DANUBIUS–RI "The International Centre for advanced studies on river-sea systems"
Project Acronym	DANUBIUS-PP
Grant Agreement No.	739562
Coordinator	Dr. Adrian Stanica
Project start date and duration	1st December 2016, 36 months
Project website	www.danubius-pp.eu

Deliverable Nr.	9.6	**Deliverable Date**	M33
Work Package No.	WP9		
Work Package Title	Capacity building		
Responsible	Deltares & UCC		
Authors & Institutes Acronyms	Ireland ***University College Cork*** Dr Martin Le Tissier & Jeremy Gault		
Status:		**Final (F)**	●
		Draft (D)	
		Revised draft (RV)	
Dissemination level:		**Public (PU)**	●
		Restricted to other program participants (PP)	
		Restricted to a group specified by the consortium (RE)	
		Confidential, only for members of the consortium (CO)	

1 Introduction

This report outlines a short-course for current professionals as part of their Continuous Professional Development (CPD): This is in fulfilment of deliverable D9.4. DANUBIUS-RI professional training program module. These activities address the project objective to "Establish education/training programs with partner academic institutions". The CPD course is designed to complement the Masters Module produced as Deliverable D9.3. The CPD Course uses some of the same materials but will be customised for a professional audience.

The present report outlines the possible contents of a CPD course on planning and management of River-Sea Systems (RSS), tailored to the interests and concerns of professionals from within river basin industries, but also regulators, research professionals, representatives from other interest groups. It is not designed for direct roll-out but rather provides a general framework which can be tailored to suit local conditions and the different levels of knowledge that may exist across the industry, regulatory and research community.

The CPD course materials will be web-based and designed to be incorporated into any new or existing CPD provision that has a focus on the integrated management of river-sea systems spanning traditional disciplinary and geographic boundaries. These materials will be freely available to:

- Any person who, or organisation that, wants to construct, validate and deliver such a CPD Course, or draw on any part of it for teaching purposes;
- Any interested person who wishes to learn more about RSS planning and management frameworks.

Specifically, the course materials are designed to improve the awareness and background knowledge of participants towards an understanding of the management needs from societal and environmental contexts for the integrated understanding of the functioning of river-to-sea systems and address the key societal challenges associated with, and opportunities they provide. The course materials build upon a proposed new education program for the Danube-Black Sea (DBS) region from the FP7 project DANCERS (DANube macroregion: Capacity building and Excellence in River Systems (basin, delta and sea)). The course design supports the objectives of the DANUBIUS-RI project and that can reflect the 'local' specificity of the geographic locality and/or overall CPD focus.

Study of the module materials will develop a detailed and critical knowledge for the management of river-sea systems, including:

1. An understanding in principle of how to develop and apply EU, national and regional spatial planning and management frameworks for RSS; and
2. A critical understanding of social and environmental concepts relevant to planning and managing space for RSS.

One completed, participants will have obtained a broad overview of the management of the RSS resources as well as an awareness of how these can and have been implemented in a variety of spatial contexts. Participants will have an appreciation of the scientific basis underpinning the management of RSS. This will enable those successfully completing the

course to operate within their own professions and be familiar with the emerging and evolving fields of governance, planning and management as they apply to RSS.

1.1 Project background

River-Sea Systems (RSS) comprise rivers and their catchments, estuaries, deltas and lagoons, as well as their adjacent coastal seas (Figure 1). As such, River-Sea Systems cover freshwater, transitional and coastal waters, including semi-aquatic and semi-terrestrial environments, such as floodplains. The extent of a River-Sea System is defined by the surface-water (or groundwater) boundary and the marine boundary, which is more variable. It is defined by the extent of riverine influence on individual parameters of interest. RSS are very dynamic and highly complex due to various interfaces and interactions: longitudinally (freshwater to marine), laterally (river to floodplain; coast to sea), and vertically (surface to groundwater) with interrelated processes between physical, chemical, biological components as well as social and economic processes (Figure 1). These processes provide a wide range of valuable ecosystem services to humans that face compounding pressures: from climate change and human drivers, such as urbanisation, energy generation, waterborne transport, agriculture and fisheries at different spatial (local, national and global) and temporal (seasons to centuries) scales. The resulting changes in the structure and the functioning of River-Sea Systems lead to the decrease or loss of ecosystem services. This poses a number of societal challenges, for example, eutrophication, hypoxia, pollution, changes in hydrology, sediment transport and morphology, loss of biodiversity and sea level rise. A diverse range of disciplines have shown interest in exploring various aspects of the water continuum partly reflecting the disciplinary structure and organisation of research but also reflecting the wide range of processes that are part of the RSS. Attempts to understand and manage RRS also are

