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REGIONAL COOPERATION IN TRANSBOUNDARY FLOOD RISK MANAGEMENT

Master Thesis

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Abstract

Current thesis uses the case study of the Tisza River Basin for a mapping of governance mechanisms, i.e. international institutions shaping flood management policy in the Tisza River Basin. Integration level of bilateral and basin level international institutions specialized on or partially focused on flood management was identified, along with an analysis of their influencing factors. The role of the EU as well as its interactions with the analyzed river basin organizations has been addressed. Results of a qualitative research have shown that the institutional setup available in the river basin allows for an integrated cooperation on basin level, whereas there are indications that pairwise integration of cooperation in flood management reaches higher levels than integration on river basin level. The current good cooperation in flood management in the basin is tightly related to the role played by the European Union`s water and flood management policies and the roles played of the ICPDR and the EU in a meta-governance process, whereas the level of integration of bilateral organizations of states is only moderately influenced by the EU membership of cooperating parties. The thesis opens the path for further research into stakeholder analysis of the governance in the basin as well for a suitable institutional architecture for a Tisza River Basin Joint Commission.

Kurzfassung

Die vorliegende Arbeit schafft eine Bestandsaufnahme der Governance-Mechanismen, also internationaler Institutionen die ein Einfluss auf Policy für Hochwassermanagement ausüben, anhand des Studienfalls des Einzugsgebiets für den Fluss Tisza / Theiß. Das Ausmaß der Integration analysierter Institutionen wurde identifiziert, sowie auch dessen Einflussfaktoren. Weiters wurde die Rolle der Europäischen Union und deren Interaktion mit den analysierten Organisationen miteinbezogen. Resultate der qualitativen Analyse haben gezeigt, dass der institutionelle Aufbau verfügbar im Flusseinzugsgebiet ermöglicht eine gut integrierte Kooperation auf Einzugsgebietsebene wobei es Hinweise darauf gibt dass die paarweise Kooperation der Länder auf bilateraler Ebene eine stärkere Integration aufweist. Die im Gegenwart vorherrschende gute Integration des Hochwassermanagements im Flusseinzugsgebiet ist eng mit der Rolle der Europäischen Union was die Wassermanagement- und Hochwassermanagementpolitik betrifft, als auch mit den Rollen die die EU und die ICPDR in einem Meta-Governance Prozess spielen, verbunden. Währenddessen ist die Zusammenarbeit der Länder nur moderat durch die EU-Mitgliedschaft der jeweiligen Partner beeinflusst. Die Arbeit öffnet den Weg für weitere Forschung in Stakeholder-Analyse des Governance im Wasserbecken sowie für die Erarbeitung eines idealen Institutionsaufbaus für eine Internationale Kommission für den Fluss Tisza.

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“…water ignores political boundaries, evades institutional classification, and eludes generalizations”

Aaron T. Wolf

1 Introduction

1.1. Background and problem definition

Rivers flow through various landscapes providing valuable habitat for fish and water plants and create wetlands along their path for a variety of wildlife. They collect snow- and rainwater from mountains and bring the much-needed water into endless meadows creating fertile and livable spaces for animals and people. Their water is used for agriculture – irrigation, energy production and, not last, as drinking water. The view and sound of water plays as well an aesthetical role, it offers endless opportunity for leisure activities for some and fills others with a sense of serenity and peace. The challenge comes when rivers disregard political boundaries and flow through several borders, which poses the task of sharing all benefits but also to cope with the risks brought about by the waters to riparian countries. A total number of 276 trans-boundary watersheds (Giordano et al. 2013) or 279, according to other sources (Bakker 2009), overlaying 148 waters, are currently known. A study by Bakker in 2009 found that out of the 279 known international river basins only 78 were represented by trans-boundary river institutions. A total of 43 river basins that frequently experience trans-boundary floods during the study period 1985-2005 did not have institutional capacity to deal with trans-boundary water issues such as floods. The average death and displacement tolls were found to be significantly lower in those flood-prone basins that did have institutional capacity to cope with the consequences of floods, in spite of more frequent and more powerful floods (Bakker 2009).

According to estimations by the United Nations Development Programme (UNDP) cited by Bakker (2009), about 196 people living in more than 90 countries were exposed yearly to catastrophic flooding. The flood risk is additionally increasing heavily, meaning that flood losses in economic terms are becoming higher and higher. This does not necessarily mean that there are more and heavier floods. The increased risk in economic terms is due, in general, to more capital being placed in floods` way, be it out of unawareness of flood risk or out of unfitting land use planning paired with a misguided trust in *human-driven transformations of hydrological systems.* A positive evolution is the fact that death tolls have been found to be constant or decreasing throughout the 20th century and since (Mitchell 2003).

