Interreg

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Danube Transnational Programme

CAMARO-D

Report for OUTPUT T2.2

Pilot Action Clusters

Cluster 2 ***"Land use and vegetation cover along torrents, small rivers and their catchments – erosion, floods, soil compaction, surface runoff, invasive plant species and water pollution"***

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1. Introduction

Cluster 2 *"Land use and vegetation cover along torrents, small rivers and their catchments – erosion, floods, soil compaction, surface runoff, invasive plant species and water pollution"* encompasses the interdependencies between land use and vegetation cover along small rivers and their catchments. Four project partners participate within the Cluster 2 with their pilot areas and implemented activities:

- PP9: Executive Forest Agency, Bulgaria/Ochidolska reka – Cluster 2 leader
- PP1: AREC Agricultural Research and Education Centre Raumberg Gumpenstein / Tributaries of Enns Valley
- PP3 UL & PP4 JP-VOKA / Ljubljansko barje – Iška River
- PP6: ROMSILVA National Forest Administration / Putna River basin

The implemented pilot actions were divided in direct and indirect interventions.

Direct interventions:
Management activities, case studies, research activities, monitoring directed to erosion, torrent and flood control, water pollution, role of forests for water protection and flood risk prevention, monitoring of invasive plant species and special planning best practices in small river catchments. The identified "hot spots" and risk potentials in the pilot areas were the basis for analysis of the current status, common problems and planned activities in project partner areas. Exchange of experiences and best practices between the partners were carried out during thematic pilot workshops.

Indirect interventions:
Public awareness, knowledge transfer actions, workshops, field trips, training activities, and other activities related to active stakeholder involvement in planning and management processes. The stakeholders in every watershed were involved. Training sessions with them are organized, in order to transfer knowledge to other project partners and recommended on transnational level and to the regional/local stakeholders and population.

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2. Risks

2.1. Erosion

All countries have long term experience in erosion control, but in some vulnerable areas the problem still exists. In some cases the erosion activities could be dangerous for the nearby settlements, agricultural areas and for the population. In all catchments, forest territories are vulnerable to bark beetle infestation, which can lead to deforestation and high erosion risk due to the destabilization of forests. On the steepest slopes of the catchments, surface runoff may occur, which is a prerequisite for erosion processes.

In all catchments in forest conditions, surface runoff and soil erosion are generally low because of the surface litter cover. Soil erosion in forests generally follows a disturbance such as road construction, a logging operation, or fire. Ground cover by forest litter, duff, and organic material is the most important component of the forest environment for protecting the mineral soil from erosion.

Except in Bulgaria, the clear cuts are not forbidden, which creates erosion risk.

2.2. Soil compaction and soil quality

More or less problems with soil compaction can be observed in all involved countries caused by intensive agricultural use or settlements. The development of traffic infrastructure and its density varies within the Cluster, which causes different problems. Increased surface runoff, loss of soil retention capacity and increased danger of flash floods may occur in catchments with well-developed transport network (Austria and Slovenia). In Bulgaria and Romania, where lack of adequate road network exists, there are problems related to the exploitation of the resources. In Ochindolska, Putna and Iska rivers the problems are related with the abandoned and degraded agricultural lands while in Austria the intensive grazing (particularly in the alpine pastures) and crop farming have at several places a great impact.

2.3. Floods

All pilot areas are torrent water catchments, where floods and river rising often occur and the nearby settlements are endangered. The torrentiality in BG, RO and AT is partially controlled

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through previously implemented technical measures and afforestation. In all countries, the risk planning and management documents are based on the EU Flood Directive.

The vulnerability of water resources depends on climate changes at different degree. Climate change (trends and extreme events) and land use changes (erosion, land degradation, soil compaction, forest fires, etc.) decline water retention capacity and increase flood and drought risk in Slovenia, Bulgaria and Romania. Romania observes a decrease in water availability. The extreme events will become more frequent and in case of durable and intensive rain new floods could be expected. The main problems are the flash floods and river risings which endanger settlements in Austria, Slovenia, Bulgaria and Romania.

2.4. Water pollution

In all pilot areas (AT, BG, SLO, RO), the pollution of surface water and contaminated waste waters, particularly in settlements, touristic sites and traffic infrastructure is taken into consideration.

