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Danube Transnational Programme

CAMARO-D

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Cooperating towards Advanced Management routines for land use impacts on the water regime in the Danube river basin

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Foreword

From the mountains of the Black Forest in Germany to the shores of the Black Sea in Romania, the Danube River Basin is considered to be one of the most international river basins, since it covers more than 800,000 square kilometres, involving almost 20 countries. However, challenges and needs to be tackled are similar in the Danube countries, such as issues in the context of land use and its impacts on the water regime, flood events and other natural hazards. In the EU-Strategy for the Danube Region (EUSDR), the importance of the availability and quantity of fresh water resources, the proper function of ecosystems to maintain and restore biodiversity is highlighted. Water management is therefore a central issue and requires a strong coordination and cooperation across different countries and sectors.

Land use activities are strongly influenced by agro-economic and political circumstances. Those are the reasons why 14 partners and nine associate partners from nine different countries from the Danube Region pursue broad cooperation in a transnational project, co-funded by the European Regional Development Fund (ERDF) and Instrument for Pre-accession Assistance (IPPA). This is a cooperation not only in geographic terms, but also referring to diverse scientific and governmental fields of responsibility. The transnational collaboration of representatives of governmental bodies, water suppliers, research and education institutions, agro-meteorological services, environmental agencies and spatial planning institutions are acting on local, regional and national levels. The networking of the thematic fields enables the development of holistic strategies and solutions in the sense of sustainable water protection and flood prevention.

The common objectives in the CAMARO-D project are „set the frame-steer and manage“, ensure positive impacts – harmonize and improve“ and “bring it to life - accept and apply“.

The partner institutions’ various know-how and interest to cooperate towards advanced management routines for land use impacts on the water regime in the Danube River Basin served as a basis for the project implementation.

The results of the project cooperation are summarised in this brochure.

A common declaration for cooperation among the institutions within the participating countries in the project state the common wish to further develop various kinds of cooperation, acknowledging the importance of the coordination within the Danube river basin, taking into account the need for concerted actions and for promotion of the thematic field “protection of water resources and prevention of floods” for the general public while fostering the cooperation in the field of strategic policy.

Hubert Siegel

on behalf of the lead partner Federal Ministry of Sustainability and Tourism, Republic of Austria

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1. Introduction

The main goal of CAMARO-D project is the development of guidelines which will steer stakeholders and their activities towards long-term water resource protection and flood risk mitigation. The result of the implementation of advanced best management practices is improved infiltration and water retention potential of soil which will have positive impact on erosion and flood mitigation.

During 30 months of project implementation, the partnership developed various tools and strategies in order to foster long-lasting protection of water resources and of enhanced flood risk prevention. Different measure bundles, defined as-**transnational "Best Practice Manuals"**, related to arable agriculture, grassland management, forestry, spatial planning and water management to mitigate the relevant risks were elaborated and partially tested and implemented in selected pilot areas. Within those pilot areas, **stakeholder workshops and trainings** were conducted in order to initiate this process.

Furthermore, a concept for a **Land Use Development Plan** (LUDP) was elaborated which will enable cooperation and coordination of different sustainable land use management practices in the Danube river basin. It represents the initial action for a transnational catchment-based cooperation and the commonly developed measure bundles should therefore be integrated in existing River Basin Management Plans and Flood risk management plans.

An innovative **transnational guidance for sustainable land use planning** (GUIDR), tested within the pilot action areas, will allow stakeholders and decision makers to take an active approach for participation in processes of planning and management. Those guidelines will contain a set of best management practices for the adaptation of different land uses and environmental management for the long-term protection of water resources and flood mitigation while taking into account extreme weather conditions. By means of a tailored "**Stakeholder toolkit**", decision makers and other stakeholders get support for the mitigation of different conflicts of interest and receive recommendations for the implementation of optimized steering tools for regional development strategies and respective funding programmes.

These newly developed planning instruments demonstrate procedures for a sound water management on a transnational basis and additionally provide important inputs for the further development of the EU Strategy for the Danube Region (EUSDR) and other relevant EU-policies like the Water Framework Directive, Floods Directive and Nitrates Directive.

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2. Knowledge base

First, a transnational "**GAP- and SWOT analysis"**, encompassing stakeholder needs and requirements, were compiled, so-called "hot spots" in partner countries were defined, strategies for improving water management and flood risk prevention as well as land use practices were developed. Then, impacts were evaluated and consequently a joint check-list on the basis of the gap-analysis was created.

2.1. Summary of challenges and evaluation of actual practices

In a first step, the project CAMARO-D identified negative practices used within the entire Danube catchment. These gaps were listed at pilot area levels, depending on the respective forms of land use. Two directions were used:

- Review of available official materials, identifying key environmental problems of target areas
- Specific check-lists, where GAP analysis was performed and negative practices were listed by national experts from CAMARO-D countries, assessed by frequency and importance of their use

This approach gives a unique opportunity of confrontation of literature (objective information), with specifically gathered information from CAMARO-D expert teams (GAP analysis) and stakeholders' opinions (SWOT analysis). Individual approaches differ sometimes, bringing interesting results.

The performed analysis helped to define real gaps in landscape management. These results built the basis for the formulation of a catalogue for Best Management Practices (BMPs):

- Agriculture – arable land
- Agriculture – grassland
- Forestry
- Water management
- Spatial planning

In **arable agriculture**, the most frequent negative practices are:

- Intensive crop production, regardless of soil and water conservation and suitability of the type of production
- Intensive use of heavy machinery (soil compaction)
- Lack of inspection and control of manure, fertilizer, pesticide application and therefore massive application of pesticides
- Subsidy driven production of technical crops, including erosion accelerating crops such as maize

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In **grassland management**, the most frequent negative practices are:

- Practice of keeping cattle indoors for longer periods and a decreased number of grazing animals in total, inappropriate coupling of livestock and fodder production
- Lack of inspection and control of manure or fertilizer application and unfavourable status of storage facilities for livestock manure, therefore drainage of contaminated water
- Reduction of plant species diversity through intensive fertilisation and mowing too frequently
- Management of protected areas without consideration of object worth protecting, short-term contractual nature conservation, which is dissolved again after support periods, lack of monitoring of measures and immigration of invasive plants
- Burning of stubble after harvesting, especially in southern countries of the Danube region

In **forestry**, the most frequent negative practices are:

- Monoculture forests, allowing no natural regeneration and generally areas missing tree species diversity, age-group forests with little or no natural regeneration
- Not stabilized forest roads and forest roads without proper drainage
- Timber harvest techniques generally, especially inadequate techniques, like tractor-skidding, clear cuts

In **water management**, the most frequent negative practices are:

- Incomplete and missing wastewater treatment plants
- Intensive agricultural use of floodplains, intensive building and infrastructural land use in floodplains (urbanization)
- Pollution of river sections and gullies through vegetation and waste (agricultural residues, dead trees, branches, etc.)
- Direct diverting of rain-water into streams and rivers
- Lack of natural retention areas

In **spatial planning**, the most frequent negative practices are:

- Direct urban drainage into water courses and no sewage systems due to dispersed settlements
- Development of areas with a high share of sealed (impermeable) surfaces (e.g. commercial areas with large parking lots)

2.2. Conventions, policies, strategies and legislation

There are a high number of EU common strategies linked to environment, biodiversity, adaption to climate change, water management, spatial planning, forestry and soil conservation. They are used as reference framework for activities at EU and at national and regional levels.