Apart from the appalling numbers listed above, what is it that makes trans-boundary floods so problematic and worth dedicating a thesis to? Governments need to manage their own resources and defend their citizens from natural disasters. When those natural disasters are caused by floods from rivers, protection measures could mean anything from structural measures such as construction of protection dams, reservoirs or flood channels to non-structural measures such as interdiction for constructions in flood prone areas or subsidies

for relocating people already settled in flood-prone areas and re-allocating floodplains previously taken form the rivers. Political borders rarely coincide with hydrological borders and as such, states get to share both the benefits and the dangers brought by rivers. Hydropolitics researches conducted in the recent decades has found that from all water-related issues, water scarcity seems to be the most conflictive; the other end of the scale is represented by technical cooperation (including flood management), which is significantly less conflictive – up to 2% of inventoried events were conflictive in nature (De Stefano et al 2003, cited in: Schmeier (2013)). The odds for river basin flood risk management in international river basins are therefore not bad.

The factors that are expected and were found to determine whether cooperation for integrated water management takes place and lead to its success or failure include political will of involved countries, the economic state of each country and the kind of institutions that are set up for managing water resources (Wolf 2007; Earle et al. 2010; Schmeier 2013). The "*interplay between the sovereign rights and responsibilities of the state and incentives to consider one´s upstream or downstream neighbor(s)*" plays an important role in the success or failure of Transboundary cooperation, as state governments might face a perceived dilemma between state sovereignty and river basin level decisions (Norman and Bakker 2015, 199).

As flood management is mainly treated as a secondary topic in international river basin level agreements and institutions, the literature on international river basin management is widely used as a reference for internationally integrated flood management research (Bakker 2009; Alexander et al. 2016); the challenges of trans-boundary floods identified are mainly the same. Just as the case in pollution that crosses borders or water scarcity that originates from across the border, risks threatening human lives, health and economic welfare are involved. With responsibilities divided between different political and administrative actors, the necessity for a common delimitation of those responsibilities and common definition of the "rules of the games" becomes necessary. Aspects such as information sharing between countries for building up a relation of trust and cooperation and avoiding power asymmetries become crucial. What kind of institutions deal with which aspects of flood management, from planning to project implementations and conflict resolutions are all valid questions that arise when referring to trans-boundary water bodies. Whereas there is a large amount of literature dealing with these same questions referring to integrated water resources management (water quality, water scarcity/quantity, environmental protection of rivers) (Earle et al. 2010; Schmeier 2013,) and the conflictive or cooperative nature of those (Wolf, Natharius, et al. 1999; Wolf et al. 2003; Wolf et al. 2005; Wolf 2007; Giordano et al. 2013), only little has been done specifically focused on flood management. The findings of those few studies, such as the one by Marloes Bakker (2009) based on the Trans-boundary Freshwater Dispute

Database (TFDD), focusing on flood-prone river basins are therefore a good starting point for analyzing smaller river sheds. The Tisza River`s Basin is well known for its trans-boundary floods that connect and separate at the same time five countries. Flood management, even in a trans-boundary context has a long past in this area and is therefore an exciting case study to analyze integrated flood risk management in.

The main goal of this thesis is to look, firstly, into the relations between countries in the constellation of water and, more specifically, flood governance in an attempt to analyze the level of integration of flood risk management throughout the Tisza basin. In this attempt, the existing river basin level organization for the Danube, the International Commission for the Protection of the Danube River (ICPDR), bilateral commissions for water management formed by the Tisza countries as well as further initiatives within or outside of existing institutional structures have been scrutinized. To a lesser extent, the relation of these international institutions with the national governments in terms of policy making and implementation was included. Second, the role played by the European Union is given as well special attention to, in terms of its role as a governance actor in the ICPDR – partner states – bilateral water management commissions - triangle, that influences policy through multiple channels, such as legal obligations, and funding mechanisms.