The settlement areas are vulnerable to contamination of surface water, flooding, artificial deposits along torrents and small rivers, increased danger of flash floods and contaminated waste water.

The water quality in Slovenia and Bulgaria is very important because drinking water protection zones and buffer zones are situated in the pilot areas.

In Slovenia and Bulgaria artificial deposits around small rivers and torrents, creating unregulated landfills, causing contamination of river water and are obstacles for high waters transition, are observed.

In industrial areas, not presented in Bulgarian watershed, loss of soil retention capacity and water pollution are main risks.

2.5. Surface runoff

All types of land use (forests, pastures, arable lands, grasslands, wetland areas, settlements, traffic infrastructures) influence quantity and quality of surface runoff in every partner pilot area. Intensive soil use reduces the infiltration capacity of the soil. During heavy rainfall, the rainwater increasingly flows off at the surface and can thus become a hazard for settlements and

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infrastructure facilities. The responsible bodies for protection of surface runoff are not clear defined in some countries.

2.6. Invasive plant species

Invasive plant species affect biodiversity and ecological stability, water regime and water quality (e.g. side erosion at river banks). They usually tend to appear and thrive on overgrown, neglected or abandoned land, such as meadows, pastures or post-industrial sites. In addition their uncontrolled presence in the riparian areas might result in disturbed water balance and stability of river banks. In Cluster 2 following invasive species occur: *Solidago canadensis, Solidago gogentea, Robinia pseudoacacia, Ailanthus altissima, Pseudotsuga menziesii, Impatiens glandulifera* and *Fallopia japonica*. Some countries stated how cultivation of potentially invasive species without given permits is a major problem.

2.7. Forest fires

Forest fires are becoming an increasingly important issue in the Danube countries. This is also due to the severe drought in the summer months. Forest fires are nowadays the main natural hazard affecting Southern Europe. Currently, an average of 500.000 ha of forest are burnt in the EU annually, causing human casualties, damaging property and reducing soil fertility trough loss of organic matter. Additionally large fires hamper biodiversity conservation.

Climate change is expected to cause, especially in Southern Europe, more droughts, higher temperatures and more windy periods which will raise the number and severity of fires. Due to already observed climate changes the fire risk increased and forest fires are happening more in the northern part of Europe.

Only Bulgaria identified forest fires as an additional risk for implementing pilot actions in CAMARO-D project.

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Table 1: Overview of current risks within the pilot areas of Cluster 2.

Risk types	PP1	PP3&4	PP6	PP9
Erosion, land slides	+	+	+	+
Soil compaction and soil quantity	+	/	+	+
Floods	+	+	+	+
Water pollution	+	+	+	/
Surface runoff	+	+	+	+
Groundwater recharge and quantity	+	+	+	/
Surface water and groundwater interaction	+	/	+	/
Invasive plant species	+		+	/
Other risks: forest fire	+	/	/	+

+ risk is relevant in Cluster 2

/ risk is not relevant in Cluster 2 or no Pilot action within the Cluster is foreseen

3. Best solutions

The best solutions that have been identified during the implementation of the pilot activities could be used for necessary adaptations of management concepts for securing a sustainable protection of water resources or contributing to integral flood prevention.

3.1. Tailored forestry in torrential watersheds

Forestry practices in torrential watersheds do not offer a universal solution to the protection of water resources or to flood risk prevention. The role of forests is essential in torrential watersheds and long term silvicultural practices and decisions usually are the main way to control the disaster risks. Despite the differences in the Danube region, the forestry practices within pilot areas of Cluster 2 are common and used on transnational level.

The best practice for erosion and flood control in torrent catchment areas is the afforestation with site specific tree species (in some areas e.g. Styrian Enns valley together with game

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regulation), especially above settlements and on dangerous terrains. Although the natural regeneration with native species is presented, in most cases on the spots where no natural regeneration is presented, mostly on the steepest slopes, rocky terrain around the river bed and near settlements, there is a need of fortification and afforestation activities in order to ensure the anti-erosion function of the forests. A reduction of clear cuts (or the reduction of the area size for clear cuts) in endangered areas is important.