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In the project, the most important strategies, directives and regulations were selected at international, EU, national and regional level to demonstrate how those documents and requirements are fulfilled and used in practical landscape management within Danube countries. The list can be found in the Annex. In addition there are a large number of partially binding instruments such as ordinances, standards, technical guidelines, management concepts and plans, practical instruments and tools and specific funding programmes which were collected from all partner countries and listed in a so called stakeholder toolkit.

3. Pilot action clusters

In the CAMARO-D project, the areas of operation were divided into three different clusters:

- Cluster 1: Groundwater resources
- Cluster 2: Torrents, small river and their catchments
- Cluster 3: River and accumulation lakes

The following map shows those Danube basin countries involved in the project (Austria, Slovenia, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Romania and Serbia) and the extent of the selected pilot areas. The clusters have a specific colour for better visualization.

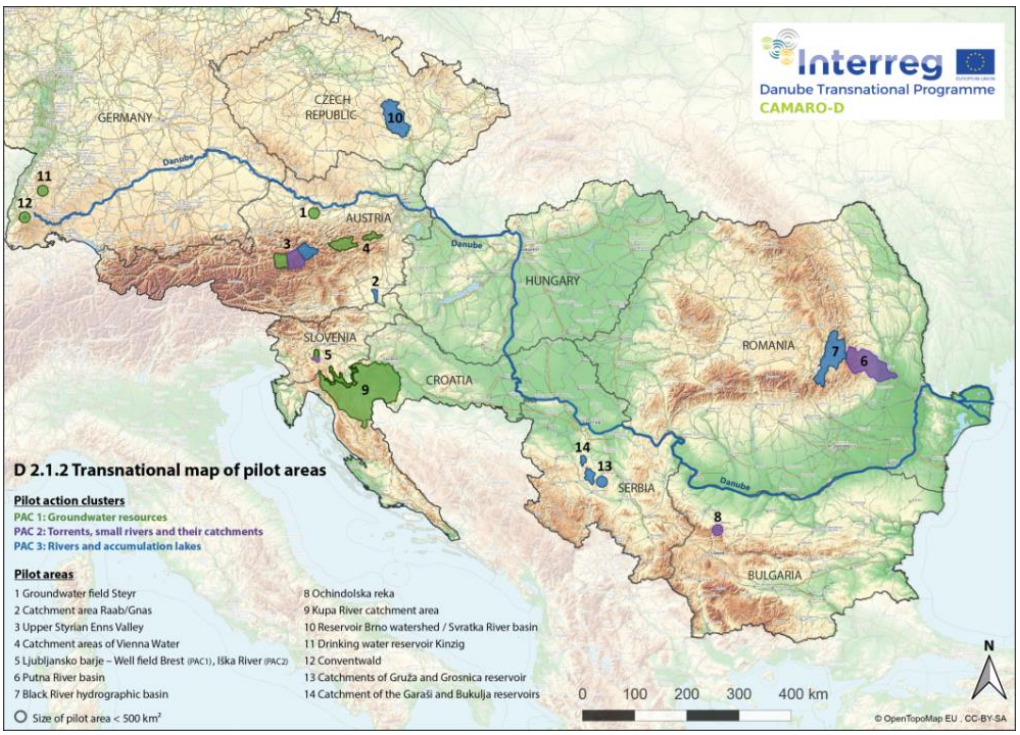

Figure 1: Transnational map of pilot areas

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The following risks were selected in outlining comparability templates:

- Water protection: water pollution, unfavourable surface water and groundwater interaction, impairment of groundwater recharge and quantity, drinking water shortage, cyanobacterial blooms and toxins in drinking water supply reservoirs
- Flood and soil protection and stabilisation: erosion, floods, surface runoff, soil compaction & deterioration of soil quality, invasive plant species, forest fires, bark beetle infestation, spread of beaver populations with associated destabilisation of flood protection measures

4. Transnational best practice management

The transnational approach means that certain "problems" were identified in several countries of the Danube River Basin and the respective best practices were elaborated by the whole project consortium. Twelve transnational best practice manuals (BPMs) provide ideas of how to solve existing conflicts between land uses or vegetation cover and the protection of water resources. Furthermore, they show how flood prevention challenges in the countries of the Danube River Basin are linked to existing strategies and policies while also collaborating with the local population, institutions and governmental authorities.

<table>
<tr><th>CLUSTER 1
Groundwater resources</th><th>CLUSTER 2
Torrents and small rivers</th><th>CLUSTER 3
Rivers and accumulation lakes</th></tr>
<tr><td>Groundwater protection through targeted silviculture</td><td rowspan="2">Tailored forest management in torrential watersheds</td><td>Adapted agriculture for optimal surface water and soil protection under climate change</td></tr>
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Figure 2: Overview of Transnational Best Practice Manuals, allocated to the different clusters

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4.1. Groundwater protection through targeted silviculture

In order to maintain the high quality and quantity of forested watersheds several aspects have to be taken into consideration. First of all, it has to be mentioned that one reason for the high quality of these water resources stemming from forested watersheds is the general absence of the use of pesticides and fertilizers compared to agricultural land. But it needs to be emphasised that to guarantee a high quality and sufficient quantity of drinking water, forest management does have to follow specific rules and guidelines. The aim of this BPM is to give an overview of the main related processes and explain how silviculture has to be adapted in order to protect groundwater resources. The use of the BPM and its suggested measures should guarantee the protection or the re-establishment of forest ecosystems' water protection functionality.

Specific processes in natural forest ecosystems are responsible for the protection of groundwater resources, such as rainfall infiltration into the forest soils, water storage within soils and vegetation, snow storage capacity, prevention or mitigation of erosion processes and filtration of precipitation water. It is crucial that silviculture follows the purpose of groundwater protection. However, it has to be emphasised that only stable forest ecosystems serve the purpose of proper water protection. In order to achieve stable forest ecosystems several measures should be taken, of which the tree species selection is the most important one. This usually does not agree with classical timber-yield forestry. The Forest Hydrotope Model which is based on classical forest site mapping surveys provides the necessary information to maintain or improve forest ecosystem stability and defines the tree species diversity of the natural forest community in detail. The autochthonous tree species diversity of a forest site is very important, as the native trees have evolved over thousands of years in the respective climate and hence showed the best adaptability.

Measures can be summarized as follows:

- Avoidance of the clear cut technique
- Establishment of stable, site adapted forest ecosystems
- Establishing continuous cover forest systems
- Improving stability and structural diversity of forest ecosystems
- Preservation of strong and stable trees

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4.2. Best practice restrictions for drinking water quality in agricultural land

Safe and sufficient drinking water is the key to life. Humans need fresh water for drinking, food preparation, cleaning and last but not least providing livestock. One of the main threats to drinking water sources is nitrogen pollution, which is linked to the agricultural practice of using manure and fertilizer for crops and on fields. For this reason, drinking water protection zones (DWPZ) have been established in order to secure the supply of drinking water and prevent water contamination.

The aim of this BPM on restrictions for drinking water quality in agricultural land is to illustrate areas of difficulties and to suggest adequate solutions. In order to do so, requirements for farming in DWPZ were decided on and necessary measures were listed. These requirements and measures were concretised, first for the inner DWPZ and, secondly for the middle and outer DWPZ.