The present thesis uses the hydrological definitions of the Register of International River Basins of the World, as cited by Wolf et al (1999). According to this, *"a river basin is the area which contributes hydrologically (including both surface- and groundwater) to a first order stream, which, in turn, is defined by its outlet to the ocean or to a terminal (closed) lake or inland sea. Thus, a river basin is synonymous with what is referred to in the US as a ´watershed´ and in the UK as a ´catchment´ "* (Register of International River Basins of the World cited in: Wolf et al. 1999, 389.). Using this definition, any smaller area or catchment of a river that flows into a bigger river before reaching the sea is a *sub-basin*. Throughout the thesis, the notion *river basin* often refers to such sub-basins; the two notions are used inter-changeably; the notions *watershed* and *catchment* are used as well occasionally throughout the text as synonyms. The *Register* further defined a basin as international, *"if any perennial tributary crosses the political boundaries of two or more nations"* (cited in: Wolf et al. 1999, 389.). Once again, the thesis uses the notions of *international basin* and – *sub-basin* interchangeably.

1.2. Research aims

The idea that initiated the present thesis was to achieve a clear overview of the current state of trans-boundary flood management in the Tisza River Basin in terms of governance. Based on the governance definition applied in this thesis, this includes agreements, national and international institutions and decision or execution bodies of

organizations. I borrowed Bakker`s working hypothesis of her 2009 published article on institutional capacity of trans-boundary river floods, stating that *"trans-boundary flood events are underrepresented as principal issues of institutions and treaties"* (Bakker 2009, 554). I expected to find in my case study agreements referring first of all to several aspects of water management and for flood management to be either included as one of the many aspects addressed or just briefly mentioned, perhaps even omitted. Wolf and his colleagues (Wolf et al. 2005) as well as Bakker (Bakker 2009) showed that basins at risk that have institutions at hand which can absorb "rapid changes", a term they coined for major unexpected events, such as bigger floods or droughts, were more likely to have instances of cooperation than of open conflict. Therefore the research focused on specialized flood-oriented institutional capacity, including agreements referring to or exclusively focusing on flood management as well as organizational bodies related to them.

Taking the working hypotheses formulated above I attempted to build an image of the current level of integration of cooperation focused on flood management in the studied Tisza Catchment Area. Whereas several informal, historically impregnated institutions and mechanisms can exist in internationally relevant basin, the current thesis only looks at formal ones. As Bakker points out, *"managing international river basins complicates water management because control of international rivers that cross political boundaries indiscriminately is tangled with power issues, economic opportunity, national security, society, and culture"*. She therefore concludes that one of the dominant roles of water institutions is to dominate conflict by clearly defining rules for every interaction/cooperation, which is another working hypothesis of this thesis. Bakker`s description of such institutions includes a cascade-like categorization of cooperation: from putting down the rules of cooperation into a formal document agreed upon (existence of an agreement), through joint and cooperative management of water resources and culminating in *"joint projects or even joint planning"* as a last, most complete stage of common efforts (Bakker 2009, 555). This categorization can be recognized in the methodology set up for analyzing the stage of integration of the cooperation work in the chosen case study in chapter 4.

The Tisza River Basin is the largest sub-basin or sub-unit of the Danube basin, widely recognized as the river catchment with one of the best-practice examples of basin-wide management throughout the water management literature (Schmeier, 2013; Earle et al. 2010). However, it has also been pointed out to be the river basin without an existing basin-wide flood management related agreement and where all agreements that explicitly address the topic of flood management are restricted to bilateral level (Bakker 2009); this refers as well to the lower, Tisza sub-basin level. Looking at the Tisza Watershed`s long history of floods, flood management measures (as early as the 18th-19th century) (ICPDR 2007), the expectation would be a different one. This expectation is doubled by the fact that since the

publication of the above-mentioned article in 2009 there have been important international developments in the area of flood management. One very significant such event is the introduction of the European Union`s Floods Directive (European Parliament and Council 2007) and the closing of the first planning cycle drafted thereby in 2015, which is expected to have shaken up the international flood management in the area. The existence of such a policy area over-arching legal framework and a control body, impersonated by the European Council, that has the authority of trialing its members to whether commonly appointed policy goals have been achieved, points to a governance at a higher level. Jessop`s multilevel governance analysis of the European Union is a guide at this point (Jessop 2014). He describes several changes in statehood in current capitalist states. One of those trends is a *"complex trend towards the internationalization of policy regimes"*. The trend involves states considering to a growing extent *"transnational constraints, consequences, and conditions of state action"* and therefore turning to "inclusion of foreign agents (own remark: there is no specification on the nature of these; they could be states or organizations) and institutions as *sources of policy ideas, policy design, and implementation"*. Throughout this the state does remain a key political factor *"as the highest instance of (…) political accountability* in Jessop`s view, keeping its role mostly through meta-governance, i.e. in a policy orchestration role; making sure to achieve the goals set through the synergies used between a complex variety of policies that belong to separate policy areas (Jessop 2014, 13-14).