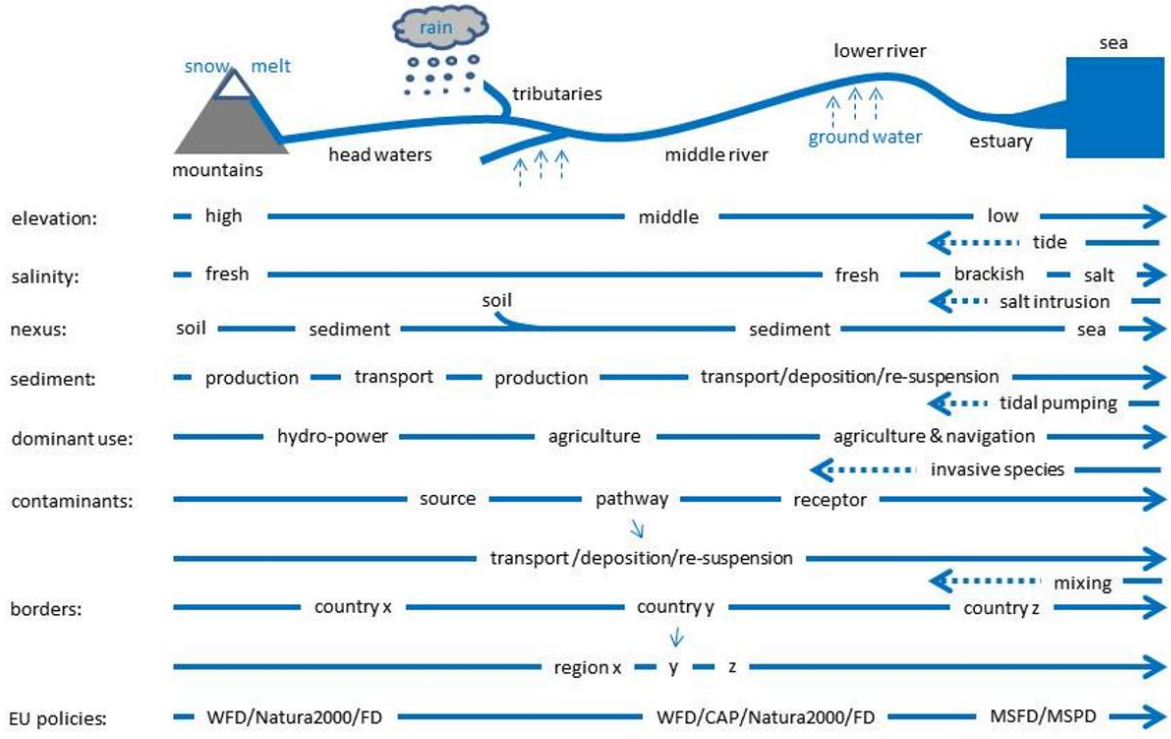

Figure 1. River-sea continuum (extremely simplified; by Brils, Deltares).

reflected in the diversity of policy instruments that are applied. For instance, in Europe these include the Water Framework Directive 2000; Floods Directive 2007; Marine Strategy Framework Directive 2008; Natura 2000, and there is no Sustainable Development Goal that does not have some connection to RSS. Analysis of the current research space pertaining to the RSS has recognised that the current situation leads to distinct gaps in terms of geography, disciplines and policy that means the RSS is not addressed as a continuum but rather as a series of disconnected fragments.

To address the current fragmentation, Integrated water resource management (IWRM) has been proposed by the DAMCERS FP7 project as a means to overcome the interconnectedness of social, economic, hydrological and ecological needs in river basins and associated coastal zones. The IWRM approach uses the basin as the managed unit, and recognizes the dynamic relationships between stakeholders and central governments who must work together (the Danube catchment includes 19 countries) to meet sustainable development goals. Thus, IWRM aims to balance the needs of stakeholders while balancing the needs of the environment. In principle, it achieves this through the coordination of management across sectors and the active engagement of stakeholders and policy-makers at multiple scales, including local, national, and international. The knowledge skills required to overcome the current challenges to break down the traditional silos of research disciplines was identified as a priority to develop an integrated and more holistic understanding of the Danube river-delta-sea system, including:

- Application of pure and applied research spanning and integrating across the disciplines in the science and humanities;
- Understanding of environmental, ecosystem and natural resource management and governance and planning from the local to the international level;
- Addressing the needs of industry that sustainably builds on the ecosystem goods and services of river-delta-sea systems; and
- The relevance of environmental policy, law and regulation.

1.2 DANUBIUS assessment of needs

The DANUBIUS project has identified that current gaps centre on approaches that span traditional disciplinary and geographic boundaries, and be implemented in a consistent and quality assured framework, particularly at the freshwater-marine interface. These approaches need to integrate the biological, chemical and physical sciences, and recognize the significance of interacting social and economic processes, to better understand a complex set of biogeochemical and socioeconomic interrelationships and feedbacks. Four overarching and interrelated challenges in River-Sea Systems have been identified: (i) Climate Change and extreme events, (ii) Water Sufficiency, (ii) Sediments and their Management, and (iv) Ecosystem Health (Figure 2).