Climate change and drought in recent years have had a significant impact on the condition of artificially created forests. Drying of coniferous stands has a pronounced pathological nature and is due to the intensification of pest attacks. There is a need of urgent measures, e.g. cutting of the affected forests, shorten the rotation period and support of transformation processes in pine plantations and encouragement of natural regeneration of the broadleaf species in their natural areal.

When the attacked by bark beetle coniferous stands are on big areas, this will lead to deforestation of certain areas and the risk of erosion and floods in torrent catchments is rising. In order to prevent the bark beetle distribution, regular monitoring should be conducted not only by forest services, but also from relevant stakeholders /forest owners, local citizens, etc./. Regular implementation of sanitary fellings and thinnings in pine plantations are of crucial importance to guarantee their good health condition.

Modelling of annual soil loss in the **catchment area of "Ochindolska River"** can serve as basis for the development of risk governance practices and land use management. The methodology is based on satellite remote sensing and GIS information and the mapping of erosion processes has been done through the implementation of mathematical model for erosion caused by precipitation (USLE – universal soil loss equation). The use of remote sensing data identifies hotspots and tracks erosion processes, and serves as a basis for planning of interventions to reduce land degradation and environmental risks.

The above-mentioned practice is very quick, non-expensive and innovative approach to explore the soil loss in torrential areas, to evaluate the vegetation cover and as a result to control the erosion processes in the risky areas within the catchment. It is easily applicable on large areas and transnational level.

A correlation between active forest management and the reduction of fire risks exists. To prevent forest fires and to reduce fire risk and fire danger the most common forestry practices

are reduction of surface-fuel to limit fire intensity, thinning and elimination of scale-fuel to lower the probability of vertical fire development. To improve the cross sectoral coordination, good solution is the preparation and implementation of common annual planning for firefighting between forest and fire safety services. Establishment of special automatic systems for observation and alerting of forest fires is helpful for more effective fire prevention and protection of forest ecosystems. Exchange of experience and demonstration of automatic system for observation and alerting of forest fires is a good practice for stakeholders involvement and knowledge transfer. During the terrain work, field trips and workshops experts from different levels took part in them and exchanged experience and discussed the problems with forest fire prevention. Traditional fire prevention measures have been highly improved in recent years, which have led to a quicker and more effective response to the majority of fires.

The knowledge transfer with local stakeholders on the spot is a successful best practice and could be implemented regularly without big expenses. Exchanging ideas and experience between relevant stakeholders and the authorities at any level /local, regional, national/ is helpful in decision making and planning process.

In some countries, a forest fire data base exists (e.g. Austria). A special information tool (http://fire2.boku.ac.at/firedb/) is available where you can click one of the red buttons and then you get a short information about the fire event (type of fire, date, federal state, municipality, area in m^2, cause (natural, anthropogenic), involved fire brigades, task forces.

All forestry interventions carried out in watersheds and best solutions derived are a basis for the necessary adaptations of management concepts for securing a sustainable protection of water resources and flood risk prevention.

Despite the fact that in some countries in the Danube regions still don't face some of the problems in the region because of their site and climate characteristics, the expected climate changes and land use development will induce them. In this manner the exchange of experience on transnational level is of great importance for the successful development of the region.

3.2. Spatial planning in catchments and river stretches

Riparians of fluvial systems as well as torrents are linked by the gravitational flow of water. Flood control schemes aimed at protecting vulnerable areas, as well as the intensification of land uses (e.g. land development, soil sealing or drainage of wetlands) accelerate flood runoff and increase the downstream peak discharge. On the other hand, downstream riparians can benefit

from upstream measures of flood prevention (e.g. flood polders) or the extensification of land uses (e.g. restoration of wet lands, natural retention areas) in the form of attenuated and delayed peak flows. Addressing these interdependencies – commonly referred to as upstream-downstream relations – calls for regional approaches in flood risk management and coordination at the scale of catchments or river stretches, as mandated by the EU Floods Directive (2007/60/EC).

This transnational best practice manual presents two types of regional coordinative approaches with regard to spatial planning:

Regulatory instruments at regional planning level: regulatory spatial planning instruments (such as regional plans) may designate suitable areas to secure the necessary land resources for flood retention and flood runoff as well as for future flood control measures. Such top-down planning directives are legally binding and generally entail zoning restrictions, which have to be implemented in local land use plans.