The research question posed here is therefore a complex composite of questions that force one to look at several aspects of the flood management in the studied basin in order to disentangle the governance structures of authority, decision power and planning mechanisms applied to flood management in the trans-boundary region of the Tisza. The first question is therefore served here: *to which* extent is flood management *integrated* in this river basin*?* in order to then shift attention to *factors* influencing the level of integration, looking at the question *why* is there this level of integration and *what* or *which institution* influences the current level of integration.

1.3. Hypotheses

The present thesis has worked with several hypotheses whilst looking at the levels of integration of cooperative flood management. Each of the hypotheses is related to institutional or social factors that exercise an influence on the cooperation.

The first hypothesis formulated is based on a so-called "common wisdom" (Wolf et al. 2003): *states that cooperate in general with each other in terms of belonging to the same organizations, same customs and free trade agreements, would have automatically a better cooperation in terms of their flood management and vice versa.*

– Did the fact that three of the five countries in the Tisza River Basin became EU members change the level or quality of cooperation in the Tisza River Basin overall?
– Does EU membership of the countries involved in bilateral partnerships influence the level of integration of those bilateral partnerships
– Are partnerships between two EU members better integrated according to the selected criteria than mixed – EU-member and non-EU-member – partnerships

Wolf and his colleagues (2003) have studied the validity of this assumption on an international level and have found only a moderate positive correlation. As the current thesis turns the attention to a single case study involving merely a few countries, the correlation could still be valid and possibly even significant, influencing the level of integration in the studied river basin to a greater extent. Proximity theory applied to flood management cases seems to support such an assumption. Thaler et al. (2015) look at proximity or, conversely, distance, and the partnerships that emerge under the influence of institutional, social, technological and relational proximity. This hypothesis is based on the *institutional* and *technological* proximity as defined in their research to *"define regular, normative and cognitive aspects"* – referring to the former – and expressing *"the shared understanding of technological experiences, knowledge and expertise"* – referring to the latter (Thaler et al. 2015, 842-843). The assumption leading to this hypothesis is that these two types of proximity would be given between states that belong to one customs and free trade agreement area, additionally having committed to implementing similar laws and institutions, such as the case is within the European Union. The level of proximity would, however, be different based on how much these adjustments actually took place in practice.

The second hypothesis relies on the assumption that each country of the catchment area takes a generally different approach to flood management, evolved over a long history of coping with floods and deeply entrenched in structures and mechanisms. The currently accepted level of knowledge in flood management relies more and more on a combination of non-structural measures with structural measures, in an environmentally friendly (-er) way, the so-called *integrated flood risk management.* This focuses on prevention, protection and preparedness, including forecasting and includes different measures, such as awareness raising, land-use changes or floodplain restorations, additionally to the traditional engineering flood protection measures. The new flood management approach is mirrored in the EC`s Floods Directive, strongly connected to the Water Framework Directive (European Parliament and Council 2007; ICPDR 2015, 77-78). For some – or all – of the countries studied in this case study, this involves a shift in the way they had prepared for protection against their floods. Harris and Penning-Rowsell (2010) call this "*institutional inertia"*, acting as barrier in the context of adaptation to climate change. I use it in an assumption that the same factors would have an effect in international cooperation and would eventually lead to

potential conflicts or bumping points between countries in their attempt to join efforts for a comprehensive basin level flood management planning. *Hypothesis 2* is therefore: *the type of flood management that is more likely to be applied nationally is historically determined and moves in old patterns, which potentially leads to conflicts in flood management dealt with in international context, usually related to the same topics.*

- Do flood risk management measures implemented in each country`s part of the river basin show a “pattern”
- If yes, is this pattern determined other than by geographical and hydrological characteristics of the river sections
- Do such patterns or “old habits” constitute conflicting points within trans-boundary common planning and projects, or act as obstacle therein

1.4. Structure of the thesis

The remainder of this thesis is structured as follows: chapter 2 offers a literature review on river basin organizations and river basin governance as well as flood risk governance, ending with a short international outlook into selected river basins. Data and methods used are described in chapter 3, which contains a detailed description of the conceptual framework and the methodology used in the research for this thesis. The second sub-chapter is dedicated to a summary presentation of the case study area particularities. Chapter 4 summarizes the results and offers a discussion on the results. Chapter 5 concludes the thesis and offers an outlook for further research.