It can be said that an unprofessional use of plant protection products (PPP) or fertilizers can result in major agricultural threats to the quality of groundwater. The professional use of PPP is defined as being carried out by a professionally trained person, using an examined and appropriate spraying device. In addition, it is widely recommended to solely use products also allowed in organic farming or if possible, avoiding PPP where there is no (urgent) need. When it comes to fertilizers, a detailed fertilization plan has been established, which clearly defines several measures. It can be assumed, that the majority of farmers respect these measures in relation to PPP and the fertilization plan, nevertheless it is important to compensate farmers for loss of crop and consequently income. By implementing “Good agricultural practice”, farmers contribute significantly to reducing groundwater contamination from agricultural sources. The combination of measures taken has positively influenced the biotic diversity of flora and fauna, habitat types are preserved, which is especially important for Natura 2000 areas.

The measures can be summarized as follows:

- Plant protection products (PPP): professional use of PPP, examined devices only, use of recommended substance, etc.
- Fertilization: banning the storage of livestock manure, prohibition of certain methods, compliance with the fertilization plan, etc.
- Good agricultural practice: limit growth of invasive plants, minimal processing of arable land, buffer belts along watercourses, etc.

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4.3. Mountain grassland management towards groundwater protection

Alpine Pastures or Mountain grasslands can be found all across the Austrian Alps and play a major role for the entire Danube river basin. It is a historical type of land-use, growing for thousands of years and evolved during the last centuries. At some point during the last century, however, many alpine pastures were abandoned. Fortunately, towards the end of the last century, alpine pasture management became increasingly popular again, especially for tourism. In many cases, the management of alpine pastures also has a protective function, such as mitigating erosion processes. Mountain pasture management is an activity of livestock farming, carried out solely in the summer months. If no more grazing takes place (e.g. due to insufficient water, or lack of interest in management), mowing (mostly by hand or small implements) is also an important contribution to the sustainable use of this cultural landscape. Site-specific re-cultivation and restoration in high zones is an important measure against erosion and for water protection.

The aim of this BPM is to provide a guideline for land-users and water suppliers within the context of alpine pasture management practices in order to avoid future problems, such as partial dryness or too little drinking water. The targets thus are securing the drinking water supply as well as improving the efficiency of alpine pasture management. Therefore, a focus is set on adapted land-use practice in accordance with the requirements of groundwater protection.

It is necessary to apply specific strategies in order to ensure enough water resources, depending on human and livestock needs and properly dispose of wastewater. If necessary, it is advisable to contact the respective authority to determine a solution for the specific situation.

Measures can be summarized as follows:

- Correct placement of water troughs as part of the alpine infrastructure
- Avoiding the spraying of liquid and solid manure on alpine pastures
- Fencing of dolines and sinkholes to minimize the risk of source water contamination and prevent grazing livestock from falling into those potentially dangerous landscape features
- Building embankments uphill of dolines and sinkholes (on karstic alpine pastures) to prevent surface water inflow
- Prevention or mitigation of erosion dynamics in ditches
- Controlled sewage paths on alpine pastures

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4.4. Hydropower plants and wastewater treatment

It can be said that hydropower plants are usually situated in the mountainous areas given to technical reasons, however they also significantly influence upstream or downstream watercourses and water bodies. The most frequently used types of hydropower plants are: run-of-river hydropower plants, storage run-of-the-river hydropower plants, reservoir hydropower plants and pumped storage hydropower plants.

In the EU, all types of hydropower infrastructure and facilities have to comply with the directives and regulations related to the protection of EU water bodies and connected ecosystems.. The main issues and risks promoted by the use of hydropower are changes to the hydrological regime, disruption of sediment dynamics, degradation of water quality, barriers to migration and the dispersal of protected species and negative impacts on biodiversity and landscape values. According to the guidance on requirements for hydropower in relation to Natura 2000 (2018), hydropower generation accounts for around 45% of interruption of river and habitat continuity in the Danube River Basin.

This BPM aims to provide guidelines for land-users as well as hydropower suppliers regarding impact assessment and for the planning of small hydropower plants to avoid or mitigate negative impacts.

Measures can be summarized as follows:

- Removing old dams
- Water flow regulation
- Mitigation of sediment transport
- Improvement of the ecological state of riverine habitats
- Construction of fish pass

4.5. Tailored forest management in torrential watersheds

This BPM presents the available approaches and data to provide a wide scope of learning possibilities in terms of forestry for protection and flood prevention within the Danube river basin. The manual aims to make the different approaches accessible for practical work as well as transfer state of the art know-how to the relevant stakeholders on a transnational level. In addition, problems that might arise in future, due to climate change are also taken into consideration.

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In general it can be said, that all types of land use influence quantity and quality of surface runoff and that changes in climate and land use can further decline the water retention capacity and increase flood and drought risk. Some of the participating countries also reported a recent decline in water availability. It is apparent that extreme weather events become more frequent, including problems such as flash floods and river risings. The consequences are biodiversity loss, loss of forest ecosystem stability and erosion processes. Additionally, it has to be emphasized that these climatic events often put settlements within the Danube region at risk.

Measures can be summarized as follows:

- Reforestation and afforestation
- Avoiding clear cuts and harvesting on steep slopes
- Erosion control in relation to road construction, logging operations, fires, etc.
- Erosion modelling, using models such as the Digital Elevation Model (DEM), Romanian Soil Erosion Model (ROMSEM), which is based on the Universal Soil Loss Equation (USLE) and GIS-data
- Modelling of vegetation processes, using the Normalized Difference Vegetation Index (NDVI), which indirectly provides information on plant health status
- Combating bark beetle infestations, using different measures, such as consistent monitoring, the use of trap trees, the implementation of regular forest thinnings and sanitary fellings

4.6. Adapted agriculture for optimal surface water and soil protection under climate change

Sustainable development, management and planning in agriculture aim at specializing the production by determining and growing appropriate crops for every region through analysis of pedo-climatic conditions. Crop efficiency is strongly influenced by climate variability, thus the agro-meteorological monitoring methods and additional specialized field observations present the information needed for an accurate assessment. Promoting a sustainable agriculture requires that farmers/ practitioners apply practices based on the most advanced scientific knowledge. Therefore, it is necessary to elaborate and implement codes of good agricultural practice on a transnational basis. The aim of this BPM on adapted agriculture for optimal surface

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water and soil protection thus is to provide a wide scope of learning possibilities in the field of agriculture within the Danube river basin.

There are certain problems and vulnerabilities that occur in the pilot areas, such as soil degradation, soil compaction, extreme weather events, decreased soil and water quality and biodiversity. In some areas, the risks of climate change for the agricultural sector are particularly immediate and challenging. Additionally problematic is the fact that in many of these countries amajority of the rural population depends on the agricultural yield as primary income. Therefore, certain measures have been suggested to minimize the impact of these potential difficulties.