Upstream-downstream cooperation: voluntary cooperation between upstream and downstream riparians represents another option to encourage catchment-oriented planning. Such bottom-up cooperation is flexible in scope and in scale. Moreover, compensation mechanisms may be tailored according to the interests and needs of the cooperation members.

Unlike for fluvial catchments and river stretches regional planning is not that important for managing upstream-downstream relations in torrential watersheds, as those watersheds are often located within a municipal planning area. Voluntary cooperation, however, is a suitable instrument of catchment-oriented planning also in torrential watersheds.

The manual introduces the organizational types of water cooperatives and water associations in Austria as a best practice example. Different groups or interest are foreseen for solutions in endangered areas, e.g. water cooperatives and water associations (Austrian Water Act, WRG 1959 idF BGBl. I Nr. 73/2018).

Water associations:

- by recognition of a free agreement of the parties involved (voluntary water association),
- by recognition of a majority decision of the parties involved and simultaneous involvement of the reluctant minority (water association with compulsory membership),

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- by order of the Governor of the Land (compulsory association).

The purpose of a **water cooperative** may be in particular:

- Protection of real property and buildings against water damage, the regulation of the course or discharge (water level) of a water body, precautions against torrents and avalanches, the maintenance of banks and channels including clearance;
- Supply of drinking, industrial and fire-fighting water, including the necessary storage, enrichment and protection measures;
- Dehydration and irrigation as well as the regulation of the groundwater balance;
- Disposal and purification of waste water and the purification of water bodies;
- Construction, use and maintenance of common facilities for the exploitation and upgrading of hydropower;
- Payment of contributions to hydraulic engineering or water management measures of others;
- Provision for compensatory measures in water bodies, insofar as such measures are required by the installations of several water users;
- Exercise of regular supervision of waters and water facilities or the payment of contributions thereto;
- Control, supervision and maintenance of facilities licensed under water law;
- Collection, recovery and disposal of waste.

Water cooperatives therefore mainly comprise non-state actors, in most cases private landowners, who are affected by flood protection measures. The tasks include construction, monitoring and maintenance of flood protection schemes (in most cases smaller schemes against torrential hazards) and fund raising from interested parties (mainly landowners who benefit from flood protection). As legal entities they represent the interests of their members. Usually affected landowners take the initiative for a water cooperative. Water cooperative members financially contribute to the protection measures in the sense of burden sharing. The major cost share of a flood protection scheme, however, is covered by governmental authorities. Cost sharing within the water cooperative depends on the advantage received (by the flood protection scheme) or on the degree of potential damage averted. Water cooperatives are self-governing organizations, however with a formalized character. Decisions are taken democratically and problems should be solved internally, against the background of a regulatory

legal framework. Thus, the water cooperative stands between state administration and self-organization.

With reference to torrential watersheds the transnational best practice manual concludes with a recommendation to provide incentives for voluntary cooperation in catchments and river stretches. Incentives can on the one hand be financial, on the other hand assistance by (legally) formalized types of cooperation – e.g. water cooperatives – can be very helpful for municipalities or other stakeholders to take a decision for cooperation.

3.3. Control of invasive plant species

Invasive plant species are plants that are introduced either by accident or deliberately into an environment where they are not usually found. This has serious negative consequences not only as they are threat to native plants and animals, but also cause an enormous economic damage. Given how invasive plant species do not respect borders, coordinated action at the European level is more efficient than individual actions at the Member State level.

Some of the invasive plant species are: *Impatiens glandulifera, Solidago canadensis, Solidago gigentea, Fallopia japonica, Alianthus altissima, Robinia pseudoacacia, Ambrosia artemisifolia,* etc. *Impatiens glandulifera* is a highly invasive annual herb, which once widely established is extremely difficult to eradicate. Individual plants may produce more than 2,500 seeds in a vegetative period with taller plants producing more seeds and pods. It thrives in riparian zones and disturbed areas. Its root system and characteristic dying back in the fall makes river banks more susceptible to erosion in the fall and winter, which results in damages and increased flood risk. *Solidago canadensis and Solidago gigentea* are invasive perennial herbs of vigorous growth which occur in poorly managed pastures and gardens, in areas of inappropriate use such as brownfields etc. They are propagated by rhizomes and seeds which are produced in very large number. *Solidago canadensis* is still used in gardens and botanical gardens due to its ornamental value thus leading to further spreading. *Fallopia japonica* is a fast growing, extremely invasive weed and is one of the 100 worst invasive species as identified by the IUCN. It is usually spread along river banks due to flooding events, by unintentional introduction as a result of inappropriate control measure, through use of contaminated soil on development sites etc. It can cause increased risk of flooding, modifies hydrology, alters ecosystems, reduces biodiversity etc.