2 Literature Review

2.1. Thematic of Conflict and Cooperation in International River Basins. Integrated River Basin Management

The state of the art knowledge in water management acknowledges integrated river basin management – an interdisciplinary approach to water management – to be the best way of managing water resources, as it deals with all roles filled by water and all facets of potential water usage and ecosystems issues, while considering all stakeholders` interests. The term *integrated water resources management* (IWRM) was first coined in 1977 at a UN Conference and covers, according to the Stockholm-based Global Water Partnership *"a process which promotes the coordinated development and management of water, land and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"* (GWP, cited by Ganoulis et al. 2011, 19.). Water management or, more specifically, integrated water resources management / integrated river basin management builds on a structured approach to address different aspects of managing the resource water. It is, *"by definition, a conflict management"* (Wolf 2007, 3.5) as it aims at accommodating all usage areas of the water resource. Its definition does not contain an explicit reference to floods or flood management in particular, neither to river basins (or catchment areas). Floods – and flood risk management, as such – however, are strongly related to other points specifically included, such as land management, economic and social welfare. Modern water resources management rediscovered nature`s talent to manage itself and recommends increasingly sustainable and environmentally friendly measures for reource management. The value of naturally meandering, bifurcating and partially even flooding rivers was recognized in the recent decenies and measures such as floodplain restorations or reconnection of oxbows became a valid water management measure that reduces, in parallel, flood risk (ICPDR 2015). Such measures do not completely replace inginerial measures – renaturation measures are executed with significant inginerial planning and effort; pure constructive flood defense also cannot be replaced in highly exposed areas that are densely populated or shelter economically or culturally valuable assets.

There is a lot of potential for international conflict stemming from water quality and quantity issues. Coping with risks brought along by the water is a major endeavor by itself for the institutions carrying its responsibility. Should those risks disregard political boundaries – and those are known for being disregarded by nature´s forces – the endeavor becomes a real millstone around any institutions` neck. Parties involved, divided by political and administrative borders, must choose between cooperating with their neighbors and coping on their own taking measures confined to their countries` territories. Conflicts between riparian

states sharing a river in an upstream-downstream position are not uncommon. Water is needed for various functions: irrigation, hydropower and covering other needs and rights of its users. The two most documented water-related conflict sources are water quantity and water quality. As Wolf (2007) notes, timing of water flow plays as well an important role and can amplify conflict between diverging water uses. Most common example is the conflict caused by increased water demand for irrigation in summer and increased water supply in the winter. The Syr Darya is a classical example of such a conflict prone river where upstream Krgyzstan`s winter hydropower use must carefully be balanced with downstream Uzbekistan and Kasakhstan`s spring and summer time irrigation demand (Wolf et al. 2005). It is a hydrological fact that many of the flood protection or other water use measures can have an effect – negative or positive – downstream and even upstream. Some of those effects are easily foreseeable, such as the water quantity consequences described. Other effects occur in a less direct manner but with obvious causality: decreased water quantity can lead to quality issues, such as changed salinity, which conversely affects fish ecology of a river. Such an effect was noted by Wolf et al. (2005) in the Incomati River in Mozambique, as a result of dams built in the South African part of the river, that had reduced fresh water flows. Hydrological constructions that disregard continuity of the river to allow free movement of fish can have economic impacts, by affecting fishery and related branches, such as tourism. The Mekong River basin has suffered such an effect after construction of the Pak Mun Dam in Thailand in 1994: upstream fishery was gravely affected, which had an effect on the communities heavily dependent on fishery (Wolf et al. 2005). Floods occupy as well an important place among the challenges carrying conflict potential posed by rivers – riparian countries with areas prone to floods or that release as well floods into their neighboring countries must protect their own citizens and national wealth, while keeping in mind their good relations with neighboring states. If floods enter from their neighbors, a country can only hope for the neighbor`s similar intentions in return. Therefore it becomes obligatory for national flood protection to be planned with consideration of any potential impact it could have on other riparian states a watercourse is shared with (Bakker 2009).