Measures can be summarized as follows:

- Against soil degradation: grass strips, forest curtains and hedges, drains/ drainage channels, crop rotation, etc.
- Against soil compaction: cultivation in compliance with pedo-climatic conditions, increase humus content, improve soil structure, minimise impact of machines, etc.
- Against extreme weather events: maintaining areas naturally by hay and pasture, use of certain cultivation practices, slope terracing, etc.
- Improving soil and water quality: adequate (agricultural) waste disposal, crop covers, enhance soil organic matter levels, reduce fertilizer application, etc.
- Improving biodiversity: assess status for ideal use of agricultural land, promote use of native species, inform consumers, combat invasive species, etc.

4.7. Conversion from arable land to grassland mitigating soil erosion

Conversion to grassland is the most effective soil erosion prevention when it comes to steep areas of arable land. Only high quality afforesting could be even more effective, yet it is harder to implement. The conversion to grassland does not guarantee the prevention of pluvial floods, however it effectively supports the retention of low intensity rainfalls. Therefore it can be said that grassland will help to prevent soil erosion to a certain degree, protect the soil and impede muddy floods. In order to reach the highest soil protection effect grassed areas have to be properly maintained. This requires farmers/ practitioners to apply the new agricultural practices based on the most advanced scientific knowledge.

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The most frequent risk practices contributing to a higher soil erosion risk are the reduction of soil productivity due to organic matter and nutrients being carried away, intensive plant production regardless of soil and water conservation, inadequate handling application of pesticides and fertilizers and cultivation of arable land with no buffer zones along water courses. An additional problem is that the percentage of energy crops is increasing and thus the phases of bare soil during cultivation are also prolonged. The problem of soil erosion is different for every region, depending on the type of machinery used and the intensity and type of cultivation.

Measures can be summarized as follows:

- Conversion of risk fields and field parts – greening strategies, especially where historically a higher proportion of grasslands was present.
- Grassed waterways aim to move surface water across farmland without causing soil erosion.
- Grass strips and other protective strips are areas of permanent vegetation located within agricultural fields to interrupt sediment fluxes and allow infiltration and sedimentation of eroded material.
- Buffer strips along water bodies are intended to intercept and slow runoff, thereby promoting water quality and soil surface protection.

4.8. Practical Guide to Spatial Planning in Catchments and River Stretches

Catchments and river stretches were formally introduced by the EU Water Framework Directive and subsequently adopted by the EU Floods Directive. Lately there has been a shift from coping with river floods by using a hazard oriented approach of flood control to a more integrated approach of flood risk management. The underlying principle is to “make space for water”, which reflects the increasing importance of land and land use in flood risk management. By spatial planning in catchments and river stretches we understand planning approaches to coordinate land uses and future land use demands with catchments or subdivisions of catchments forming the boundaries of the planning area. Spatial planning is integrative, which means that several planning issues are equally important and there are no prevailing stakeholder interests. Therefore, spatial planning in catchments and river stretches is often requested, but hardly implemented due to a lack of cooperation or agreement. This BPM firstly

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presents arguments for catchment-related planning, then it outlines two planning options – regional planning and voluntary cooperation.

Managing upstream-downstream-relations is important as flood control measures can have (negative) consequences for downstream communities. Addressing these upstream-downstream relations thus calls for regional approaches in flood risk management and a coordination at the scale of catchments or river stretches. The aim of spatial planning is to prevent floods; however, experience shows that administrative boundaries often hinder effective coordination.

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Measures can be summarized as follows:

- Establishment of legal framework in accordance with regional land use plans and water management programmes
- Development and implementation of compensation measures, i.e. financial transfer between municipalities implementing flood risk management measures
- Augmentation of voluntary cooperation in catchments and river stretches by formal approaches of regional land use planning

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4.9. Beaver management to protect flood prevention dams

The European beaver (*Castor fiber*), which almost got extinct in Europe in the sixteenth and seventeenth centuries, is now being immigrated or re-introduced to its original home in the tributaries of the Danube basin area. The reason for its near-extinction was the high demand for the beaver's fat, fur and "castoreum" – a secretion said to have medicinal purposes. The beaver is nocturnal and semi-aquatic and lives in slow-moving bodies of water with loose riverbanks.

> The aim of this BPM for Beaver Management is to illustrate possible solutions of the often unavoidable conflicts between beavers and humans as well as beavers and different aspects of nature. Those conflicts result from the beaver's typical feeding, gnawing and building habits.

Falling trees as well as direct damage to trees relevant for forestry can cause problems for humans. In addition, the beaver target plants, especially those situated close to water bodies. These may also include agricultural crops, such as maize, sugar beets, corn and young rape. The beaver's building and digging habits can result in flooding as well as in damage or even destruction of manmade flood control measures. Beaver lodges built closely to agricultural land and embankments can also be problematic. Additionally, the beaver's typical behaviour also leads to a contamination of water.

According to the *Bern Convention*, the *Castor fiber* is internationally protected. In addition, EU Member States are obliged to prohibit possession, transport and any kind of trade of specimens taken from nature. There are however some exceptions to these regulations. On top of that, many federal states, such as Bavaria in Germany or Upper Austria in Austria have introduced even more specific guidelines for beaver management. It can thus be said that EU-wide regulations vary and in order to simplify beaver management generally accepted guidelines are desirable.

Measures can be summarized as follows:

- Designation of riparian stripes or area extensification (stripes of 10-20 meters) which can be also used as flood retention areas and can and can reduce fertiliser and pesticide inputs in water bodies (a contractual nature protection measure).
- Technical measures to protect flood control measures.
- Beaver coordinators (conflict manager, monitoring, consulting, evaluation of measures).

4.10. Hydrotechnical measures mitigating flood risks & establishing of food forecasting maps in torrential watersheds and along rivers

Unsuitable planning and construction as well as inhabitation of floodplains have led to an increased flood damage potential. This BPM aims at presenting the process of identifying threatened areas where floods along the watercourses pose a risk of causing economical, physical, social or environmental threats. Additionally, the importance of constant hydrological and meteorological monitoring to avoid or at least mitigate flood damage is highlighted. The manual also presents measures for flood damage reduction and control. The Floods Directive sets the frame work for implementation of flood hazard mapping and flood risk mapping and serves as framework for the flood scenarios catalogue. The main issues on an international level are the different approaches to flood hazard management and mapping, as a result of the diverse legislative background. Different map scales, event return periods and presented elements are the consequences. Thus, it can be said, that a cooperation towards a coordinated international water management for better transnational comparison is recommended.

Measures can be summarized as follows:

- Flood hazard and flood risk mapping on an international level
- Define flood risk level according to vulnerability (number of exposed inhabitants, economic and non-economic activities, etc.)
- Additional flood hazard mapping for frequent floods by use of a hydraulic model for the area of interest
- Creation of a flood scenarios catalogue for flood risk mitigation including the following measures: maintenance of watercourses, hydraulic structures and riparian areas, flood forecasting, identification and preservation of flood plains and flood prone areas, etc.

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4.11. Control of invasive plant species

Invasive plant species, also called neophytes, are plants that brought to Europe after the discovery of America in 1492 with direct or indirect assistance of humans,. These plants often spread unhindered as they have no local enemies and are described as invasive, if their dominance leads to economic, ecological or health damage.

The aim of this BPM for the management of invasive plant species is to identify where and under which circumstances they spread and to come up with solutions to prevent or reduce the impact these species have. In order to stop the introduction as well to control or eliminate alien species, Austria signed the international Convention on Biological Diversity (CBD). Additionally, other measures in relation to the framework of the International Plant Protection Convention (IPPC) need to be taken.