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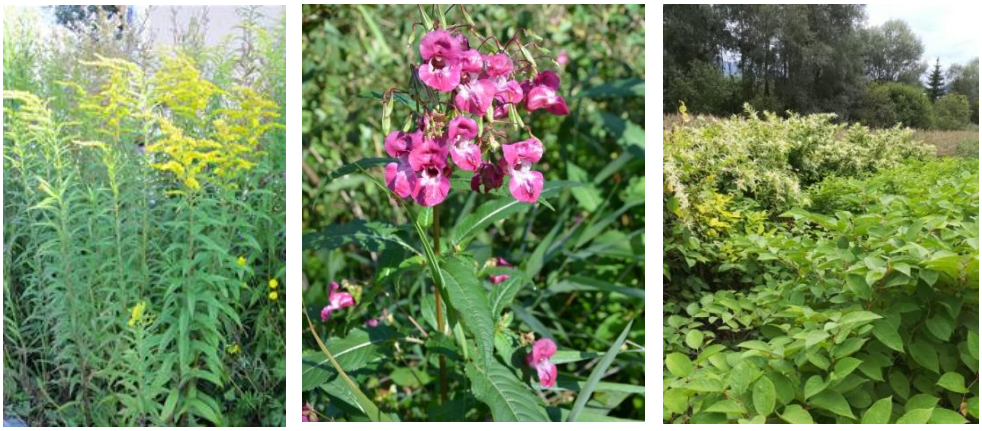

Figure 1., 2. and 3. Invasive plant species: *Solidago canadensis* (left), *Impatiens glandulifera* (middle), *Fallopia japonica* (right), © CAMARO-D, 2018

Within Camaro-D project, project partners carried out various interventions in previously designated pilot areas, with the aim of current land use practices improvement. Concerning invasive species management, identified best practices as well as lessons learnt through the implementation of direct and indirect interventions will be given below.

In **Pilot area "Styrian Enns Valley",** several types of strongly growing neophytes are recognized: *Impatiens glandulifera, Fallopia japonica, Solidago canadensis and Solidago gigantea.* Direct and indirect interventions associated with invasive species were carried out. Indirect intervention included awareness raising by conducting workshops, along with articles in journals and municipality newsletters. Knowledge and awareness of risks, species, spreading and best practice methods for removal of invasive species was increased and this important topic received necessary attention. Funding opportunities were targeted as the main challenge, which needs to be improved. As a direct intervention, during spring 2017 and 2018, distribution areas or "hot spots" were localized and documented, followed by removal of these plants from protected areas, forests, wetlands and along riparian strips. Main focus was laid on removal of glandular balsam, which had spread to the entire Enns valley floor and along the watercourses since the floods of 2013. Vegetation changes were documented before and after removal action. This action brought together experts from AREC, Styrian League for Nature Protection, Mountain Nature and Rescue Service, Office of the Provincial Government of Styria as well as farmers, water cooperatives, students, pupils, population and municipal employers. On trial pilots, measurements were carried to see how glandular balsam and Japanese knotweed regenerate after mowing. Overall reduction of invasive species was achieved in protected and wetland areas

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of the pilot and effectiveness of different elimination methods was tested. Finally, natural vegetation was able to spread again in these places and a diverse flora was established. As a conclusion, further research studies should be carried out, especially on the influence of *Impatiens glandulifera* and *Fallopia japonica* on runoff behaviour and (soil) water balance in wetland areas as well as the impact on water quality in water puffer zones, torrents and forests. Advisory facilities should promote the removal of invasive neophytes to a greater extent and funding opportunities need to be improved.

