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## **COMMUNICATING RIVER** RESTORATION

# **BANK EROSION CONTROL AS PART OF A REHABILITATION STRATEGY AT THE RIVER BASIN LEVEL**

António Pinto\* (PhD Student FEUP) Portugal, antonio.pinto@fe.up.pt), Pedro Teiga\* (PhD, Portugal), Rodrigo Maia\* (Associate Professor FEUP, Portugal), Nuno Bravo\*\* (ARH CENTRO Director, Portugal)

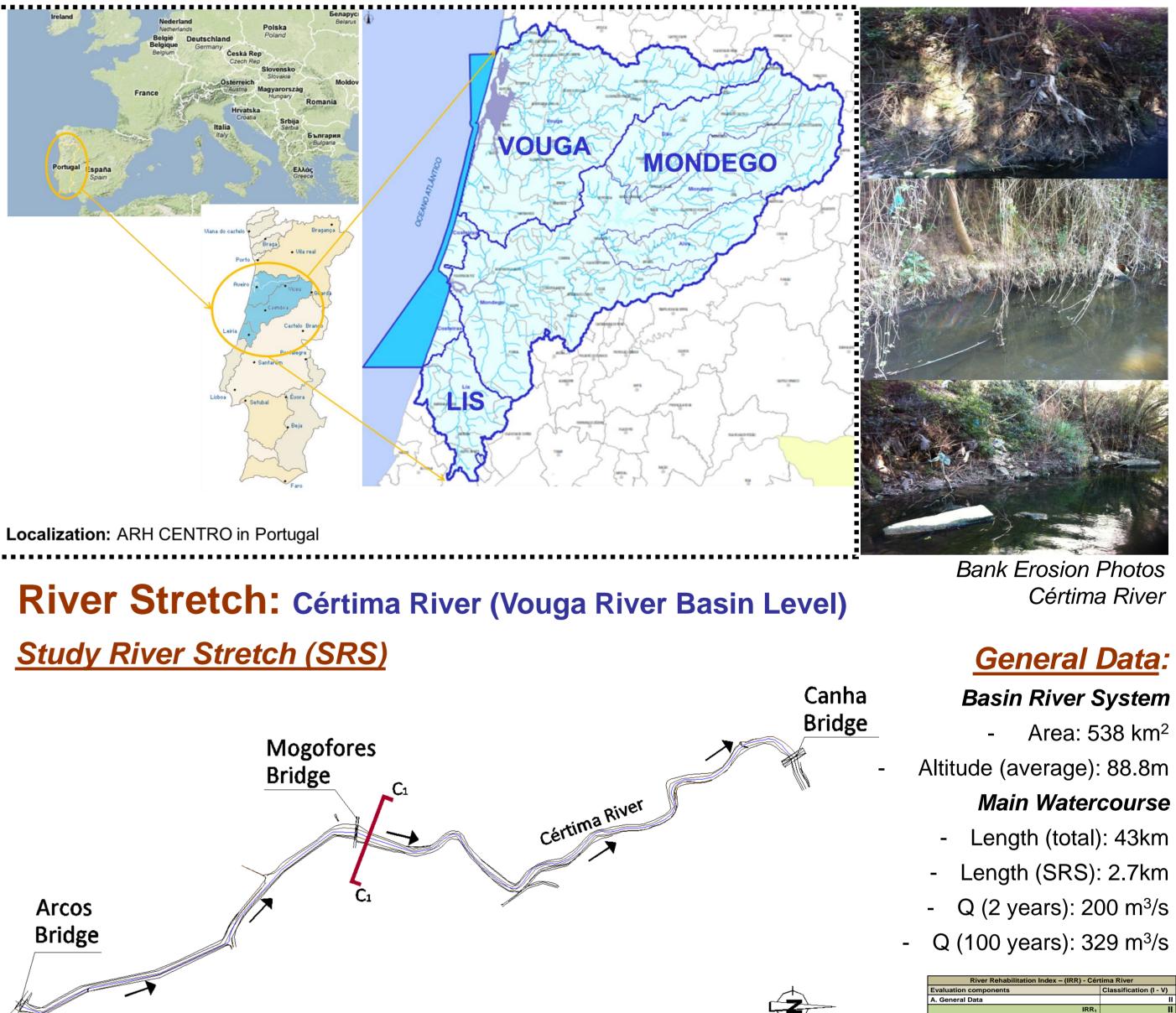
\* FEUP – Faculty of Engineering of the University of Porto, Hydraulics, Water Resources and Environment Division. \*\* ARH CENTRO – Hydrographic Region Administration Centre, Portuguese Agency Environment.