The effects of *climate change and extreme events* will be particularly marked for the water cycle in general and in River-Sea Systems with considerable socio-economic impacts, requiring long-term mitigation and adaptation for human well-being. *Water Sufficiency* relates to ensuring continued water availability for both anthropogenic and environmental needs. It includes water of sufficient quantity as well as quality of both surface waters and groundwater along the freshwater-marine continuum to maintain ecosystem functioning and to provide

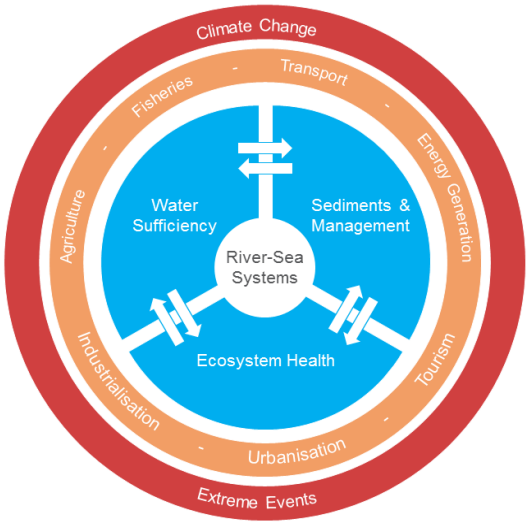

Figure 2.External (Climate Change and Extreme Events) and internal drivers (Fisheries, Transport, etc.) resulting from basic human needs cause cumulative effects on River-Sea Systems. DANUBIUS-RI identified overarching challenges related to Water Sufficiency, Sediments and their Management, and Ecosystem Health.

ecosystem services. *Sediments and their Management* is also a cross-cutting issue, with links to, and possible consequences for, many different sectors, regulatory interests and management requirements. *Ecosystem Health* links the biophysical understanding of how natural River-Sea Systems function with societal goals and human values.

1.3 Knowledge gaps

Deliverable 2.3: "Review report on environmental, societal and policy challenges in RSS and emerging research and legislation needs" has identified the knowledge areas required for sustainably managing river-sea systems as those that inform:

i. The sustainable use of the key ecosystem services provided by river-sea systems;

ii. Opportunities for Knowledge Exchange and Transfer with business and society; and

iii. Environmental policy development, regulation, societal well-being, economic growth and river-sea system management.

Such knowledge is necessary to evolve a holistic understanding and management of interacting environmental and socio-economic processes. A central nexus that frames environment and socio-economic interactions is the material fluxes arising from movement of water, sediment, contaminants, through the RSS from source to sink. These material fluxes are highly variable, both in time and space; and affected by socio-economic activities such as agricultural practices, urbanisation and river regulation (e.g. for hydropower and navigation) and coastal engineering works. The four challenges identified above represent the research areas that provide the information base to address the three knowledge areas.

1.4 Course structure

Most professions have a requirement for Continuing Professional development and principles for these are established at both National and EU level, and in the latter case often through Articles in Directives. Continuing Professional Development is defined as "*Continuing professional development (CPD) describes the systematic, ongoing structured process of learning that underpins professional practice. CPD enables professionals to maintain, develop and enhance their personal and professional skills, knowledge and behaviours, and ongoing*

competence to practise. This, in turn, advances practice, service delivery and ultimately outcomes that maintain or increase their professional competence." CPD activities can include personal learning, peer reviewed activities, internet-based activities; lecturing and publishing, as well as attending events/lectures/courses. The content outlined here is primarily focused at a CPD course, but could be adapted to contribute towards CPD activities such as internet-based activities and personal learning.

The proposed course content is based around 12 topics, representing a course which could be conducted over a two and a half days. A sample timetable is included in Annex 1 for reference. The course is designed so that there is ample discussion time thereby contributing to mutual learning of all participants. For each topic a set of slides containing exercises and sources of further reading, should be provided. These act as a framework for the content to be covered but with the caveat that material should be added to reflect the local context and specificities of the region/country.

1.4.1 Outline of Course

Lectures will cover the full spectrum of the four identified challenges of climate change and extreme events, water sufficiency, sediments and their management, and ecosystem health as well as socio-economic principles. These challenges can be placed into a locally specific context to reflect the locality and pedagogy of the course in which the module is embedded. To place these challenges into context the course will commence with a lecture outlining the context of RSS and how demand placed on RSS by increasing populations and economic activity lead to the need for a sustainable integrated approach to river basin management has become ever more pressing. The course will conclude with a lecture that revisits the first lecture to revise how an improved knowledge of the challenges can mitigate current and future management challenges. There will be a major emphasis on the integration of technical and socio-economic knowledge in attempting to balance the conflicting objectives of economic efficiency, social equity and environmental sustainability defined by the internationally accepted Integrated Water Resources Management (IWRM) approach. The suggested outlined lecture syllabus is:

Topic 1: Introduction to Integrated River Basin Management.