There are several relevant plant species in the Danube countries, such as the Impatiens *glandulifera* (high number of seeds), *Fallopia japonica, Solidago gigantea* and *Solidago canadensis* (high generative capacity), of which the latter has no natural enemies in Europe. They usually spread in locations that are more humid. Since it is somewhat difficult to control them, the aim is to weaken and reduce existing populations by mowing, cutting, milling or covering stands with UV-impermeable foil.

The EU set guidelines, but in certain countries no specific laws were determined, nor has any person or institution been assigned to implement these principles. Detailed action plans, including nation-wide regulations as well as options for advanced training are currently being developed. Fnancial support will be allocated according to the amount of the expenditure due to removal costs. In addition, municipalities need to make sure not to dump green waste in unfit locations. Additional financial costs occur in the fields of agriculture, forestry, water management, rail and road work. Measures can be summarized as follows:

- The control of invasive plant species is especially important in wet areas, riparian zones and forests.
- The removal and the compositing of *Impatiens glandulifera* (annual plant) needs to happen before flowering.

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- Currently more research needs to be done in order to gain additional knowledge on distribution patterns, damage and financially optimised control measures with the goal of a defined monitoring and control management.

4.12. Awareness raising

This manual is directed mainly to local authorities and practitioners in the watershed area and especially at the pilot action sites. Their involvement in awareness raising activities on the spot is of great importance to guarantee the cooperation with the public authorities, research institutions and decision makers on watershed level. Raising awareness among relevant stakeholders is critical for the success of any initiative, as their participation and collaboration will be needed for the development and implementation of related policies and programmes. During the project implementation, different tools were used to raise awareness in stakeholders and society and to involve them in the implementation of the direct and indirect interventions in the catchment pilot areas.

Special trainings and workshops, action days, hands-on activities, excursions, study visits, science days, traineeships for students as well as face-to-face transfer were realised within the CAMARO-D project. The experience shows that for citizens and students a combination of theory and practice on the spot is very effective. The direct contact, such as the removal of invasive plant species, results in a better understanding.

For practitioners, trainings are useful, for instance to become acquainted to a new management method. Decision-makers need to be directly involved in the relevant actions, such as involvement of representatives from local municipalities to various actions to get expertise for the implementation of guidelines and BPMs.

Measures can be summarized as follows:

- Knowledge transfer
- Stakeholder workshops
- Field trips
- Trainings
- Online consultations
- Mobile groups on the spot
- Distribution of information – website, media, newsletters, etc.

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5. GUIDR – Guidance for sustainable land use planning

Water resources provide the lifeblood of natural systems, societies and economies. People have lived near and on rivers, lakes, wetlands and deltas for many centuries. Most early civilizations emerged on the banks of some of the world's most iconic rivers. Rivers and groundwater provide a multitude of services such as water supply for farms and cities, waste disposal for factories and households, fisheries to provide food for communities, energy to drive economies, flood attenuation for downstream developments, cultural and recreational enjoyment for people, spiritual uplift for believers and a habitat for many animals.

In the course of project implementation, the CAMARO-D project focused more directly on land use planning and its potential contribution to water management and more specifically its role in achieving the EU Water Policy objectives as articulated in the Water Framework Directive (WFD) and ensuring water security in the Danube basin.

In this context, the GUIDR document (Guidance for the Danube Region for sustainable land use planning) serves as guidance to linking land use/land use planning and water management. In doing this, it was recognized that land use planning essentially involves the development and implementation of strategies and procedures to regulate land use and development in an attempt to manage and balance the numerous pressures placed upon water.

> Spatial/Land use and planning essentially involves the development and implementation of strategies and procedures to regulate land use and development in an attempt to manage and balance the numerous pressures placed upon land and water.

A code of practice was developed and can be summarized as follows: Transnational Land use planning procedures are required, amongst a range of other environmental planning and management strategies and techniques (e.g. economic instruments, demand management and pollution prevention and control), to help to address challenges associated with water.

- Changes in land use are linked to environmental change through a multiplicity of direct, indirect, sometimes cumulative and often uncertain effects. Consequently, land use planning lies at the heart of addressing environmental problems.
- Planning has a particularly important role to play where available water supplies are stretched, or where development is proposed in areas at risk of flooding.

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- The multiple uses of and demands on water resources mean that an integrated approach to managing water is required. Reconciling and coordinating competing demands relies on appropriate planning mechanisms, and planning can now be seen as the starting point of sustainable management of water resources and the associated social and economic systems.
- Land use planning has an important role to play in addressing water issues such as flooding and aquatic pollution which are strongly influenced by the nature and location of development.
- Land use planning is an established mechanism through which the water management challenges raised within the WFD can be addressed.
- The successful achievement of the WFD's goals will ultimately depend on the effective integration of land use and water management processes.
- The process, content and extent of RBMP is set by the requirements of the WFD and water related land use plans would fit into this through integration into different stages of the RBMP development and especially within the context of the program of measures which every RBMP must contain. This will effectively make water related land use planning an integral part of the RBMP.

> Land use planning can make an important contribution to the achievement of the legislative requirements of the WFD
>
> Land use planning procedures can contribute directly to some of the 'basic measures' which are minimum requirements for inclusion within RBMPs

- Planning authorities play a key role in implementing the WFD by ensuring that the development and use of land is undertaken in a manner that is sensitive to the requirements of the Directive.
- Land use planning procedures can contribute directly to the 'basic measures' for inclusion within the River Basin Management Plan (RBMP), such as:
    - Safeguard water quality in order to reduce the level of purification treatment required for the production of drinking water.
    - Control of diffuse pollution sources.
    - Eliminate or reduce the pollution of surface waters.
    - Prevent and/or reduce the impact of accidental pollution incidents.
- Land use planning can significantly affect the demand for water, water use and water quality.
- It is important that good links are made between the land use planning system and water planning.
- Land use planning can reduce flood risk and contribute to the protection of natural floodplains and permeable surfaces and reduce diffuse pollution created by runoff.
- Planners and relevant stakeholders should be encouraged by the multifunctional benefits generated by the land use planning initiatives explored during the case studies.

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- Ultimately, the 'spirit' of the WFD goes beyond the achievement of good water status and requires an evolution in the relationship between human societies and the water environment, and land use planning processes have the potential to help stimulate this.
- Meeting the requirements of the WFD via land use planning would undoubtedly provide a major boost in reaching policy objectives.
- The catalogue of measures and best practices based on experience is a valuable component of a toolbox available to water and land use planners and is seen as significant resource for the RBMP process and definition of program of measures.
- Water related land use planning should focus on ecosystem services provided by different land uses in the context of WFD requirements. It is therefore imperative that evaluation of the role of ecosystem services in water management is considered as a part of land use planning within the RBMP process.

The GUIDR document provides specific guidance and recommendations for land use planning focused on different the different land uses clustered in the project (agriculture, forestry, grasslands and alpine pastures).

It also gives land use planning guidance focused on:

- Standards for catchment based, function-oriented land use management and spatial planning
- Effective decision-making process and active participation of all stakeholders
- Catchment based political oriented, trans-sector and transnational cooperation
- Findings on trans-sector and transnational cooperation
- Implementation of best practices in existing strategies, policies etc.