Flood protection on a river basin-level, in a coherent approach makes unsurprisingly more sense than locally isolated strategies and measures, confined to a state`s territory, for the same reasons that made river basin management the state-of-the-art approach to water resource management. Maintaining synergies between flood protection effort between up- and downstream riparian neighbors should help avoid unexpected side effects or unplanned outcomes of policies. Different types and levels of cooperation can be used to move towards a more integrated, basin-level approach of flood management; based on these, different advantages can be drawn. Sharing information brings an advantage and is known to increase trust among partners, or, conversely, if not shared properly, lead to conflict

situations (Wolf et al. 2005). Additionally calamity management is highly dependent on reliable and timely shared forecast data and information. Knowledge sharing can lead to opportunities for more cost-effective solutions and optimization of implementation location can be facilitated by an enlarged planning space (Bakker 2009); cost sharing between upstream and downstream partners is a difficult topic per se, but can become a reality in case of well-working co-operations. In spite of the seemingly obvious list of advantages that can arise from trans-boundary flood management cooperation, flood protection remains a predominantly national, even internal affair of each country, carefully designed to allow for control to be held fully by national powers. One possible reason, as put by Bakker, is, that riparian states may fear of being forced to *surrender sovereign powers,* which would limit their options (Bakker 2009, 556) for coping on a national level with what they consider their internal affairs.

Insufficient water quantities are a well-known example of internationally handled topic and are often anecdotally mentioned as a leading cause to unsolvable conflicts. Aaron Wolf of the Oregon State University and his colleagues conducted a worldwide research on water-related international conflicts in the attempt to assess the reality behind the anecdotal and selective evidence available until then for water-related conflicts and their extreme form, the so-called *water wars*. Several cases worldwide of riparian parties having difficulties settling quantity or quality problems have indeed been noted in the literature (Wolf et al. 2003; Wolf 2007). Some evidence was found that insufficient water quantities or, conversely, too much water in the form of floods do cause distress in international relations, acting as an *"irritant"*. Water quantity issues – including drought or insufficient water as well as flood – made up the biggest part of *conflictive events*[1]. Water-related violence appears to be less of an international, as more of an inter-regional, inter-tribe or inter-sector violence. Water may act as a partial cause of tensions or instabilities or exacerbate previously existing tensions, however, water wars per se are virtually non-existent, especially in recent times (Wolf 2007). Such tensions might destabilize states internally, which could end up having an effect on a regional international level. When looking at the bigger picture, focusing on countries as actors on a global level and without handpicking extreme cases, such as the Nile Basin shared by Egypt and its neighbors or the Syr Dar´ya in Central Asia (even these no longer qualify as *extreme* cases), acute violence seems to lie in the past. Countries tend to put serious effort in conflict solving and cooperation, usually also creating a legal and institutional framework for this purpose, even in spite of ongoing political tensions, as found by Wolf et al. in their detailed water conflict study (2003). The same study showed that most assumptions

[1] The cited work by Wolf et al. (Wolf, Yoffe and Giordano, 2003) is a groundbreaking study of water-related international events and does rely on a precise definition of conflict and conflictive events, even differentiating between intensity of events from extreme conflictive to extreme cooperative, on a self-developed BAR (basins at risk) scale. Their work resulted in the so-called Trans-Boundary FreshWater Dispute Database (TFDD), available online.

of the prevailing wisdom about water conflict and cooperation can`t be statistically confirmed. Democracy, good political or economic cooperation or water stress on its own could not be confirmed to have a statistically significant effect on conflict or cooperation between nations within internationally shared river basins. Instead, the focus shifted to *institutional capacity*, defined in this case as a composite of a country`s economic strength, the existence or absence of joint water management bodies or treaties, general friendship/hostility over non-water issues and types of governments (Wolf et al. 2003, 42-43). This and further research on the influence of water management institutions on the conflictive or cooperative nature of events among countries sharing catchment areas (Wolf et al. 2003; Wolf 2007) has found strong evidence that such institutions tend to reduce conflict and vulnerability in areas prone to water-related problems, as well as to increase resilience.

Marloes Bakker`s study (2009) shifted attention to floods in the same context of water events related conflict. She built her research on previous work on water resources management using the same TFDD as Wolf and his colleagues did, to make an inventory of flood-prone river basins. Her study on (flood management) institutional capacity came to similar results for events related exclusively to trans-boundary floods. River basins with a water management agreement and/or institution in place that focuses mainly or at least partially on flood management were found to have a significantly higher resilience than river basins without such flood-related institutional capacity in place.