Topic 2: Institutional frameworks and the EU Water Framework Directive.

Topic 3: Managing RSS: human activity and ecosystem disruption.

Topic 4: Introduction to RSS cycles: the hydrologic cycle and biogeochemical nutrient cycle.

Topic 5: Climate change, extreme events and water resources

Topic 6: Water sufficiency to meet anthropogenic and environmental needs.

Topic 7: The dynamics of RSS sediment flows.

Topic 8: Ecosystem services and ecosystem-based approaches.

Topic 9: Economic evaluation of environmental goods environmental and social cost-benefit analysis.

Topic 10: Sustainability and Sustainable Development for RSS.

Topic 11: Tools and frameworks for IRBM for RSS.

Topic 12: Conclusion: Creating an Agenda for IRBM for RSS.

2 Licence and Attribution

[1] https://creativecommons.org/licenses/by-sa/4.0/

Annex 1. Suggested Timetable

Day 1	
Time	**Session Title and information**
09.00 – 09.15	**Welcome / Introduction / Aims of Course** Local Module Co-ordinator
09.15 – 09.45	**Introduction and background to the Danube RSS** 15 minute presentation 15 minute facilitated discussion
09:45 – 10.15	**Specific context for course (locality/setting)** 15 minute presentation 15 minute roundtable discussion
10:15 – 10:30	**Coffee**
10:30 – 11:30	**Topic 1: Introduction to Integrated River Basin Management.** 30 minute presentation 30 minute facilitated discussion
11:30 – 12:30	**Topic 2: Institutional frameworks and the EU Water Framework Directive.** 30 minute presentation 30 minute facilitated discussion
12:30 – 13:30	**Lunch**
13:30 – 14:30	**Topic 3: Managing RSS: human activity and ecosystem disruption.** 30 minute presentation 30 minute facilitated discussion
14:30 – 15.30	**Topic 4: Introduction to RSS cycles: the hydrologic cycle and biogeochemical nutrient cycle.** 30 minute presentation 30 minute facilitated discussion
15:30 – 16:00	**Coffee**
16:00 – 17:00	**Topic 5: Climate change, extreme events and water resources** 30 minute presentation 30 minute facilitated discussion
17:00 – 17:30	**End of day review** 10 minute review of principle points/outcomes 20 minute roundtable discussion

Day 2	
Time	**Session Title and information**
09:00 – 09:15	**Summary of Day 1 and look forward to Day 2** 5 minute presentation 10 minute facilitated discussion
09:15 – 10:15	**Topic 6: Water sufficiency to meet anthropogenic and environmental needs.** 30 minute presentation 30 minute facilitated discussion
10:15 – 10:30	**Coffee**
10:30 – 11:30	**Topic 7: The dynamics of RSS sediment flows.** 30 minute presentation 30 minute facilitated discussion

Day 2	
Time	**Session Title and information**
11:30 – 12:30	**Topic 8: Ecosystem services and ecosystem-based approaches.** 30 minute presentation 30 minute facilitated discussion
12:30 – 13:30	**Lunch**
13:30 – 14:30	**Topic 9: Economic evaluation of environmental goods environmental and social cost-benefit analysis.** 30 minute presentation 30 minute facilitated discussion
14:30 – 15:30	**Topic 10: Sustainability and Sustainable Development for RSS.** 30 minute presentation 30 minute facilitated discussion
15:30 – 16:00	**Coffee**
16:00 – 17:00	**Topic 11: Tools and frameworks for IRBM for RSS.** 30 minute presentation 30 minute facilitated discussion
17:00 – 17:30	**End of day review** 10 minute review of principle points/outcomes 20 minute roundtable discussion

Day 3	
Time	**Session Title and information**
09:00 – 09:15	**Summary of Day 2 and look forward to Day 3** 5 minute presentation 10 minute facilitated discussion
09:15 – 10.30	**Topic 12: Conclusion: Creating an Agenda for IRBM for RSS.** 45 minute presentation 45 minute facilitated discussion
10:30 – 11:00	**Coffee**
11:00 – 12.00	**Review and looking forward – mitigating present change, adapting to future change** 60 minute roundtable discussion
12:00	**Close**

DANUBIUS-PP

Preparatory Phase for the pan-European Research Infrastructure DANUBIUS–RI "The International Centre for advanced studies on river-sea systems"

European Commission

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 739562