In the transnational context of the CAMARO D Project it is clear that the Water Framework Directive, the Flood Directive, the Groundwater Directive and the Nitrate Directive are the main EU Policy components within which water related land use planning has to occur. These directives call for cooperation on transnational level. In this context the GUIDR provides the overall framework for the integration of land use planning into the transnational policy framework which is an integral part of the WFD (Figure 3).

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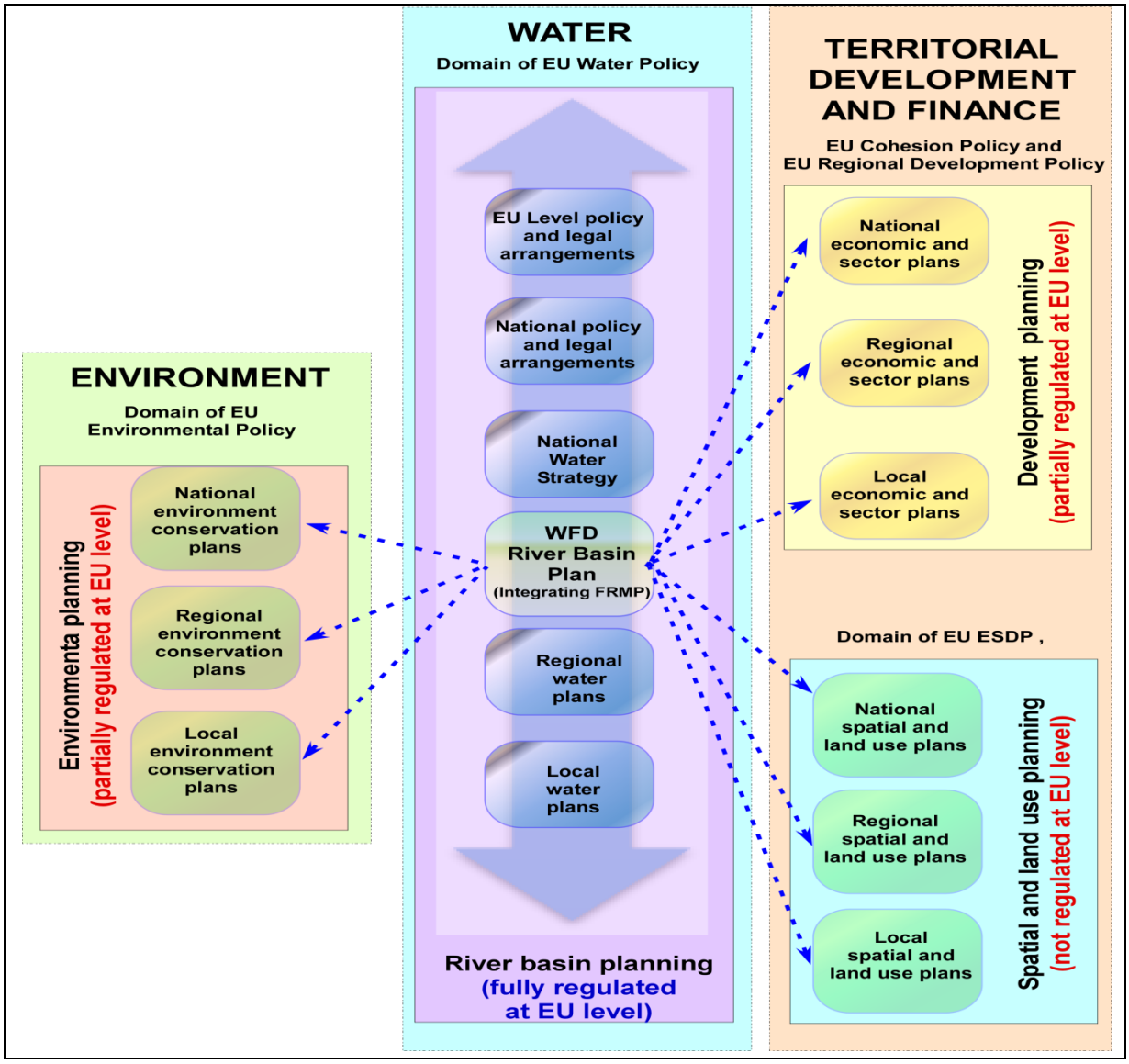

Figure 3: Overall framework for integration of land use planning into transnational water policy and planning.

It is clear, that under current circumstances, the transnational water related land use planning can most effectively be initiated and implemented if it is set within the existing system's boundaries and frameworks. Effectively, this means that water-related transnational land use planning should be integrated into the process of developing River Basin Management Plans (RBMP), as per requirements of the WFD and to a certain extent the Floods Directive. This will effectively make water related land use planning an integral part of the RBMP and will be well integrated into the so called "water box" of decision making in the water sector (See Figure 4).

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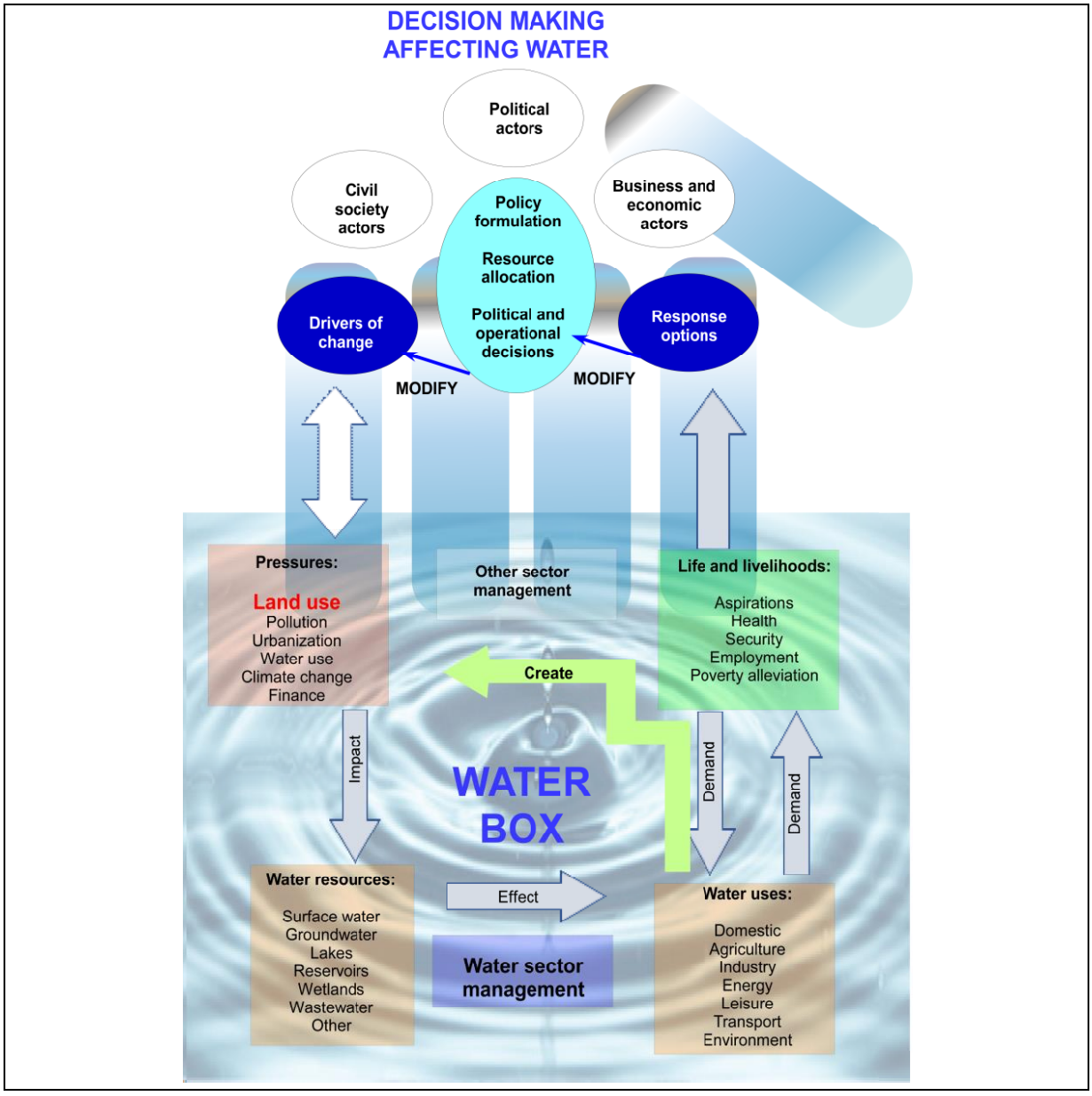