A look at the factors that influence cooperation could provide an insight into causal relations between those factors and the current state of cooperation/integration of flood protection in a river basin, therefore potentially offering policy recommendation for improvement of cooperation by offering hints on how to enhance integration. A vital element that riparian states have to build their cooperation on is a common understanding of the problem. This does not refer exclusively to the problems posed by hydrological behavior and flow regime of a river that is prone to producing major floods, but include social, economic and, not less significantly, environmental aspects; the needs and interests of all stakeholders involved must be understood (Bakker 2009).

A study that looked at three river basins in Austria (Thaler 2015) identified influential factors and drivers of cooperation (inter-local cooperation) development in a national context. As the study focused on rivers that partially stretch across federal states´ boundaries, similar factors could be expected to be found and were, indeed, partially identified in the literature (Bakker 2009) on international level. Crises, such as major flood events, leadership – or, as put by Bakker on international level, *political will* (2009) –, economic considerations – cost optimization and sharing – as well as risk sharing are some of the drivers that can both foster or hinder integration. The afore-mentioned political will, paired with the ability of involved

partners to form a common political vision and strategies have, as well, been identified as crucial elements (Thaler 2015).

Based on evidence from the literature that states rather tend to cooperate than to maintain conflict situations for sharing water resources and managing trans-boundary floods within a river basin, attention should be turned to the types of cooperation and their effect on the level of success. There is a large amount of research in literature and a vast base of books published on best-practice and knowledge-sharing for river basin management, international water management as well as integrated river basin management for internationally shared or local river resources (Earle et al. 2010; Ganoulis et al. 2011; Schmeier 2013). Most of the publications on institutional capacity for water management do not focus specifically on floods and flood management, with some notable exceptions (Bakker 2009, Thaler 2015). The next sub-chapter offer an overview on theories of institutional capacity that revolve around or can be applied for international flood management; the sub-chapter that follows focuses specifically on governance and creates a link between the two the two concepts.

2.2. Water Basin Institutions

International institutions have become important players of environmental and resource governance, almost mushrooming in various policy areas and in many different shapes and contents. De Stefano and her colleagues (De Stefano et al. 2014) put institutional structure of the water system – which they define as a conglomerate of policies, laws and organizations on the first place on the component item list of water governance. Their framework uses two further components: standard water functions and a set of key characteristics of decision-making processes.

The notion water management *institution* is usually treated in literature as a one that includes international water management treaties and international management bodies (Bakker 2009); occasionally the term *institutions* is used to refer solely to river basin organizations (RBOs), separate from *agreements* (Wolf 2007; Schmeier 2013).

This does not make drafting a formal definition of RBOs an easy task. One proposal of definition is that of *"systems of established and prevalent social rules that structure social interactions"* (Hodgson 2006, 2). In this definition, "*language, money, systems of weights and measures, table manners, and firms (organizations) are thus all institutions"* (ibidem). Susanne Schmeier (2013) addresses, as well, the difficulty of defining the actual meaning of *international (environmental) institution.* The difficulty arises especially due to the broad spectrum the definitions move on: from the very loose definition, that classifies institutions as "sets of rules, norms and decision-making procedures that shape the expectations, interests, and behaviors of actors" (Goldstein at al., 2000 cited in Schmeier 2013, 22.) to the definition

in the form of institutionalized cooperation, in which “international organizations represent the most formalized form of intergovernmental cooperation, in which states have attributed legal personality to organizations so that they can pursue jointly agreed upon cooperation goals and activities”. (Schmeier 2013, 22) This latter definition is the one used by Abbott et al. (2010) in their pursuit of international organizations as orchestrators. Susanne Schmeier does introduces in her expose of international river basin governance the notion of international regimes as a state of institutionalization between the two cited above, pointing to them as a form of more long-term and formalized cooperation efforts, while “still including forms of institutionalized cooperation below the level of formal international organizations”. She concludes regarding these that Krasner`s 1983 definition, which has dominated the discussions in the years following its publication, is the most accurate one. According to this international regimes are “*sets of implicit or explicit principles, norms, rules and decision-making procedures around which actors` expectations converge in a given area of international relations”* (cited in Schmeier 2013, 8; 22.)