3.4. Beaver management

It is widely known that when beavers and humans come into contact, problems and conflicts can and do occur. Most of these conflicts are related to flooding caused by beaver building activity, destruction and damage from gnawing. Trees can fall over and pose a danger to people and property in the vicinity of residential areas. Crop damage can also occur in agriculture.

The BPMs aims are:

- provide information on damage compensation,
- beaver management and beaver monitoring and
- approaches to minimize conflicts by different interest groups.
- Moreover, affected people will find information and effective solutions on what can be done and where to find help.
- The sharing of transnational best practice and a list of technical measures are listed.

The innovative methodology for cumulative environmental impact assessment at local and regional levels based on ecosystems services evaluation is promoted by the accepted conceptual document Convention on Biological Diversity (CBD) and Millennium assessment. In this respect, the environmental impact assessment procedures should refer to other national, regional and international legislation, regulations guidelines and other policy documents such as the national biodiversity strategy and action plan documents CBD, CITES, RAMSAR, European EIA directive, Convention of Environmental Impact Assessment in a Transboundary context. All cited documents are establishing the principles, rules and guidelines but not

contain elements regarding agreed tools for a cumulative impact assessment for environmental impact integrating the individual one carried out for the EIA project or the strategic environmental assessment of policies, plans and programs (SEA).

Steps forward:

- Comparative analysis of results from future scenarios to identify the best solutions for pilot site of Black river basin
- Local simulation of habitat condition for beaver management plan
- Testing the local condition for beaver habitats conservation

The concluding message is that an integrated monitoring system for the catchments should:

1) address the needs not only of WFD, but also of other sectoral and cross-cutting acts relevant for the management of the natural capital,

2) cover the full range of parameters needed for quantifying the ES production at the (range of) scales envisaged by decision makers,

3) provide data coupled with knowledge bases (open access models) publicly available on the web,

4) capitalize on existing monitoring networks but transcend them by institutionalized coordination, and

5) be coupled with investments in research projects and interdisciplinary human resource programs at basin scale.

3.5. Awareness raising

Raising awareness among relevant stakeholders is essential for the success of any initiative, as their participation and collaboration will be needed for the development and implementation of related policies and programmes. Adequate preliminary targeting of relevant stakeholders/practitioners will facilitate their timely involvement and effective ongoing communication. Their engagement is an integral part of good practices in modern policy-making, particularly in initiation stages and is crucial for the success of any project.

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During the implementation of Camaro-D, partners used different tools in order to raise the awareness of stakeholders and society and to involve them in the implementation of indirect interventions within selected pilot areas. Their participation on-spot activities was of great importance for establishing direct cooperation with public authorities, research institutions and decision makers on watershed level and for practical work e.g. invasive plant species management. The main objectives of awareness raising activities are transfer of knowledge and skills, promotion and implementation of measures as well as providing of tools for control and management of risks. Another very important step is the implementation of lessons learnt in the school curriculum as training, project teaching, regular teaching and science practice and pre-scientific theses (e.g. for invasive plant species management and monitoring, beaver management, hydro morphological water quality determinations). Numerous activities are also implemented according to CAMARO-D. Also Information brochures and instruction manuals for the practice are developed.

- The goals of stakeholder involvement
- Raise awareness of the problems on watershed level
- Provide stakeholders with relevant knowledge and skills
- Outlining the methods and approaches used within the Clusters for communication and stakeholders involvement
- Provide stakeholders with the tools to control and management of the risks
- Promote and implement measures
- Distribute “lessons learnt” among other relevant actors or general public

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Table 2: Allocation of Best Practice Manuals (BPMs) to the cluster-specific risks (Cluster 2).

BPM / Risks	Tailored forest management in torrential watersheds	Practical Guide to Spatial Planning in Catchments and River Stretches	Beaver management	Hydrotechnical measures mitigating flood risks & establishing flood forecasting maps	Control of invasive plant species	Awareness raising
Erosion, land slides	✓	✓	✓	✓	✓	✓
Soil compaction and soil quantity	✓					✓
Floods	✓	✓	✓	✓		✓
Water pollution				✓		✓
Surface runoff	✓	✓		✓	✓	✓
Surface water & groundwater interaction		✓		✓		
Invasive plant species					✓	✓
Forest fire	✓					✓

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