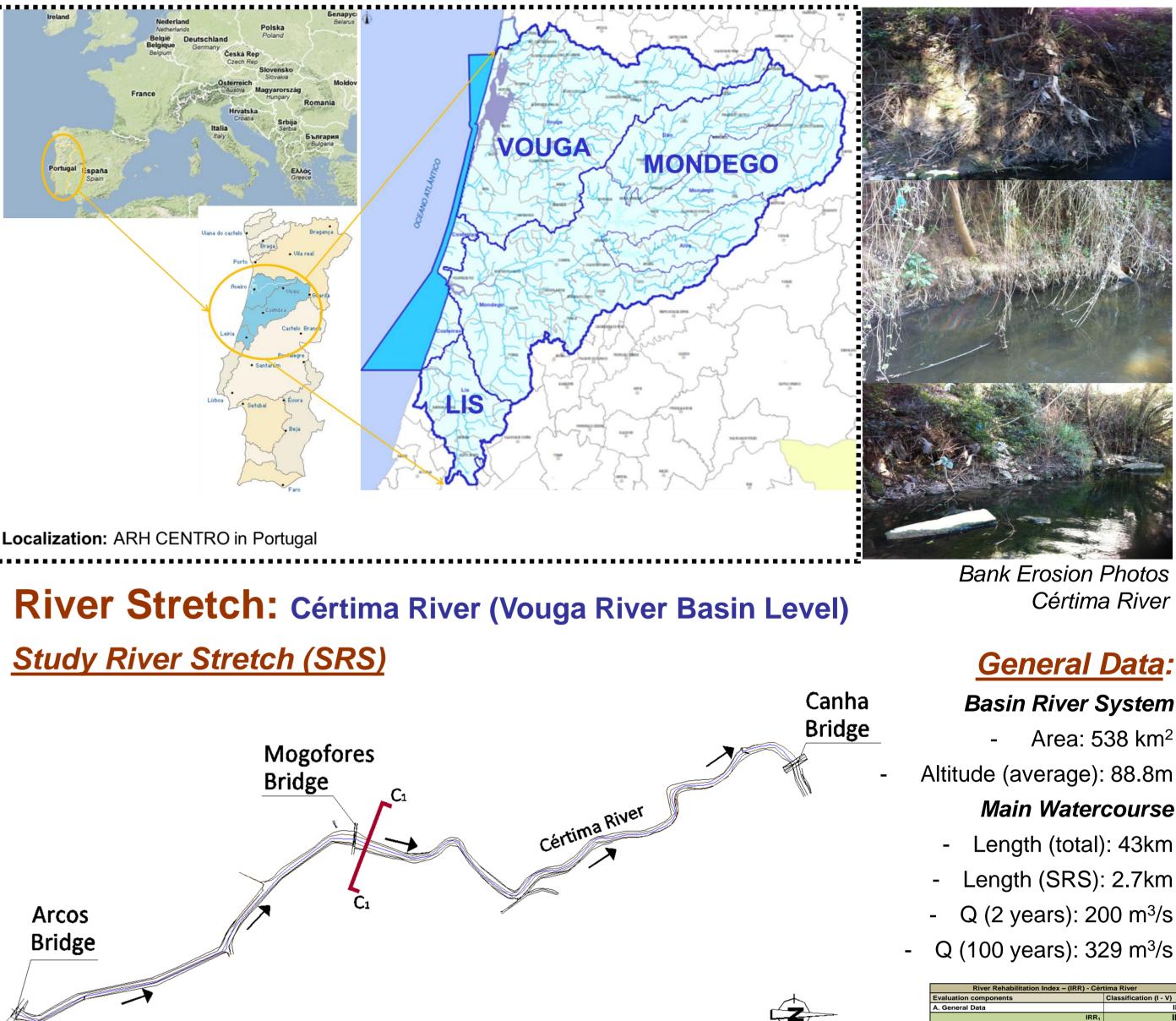
## Summary:

Environment Agency

Watercourses have many problems arising from the multiplicity of functions that they provide at the level of common uses and from the exploitation of watershed natural resources. Changing driving factors of watershed hydrogeomorphologic conditions, specifically, land use, flow regime and sediment loads, gives rise to an imbalance in river dynamics. This imbalance could be observed in the erosion of riverbanks, with associated economic, environmental and social losses. The integration of the river bank erosion in the context of the definition of a river rehabilitation strategy at the river basin arises as a process that may also contribute to the better use and improvement of integrated water resources management, in particular, to the compliance with Water Framework Directive (WFD, 2000/60/EC), namely (Articles 1 and 4) the river basin and riparian zones conservation and rehabilitation intervention goals. A rehabilitation strategy at the river basin level was developed and framed for the Portuguese River Basin District (RH4), integrating three (Vouga, Mondego and Lis) river basins. As a first step for the strategic definition, a classification and definition of the watercourse types of the each of the studied watershed was performed, providing a more adequate analysis and reflecting the reality of the region in relation to its specificities, namely in what concerns to problems, pressures and needs associated with each watercourse. In the second step the general methodology was applied, that including: the general characterization of the river system, based on three sources of information (River District Management Plan (RH4 RDMP); online questionnaires; field visits); the identification of watercourses that present dysfunctions; the identification of the river rehabilitation type of measures stated in the RH4 RDMP; the prioritization criteria for the potential measures to apply; and, selection of river stretches to illustrate those measures foreseen appliance.

#### **Localization:**





As a result, and namely in the case of the river bank erosion, a set of specific material and immaterial measures, could be defined. Each measure is associated with a set of actions that will frame the interventions to be implemented according to the proposed goals. For each measure a scheme "type" is devised, with information on its operational and technical specifications and on inherent required material and financial resources needed to implement them. Finally, specific guidance documents were created for intervention in watercourses, either for technicians as well as for the general population.

Present situation (C1)

- Area: 538 km<sup>2</sup> Main Watercourse

River Rehabilitation Index – (IRR) - Cértima River		
Evaluation components	Classification (I - V)	
A. General Data		
IRR <sub>1</sub>		
B. Water Quality	I	
B1. Physico-chemical and bacteriological	I	
B2. Ecological	I	
C. Hidrogeomorphological	I	
C1. Hydrológical Regime		
C2. Geomorphological characteristics		
D. Ecological Corridor	v	
D1. Vegetation	N N	
D2. Habitat		
D3. Fauna		

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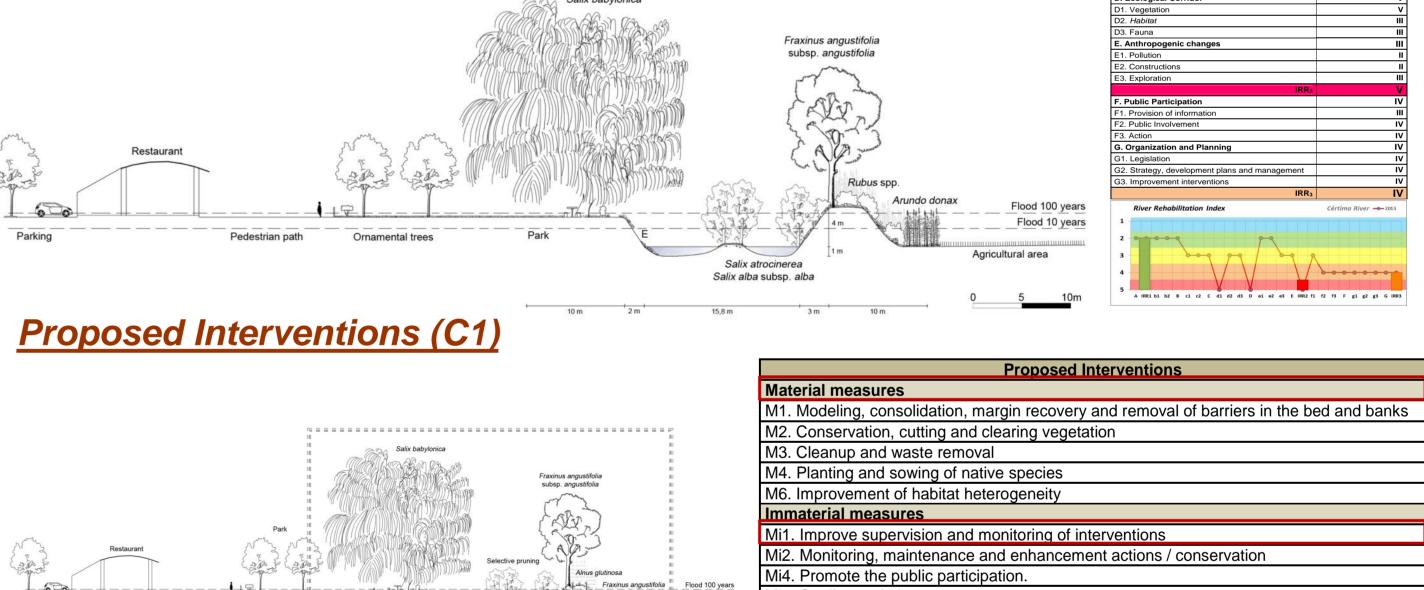
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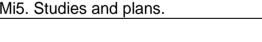
#### Goals:

The main focus of the work is the holistic view of bank erosion control, in the context of a rehabilitation strategy at the river basin level.

The application of the methodology to control bank erosion is exemplified on a stretch of Cértima River (Vouga River Basin), over which a survey of the main problems, pressures and needs associated with bank erosion was performed. As a result of that characterization and of the developed methodology, proposals of interventions to control bank erosion, namely stabilization techniques, could be defined, as exemplified for a river section at Mogofores Bridge (C1). The corresponding study area is occupied, on the left bank (LB) by a leisure and recreation park, and on the right bank (RB) by agricultural land, that justifying the use of different stabilization techniques: cribwall (LB) and live riprap (RB). As an example, a scheme "type" of cribwall, including a set of technical, operational specifications and inherent costs need to implement that solution, is presented.

The exemplifying illustrations presented do show and enable to compare the present situation and the envisaged post-intervention state on the referred study section (C1). A set of recommendations and guidelines on the level of monitoring and maintenance to observe are also specified.



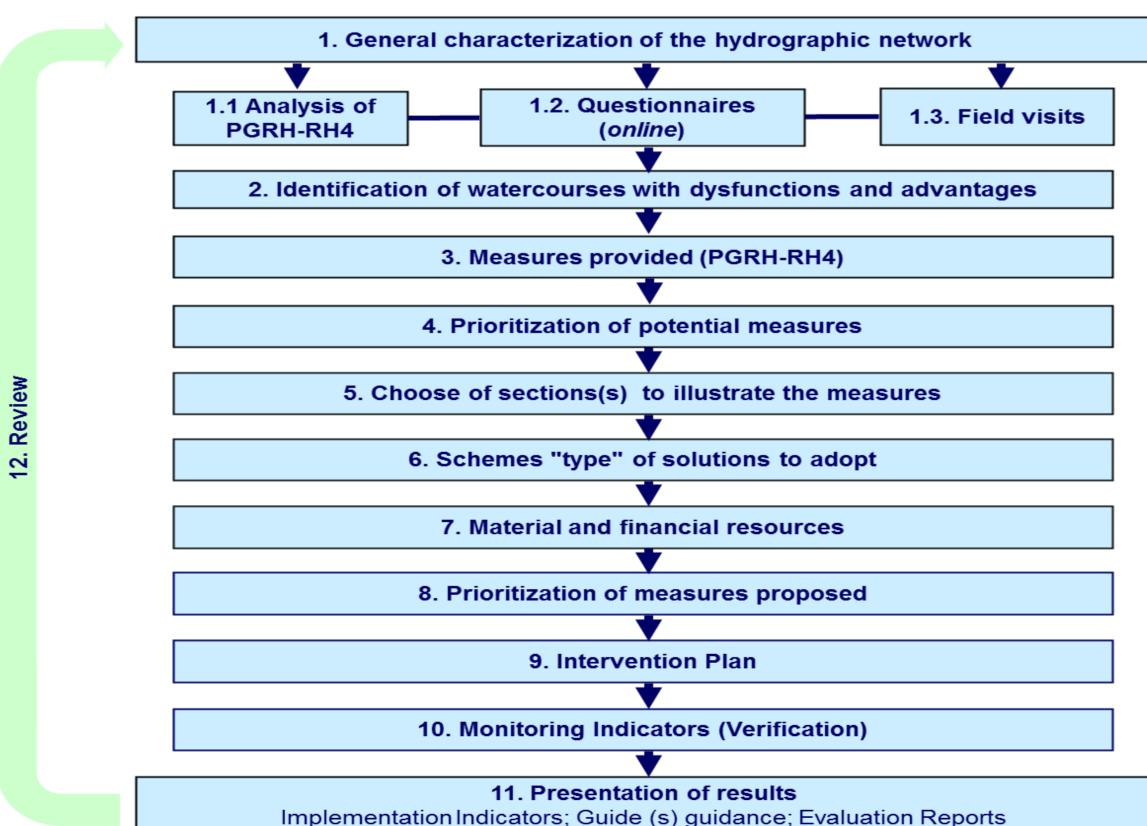


#### Schemes "type" (examples):

Material measures		Immaterial measures	
	inks restoration: Cribwall	Measure 12.1.1 Monitoring, maintenance and conservation: Monitoring: Flora	
РНОТО	TECHNICAL SPECIFICATIONS	TECHNICAL SPECIFICATIONS Description:	
	Description: Wood construction comprising a box-shaped structure formed by wooden logs arranged perpendicularly. Its lining should be done at the base with stone to reach the average level of the water, and the remaining area filling can be	information collected. Its goals are: Provide information on the progress being made in relation	

	Its lining should be done at the base with stone to reach the average level of the water, and the remaining area filling can be quite divers, depending on the needs of the location to requality, but should essentially be comprised of local terrain, native species in divot or bare root, live stakes or fascines.	<ul> <li>Provide information on the progress being made in relation to the programmed goals;</li> <li>Contribute to regular information to improve the planning process and the effectiveness of interventions;</li> <li>Increase levels of accountability being responsible for the use of resources (accountability);</li> </ul>	
	<b>Materials:</b> Wooden trunks; Local terrain; Geotextile;	<ul> <li>Train for the identification of strengths and successes and draw attention to the weaknesses (current and potential), as well as to the existing problems, in order to be able to make the necessary corrections and adjustments.</li> </ul>	
eam - Porto	Nails or iron threaded rod and wire;	The assessment and monitoring of flora is a key factor in the process of supervision and river rehabilitation projects which should reflect a specific priority in managing the restoration and conservation actions.	