Figure 4: Decision making affecting water (Modified from WWAP 2009). The 'water box', showing issues, decisions, and actions directly within the scope of water managers, and the connection to influencing factors outside the "water box".

Towards the end of project-implementation, another series of national workshops was held in each participating country in order to present the GUIDR and recommendations provided within the document. Given that water provision and governance of water systems are of a complex nature, involving many different stakeholders at different levels and shaped by the political and institutional context of a country, it was emphasized that in order to ensure effective water management it is necessary to establish its close connection to spatial planning. The GUIDR was

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found as an innovative and unified know-how tool for better understanding of the process and as a guiding document for successful decision-making processes in terms of land use planning and management. Participating practitioners agreed on the implementation of the principles of integrated catchment management, which take land use and water resources protection goals into account. This is a fundamental step towards sustainable spatial development that will ensure the environmental, social and economic functions of every land use type.

The development of joint standards on transnational level was perceived as a challenging and rather slow process, but essential for the development of the transnational concept for land use planning. Provision of national inputs and common work with stakeholders is crucial for the process. The joint conclusion was that awareness raising activities and education of the general public on existing environmental pressures should be taken to a higher level since the stakeholder engagement is an integral part of good practice in modern policy-making, particularly in initial stages of policy development. Continued coordination between all stakeholder groups is a key element in the successful implementation of any of the GUIDR guidelines.

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6. LUDP – Concept for a Transnational Land Use Development Plan

As previously stated, it became clear during project implementation that the development of holistic land use planning for river catchment areas comprises a number of interdependencies between land use practices and water resources. These linkages are characterized through the effects of anthropogenic activities, land cover alterations and land degradation on ground water resources, water quantity and quality, surface run off and floods. Climate change causes additional adverse effects.

The elaborated transnational catchment–based concept of land use planning (LUDP) in terms of a sustainable protection of water resources and mitigation of flood risk is a result of the project development and the new approaches within CAMARO-D. It is recognised that watershed management is a dynamic and continually readjusting process which is continuous and needs a multidisciplinary and flexible approach. The applied methodology identifies existing pressure on water resources and relates them to land use practices, management and policies. The variety of land use types and their interdependencies with water management determine the need for an innovative transferable concept of land use planning.

For successful land use development planning (LUDP) concepts good governance for the effective coordination of policies between different sectors and policy levels is required. Horizontal coordination of sector administrations and policies, vertical coordination of different levels of responsibilities and the active involvement of all relevant stakeholders are essential. The improvement of joint standards at a transnational level is a challenging and slow process, however it is equally essential.

6.1. How to implement LUDP

6.1.1. Determination of the planning area

When selecting planning areas, those areas should be prioritised which have a strong spatial relation to “Protected Areas”, based on the Water Framework Directive, Art. 4 and/or “Areas of Potential Significant Flood Risk” (APSFR), based on the Floods Directive, Art. 5. Other risks in endangered areas, such as erosion, soil compaction, floods, water pollution, surface runoff, invasive plant species, groundwater recharge, surface- and ground water interaction have to be taken into consideration, as well as the relevant influences and impacts of the tributaries and other connected water bodies.

The **size of the planning area** is to be determined in such a way that in all planning phases the requirements of water management, hydro-ecological and physiographical interdependences as well as land use influences can be considered in the catchment area.

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6.1.2. Processing steps

Based on the **Guideline for watercourses development- and risk management concepts** in Austria (BMLFUW, 2016: Leitfaden Gewässerentwicklungs- und Risikomanagement-Konzepte (GE-RM), Vorläufige Fassung 2017) the following steps for the implementation of **Land Use Development Plan** were established:

1. Preliminary study
2. Inventory
3. Definition of goals and objectives
4. Concept of measures

Preliminary study

- Distinction of the scope of work in the following processing steps (inventory, definition of goals, concept of measures) based on existing data. Depending on the data situation and specific risks, spatial focal points and different intensities of processing can be determined for the relevant streams or water resources. If measures for the main risks in the catchment area /planning area are already developed (e.g. in best practice manuals), these preliminary steps can be omitted.
- Development of a realistic time table
- Definition of the responsible institutions for the development of LUDP
- Review and analysis of relevant coordination requirements of LUDP with other stakeholders in the planning area
- Estimation of costs
- Review and analysis of relevant aspects for communication in the planning area

Inventory

Review of existing data bases for the:

- Analysis of existing risks and management gaps
- Definition of goals and objectives/development of an integrative guideline
- Definition of the necessary measures: Concept of measures (basis: Best Practice Manuals developed in CAMARO-D)

Development of a digital map (GIS-coordination) with all relevant issues (e.g. ortho-photos, water network, drinking water protection zones, Natura 2000 areas, laser scan, local land use plans) – as a basis for LUDP.

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Based on an analysis of the most relevant risks and gaps at catchment level respective goals and objectives, as well as the development of an integrative guideline (strategic action) were defined.

Concept of measures

According to the defined risks in the whole planning area target-oriented measure bundles can be selected from the **CAMARO-D Best Practice Manuals** (BPMs), to provide an overview of a common coordinated concept of future desirable measures. If necessary, the proposed measures have to be adapted according to existing risks and management gaps. Priority setting, time sequence, cost and financing issues as well as the necessary implementation strategies (planning, steps, possible obstacles etc.) are to be defined. The concept of measures must be coordinated with the administrative bodies responsible for the risk management plans and the River Basin Management Plan in the country, and other relevant stakeholders (e.g. responsible for spatial planning, nature conservation, agriculture, forestry).

6.1.3. Implementation

The bundles of specifically selected measures (derived from the BPMs of CAMRO-D) have to be implemented in the "Programme of measures" of the River Basin Management Plans and in the Flood risk management plans.

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7. Annex

The following conventions, policies, strategies and guidelines are summarized without claim of completeness.

Conventions

- **Ramsar Convention** aims for conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world.

EU Policy areas

EU Policy areas are the setting of priorities and implementation through policy measures.

- **Agriculture and Environment** (climate change, loss of biodiversity, challenges in terms of natural resources, etc.)
- **Rural Development**, the Common Agricultural Policy (CAP) supports a modern, market-oriented agricultural sector (sustainable supply in line with strict standards (environment, animal welfare, food safety, etc.), as well as promoting investment in the wider rural economy
- **Cross Compliance principles** (GAEC – Good Agricultural and Environmental Conditions)
- **Climate protection** in relation to adaptation measures
- **Environment** (soil quality, protection of soil erosion, protection of water resources, innovative recycling management, protection, enhancement and restoration of biodiversity, minimisation of environmental health risks, decoupling of growth from resource consumption)
- **Forest Europe** (ex MCPFE; Ministerial Conference on the Protection of Forests in Europe, MCPFE) is a pan-European forest policy process at ministerial level with 47 Member States to develop guidelines, criteria and indicators for the protection and sustainable management of forests.

Strategies

- **The Europe 2020 strategy** as a **reference framework** for activities at EU and at national and regional levels. EU governments have set national targets to help achieve the overall EU targets, and are reporting on them as part of their annual national reform programs.
- **EU-Strategy for Danube Region (EUSDR):**
- The EU Strategy for the Danube Region (EUSDR) as a macro-regional strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region.

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- **EU Forest Strategy:** Sustainable Forest Management e.g. protection function, biodiversity, environmental services, in particular regulation of the water cycle, soil protection)
- **EU Soil Framework Strategy /Directive (actually repealed):** A rather general Directive (2004/35/ES), which sets up basic requirements for soil features conservation. There is a blockage in implementation at EU level.

Directives

EU Directives: EU Directives have to be implemented on national level, however they can differ in form and methods.

- **EU Water Framework Directive:** WFD (2000/60/ES) is probably the most important widely implemented environmental EU standard related to water and landscape management. The WFD has been implemented within all CAMARO-D countries as required by its status. Every country produced its own "National Water Management Plan" and follows more or less the requirements to reach good statuses of their water courses.
- **EU Floods Directive:** EU Flood directive (2007/60/ES) is closely linked to WFD. Basic requirements of the EU Floods directive were reached within CAMARO-D countries by "Plans for Flood Management", which were worked out for main basins.
- **EU Drinking Water Directive:** EU Drinking Water Directive (98/83/ES) focuses on drinking water quality and availability within each country.
- **EU Groundwater Directive:** EU Groundwater directive (2006/118/ES) deals with ground water conservation and it is closely linked to WFD.
- **Nitrate Directive:** This is one of the basic and most often implemented general standards, mainly to protect groundwater quality in agricultural landscape. The Nitrate Directive´s (91/676/EEC) goal is to identify important and vulnerable areas of ground water recharge and to limit application of agricultural fertilizers on agricultural land, to control water quality.
- **The Natura 2000** network protects areas, based on the Flora Fauna Habitats Directive and the Birds Directive (incl. uniform coordinated landscape mapping).

Environment Action Programme 2013-2020

The 7th Environmental Action Programme of EU is aiming to stop the decrease of biodiversity.

- Improvement of the quality of life, e.g. by avoiding environmental pollution
- Conservation of natural resources as a new objective (preventive nature of environmental policy)
- Integration of environmental policy into all policy areas; sensitisation of the population for environmental protection
- Sustainable development
- The polluter pays principle and the precautionary principle

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Definition of action areas

EU Regulations

EU Regulations shall have general application and shall be binding in its entirety and directly applicable in all Member States.

EU Regulation on Invasive Alien Species provides for a set of measures to be taken across the EU in relation to invasive alien species included on the Union list.

Nation specific legislation and policy

In addition to EU legal basis, several partner countries also have their own obligatory and/ or voluntary principles, such as, for example, special subsidies for drinking water or environmental protection (Austrian Nitrate Action Programme, special subsidy agreement for nature and water protection measures, etc.). These regulations generally cover the areas of water protection, flood prevention measures, biodiversity, as well as agriculture and forestry. In case of flood prevention all bodies governed by public law are bound to participate in funding these protection measures.

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8. Facts

INVOLVED COUNTRIES: 9 (AT, SI, HU, RO, BG, HR, SRB, CZE, DE)

PROJECT DURATION: 01.01.2017 - 30.06.2019

PROJECT BUDGET: € 2,588.138 ERDF: € 2,027.792 IPA: € 172.125

9. Partners supported by the European Regional Development Fund (ERDF)

9.1. Lead Partner

Federal Ministry of Sustainability and Tourism (BMNT), Forest Department, Vienna, Austria

9.2. Project Partners

Project Partner 1:	Agricultural Research and Education Center Raumberg-Gumpenstein (AREC), Irdning-Donnersbachtal, Austria
Project Partner 2:	Municipality of the City of Vienna, Department 31 - Vienna Water (MA31), Vienna, Austria
Project Partner 3:	University of Ljubljana (UL), Ljubljana, Slovenia
Project Partner 4:	JAVNO PODJETJE KANALIZACIJA SNAGA d.o.o. (JP VO_KA), Ljubljana, Slovenia
Project Partner 5:	Herman Otto Institute Ltd. (HOI), Budapest, Hungary
Project Partner 6:	National Forest Administration (ROMSILVA), Bucharest, Romania
Project Partner 7:	National Meteorological Administration (NMA_RO), Bucharest, Romania
Project Partner 8:	Environmental Protection Agency Covasna (EPAC) Sfântu Gheorghe, Romania
Project Partner 9:	Executive Forest Agency (EFA), Sofia, Bulgaria
Project Partner 10:	Croatian Geological Survey (HGI_CGS), Zagreb, Croatia
Project Partner 11:	Czech Technical University in Prague (CTU), Prague, Czech Republic
Project Partner 12:	Forest Research Institute Baden-Württemberg (FVA_BW), Freiburg in Breisgau, Germany

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9.3. Partners supported by the Instrument for Pre-accession Assistance (IPA)

IPA Partner 1: Jaroslav Cerni Institute for the Development of Water Resources (JCI), Belgrade, Serbia

9.4. Associated strategic partners

ASP 1: Office of the Upper Austrian Federal State Government, Forest Service (UA_FS), Linz, Austria

ASP 2: Office of the Styrian Federal State Government, Dep. 14 - Water Management, Resources and Sustainability (S_FS), Graz, Austria

ASP3: Morava River Basin (PMO), Brno, Czech Republic

ASP 4: University of Agricultural Sciences and Veterinary Medicine of Bucharest, Faculty of Land Reclamation and Environmental Engineering (USAMV_FIFIM), Bucharest, Romania

ASP 5: Styrian League for Nature Protection (NATURSCHUTZBUND Stmk.), Graz, Austria

ASP6: Water Management System Covasna (SGAC), Sfântu Gheorghe, Romania

ASP 7: Croatian Waters (CW), Zagreb, Croatia

ASP 8: Republic of Serbia, Ministry of Agriculture and Environmental Protection, Water Directorate (RDV), Belgrade, Serbia

ASP 9: Bavarian State Institute of Forestry (LWF), Freising, Germany

CAMARO-D – a partnership

A successful project can only be built with a good partnership!

CAMARO-D Kick off meeting, Budapest, 22nd March 2017

CAMARO-D partner meeting, Zagreb, October 2018

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