	Live stakes of native trees: Willows (Salix atrocinerea and Salix salviifolia subsp. salviifolia) and Elderberry (Sambucus nigra).	A monitoring program of flora should follow the following steps:	
	Species in divot or bare root Alder Buckthom (Frangula alnus) and Hawthorn (Crataegus monogyna).	<ol> <li>Check the planting plan (plant species, covers, transverse and longitudinal location, size of plants, planting techniques) is according to the rehabilitation project. The first assessment should be performed one month after completion of the intervention;</li> <li>Assess the state of conservation and development of plant species through bioindicators and growth rates defined for each species (eg. vegetation type, width of vegetation; dominant height / cover; adjacent connectivity, continuity of vegetation, shade, presence of exoite );</li> </ol>	
	Should always be made to fit the phytogeographic area.		
a .	Equipments:	<ol> <li>Check the improvement in terms of biodiversity of micro-habitats in the intervention site;</li> <li>Assess the monitoring costs;</li> </ol>	
	Caterpillar. Truck. Chain saw; Hammer.	<ol> <li>Assessment for the monitoring costs,</li> <li>For each visit there should be a report describing the monitoring with the main problems and maintenance needs followed by interventions schedule.</li> </ol>	
-	Period of performance:		
	All year (wooden structure);	The monitoring program of flora should provide two annual visits: 1st Visit – Early spring in order to check the development of the plant rates applied. This visit will aim to identify the	
	Vegetative stage: October - March (live stakes and plantations) and always in periods of low or reduced rainfall.	needs for replanting marking the places to plant, defining species, evaluating costs and timing of new intervention replacement, which should preferentially be carried out between October / November; 2nd Visit – In December to verify compliance with pre-determined assumptions from 1st visit.	
		ESTIMATED COST OF INTERVENTION (€/year/500m): 500€ - 1000€	

#### **General methodology:**





Fraxinus andustifolia

SERVATIONS				
MATED COST OF INTERVENTION (€/m3): 90€ - 125€				
/·		- Monif (IRR), th - The pr		

e distribution of live stakes in the structure must be asymmetric, avoiding linear and regular

#### Intervention (example):



raxinus angustifolia

Arundo donax

### **Conclusion:**

<u>Detail</u>

taeaus monoavna

Laurus nobilis

Viburnum tinu

As a result of the integration of bank erosion control analysis in a rehabilitation strategy at the river basin level, the work presents a set of actions aimed at restoring function in riverine systems and at the fulfillment of the proposed objectives. With a holistic and integrated approach, it could be concluded that this strategy can become a very useful contribution in response to the problems of bank erosion at the river basin level, by means of the application of sustainable and integrative intervention practices.