The organizational form of river basin organizations has, as well, received some attention in the literature (Andresen and Skjaerseth 1999; Schmeier 2013), with a focus on the decision-making, executive and administrative bodies they rely on. This three-fold organizational structure is also the one used by most RBOs (Schmeier 2013). The highest level, decision making body is most of the times a commission or council; the executive or intermediate operationalize political decisions into implementable activities and are represented mostly by working groups or expert groups. These are thought to be especially in use in river basins with high levels of technical expertise in riparian states – they strengthen the technical input orm member states and ths reduce the burdens on the RBO (Schmeier 2013, 93). The administrative functions is most of the times fulfilled by a Secretariat. Within this, there is a susbtantial literature dealing with Secretariats` roles in river basin and other international organizations (Andresen and Skjaerseth 1999; Bauer 2004, Schmeier 2013; Schmeier, Oregon State University: TFDD Database 2013). A secretariat “is an international organization established by relevant parties to assist them in fulfilling the goals(s) of the treaty. Secretariats as organizations can be conceived of as actors within broader institutional structures at work. (…) secretariats represent the stable core of environmental cooperation” (Andresen and Skjaerseth 1999, 2). This definition emphasizes secretariats´ status as a separate organization which is not the approach adapted in this thesis. Nevertheless, it also expresses the essence of a Secretariat: being appointed by International partners in order to assist them in fulfilling the goals also set by them.

Within this thesis Marloes Bakker`s approach (Bakker 2009) is taken as a guiding point for usage of term *institution*. She uses the term *institutional capacity* to refer to international water management bodies and freshwater treaties altogether. Additionally, herein and for the

remainder of this paper the word *agreement* is used to denote any form of signed legal international (bilateral) treaty or agreement between at least two riparian countries referring to or including flood related events. Conversely, any management body established on a river basin level is a *river basin organization* (RBO). Similar management organizations that work on a bi- or multilateral, but lower than river basin level, are denoted throughout the thesis as *bi-(tri-, multi-)-lateral water management organizations or committees/commissions*, depending on the official naming used.

2.3. Water Basin Governance

Additionally to definitions of institutions, *governance* is a term – or phenomenon – that has known many different definitions since its first use, having become *a ´catch-all concept for various forms of steering by state and non-state actors´* (Steurer 2013, 388). The term has got a lot of attention dedicated to in social sciences (Stoker 1998; Jessop 2009; Jessop 2014), Countless social science publications deal with definitions of governance as well as mechanisms and its application in different policy areas (Héritier and Eckert 2008; Schmeier 2013). The term is most often referred to as a form of ´governing without government´ (Rhodes, 1997 cited in: Stoker 1998; Hysing 2009), i.e. a change in the way of functioning of governments, a new process of governing. Since New Governance (Abbott and Snidal 2009; Jessop 2009) the term `governance` denotes forms of steering that have little or just partially to do with government. The government`s command and control (or *"authority and sanctions"*) no longer solely cover all areas, but other, non-authoritative governance mechanisms become important (Stoker 1998, 17).

There is agreement in the governance literature on a definition of governance as "development of governing styles in which boundaries between and within public and private sectors have become blurred. The essence of governance is its focus on governing mechanisms which do not rest on recourse to the authority and sanctions of government*"* (Stoker 1998). A definition of water governance is offered by Gerald Kaufmann, as "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society*"* (Kauffman 2015, 5690). Referring to integrated water resources management, Iza and Stein use the term *governance capacity*, which is made up of `policies and law, combined with institutions, implementation, and enforcement mechanisms´ and represents ´a society`s level of competence to implement effective water arrangements´ through those elements (Iza and Stein 2009).

The present thesis relies on these two latter definitions, as they comprise the elements of steering, and policymaking that encompass stakeholders from various sceneries of water use and water management in an apparently exhaustive manner. Based on Kaufmann`s

definition of water governance international flood risk governance is defined here as the totality of formal and informal social, administrative and economic systems that exert an influence or control flood protection policy and on the implementation of flood risk management, on both international and national level. The loose form of this definition of flood risk governance is very broad and includes e.g. self-governance by people living in flood-prone areas, therefore it becomes necessary to delimitate levels of governance – individual, local, regional, national and trans-national.

Usage of the term governance goes hand in hand with the notions of responsibility and accountability. When governing is done ´without governance´, as interpreted in several definitions of governance pointed out before, the question *who* carries responsibility in policy decisions` effects becomes interesting. European flood risk management, which is the main focus of current thesis is far from becoming a case for governing without government, as will be shown later in the thesis. The idea of the shift in responsibility brought along by governance (Pellizzoni 2004; Johnson and Priest 2008) deserves attention though. Pellizzoni (2004) proposes an analysis of responsibility`s four dimensions with regard to changing policy approaches: care, liability, accountability and responsiveness. All four dimensions can be traced in modern states` functioning. The dimension liability *"*entails a strong authority – a state that knows what to ask for, and how to apply controls and sanctions. The weakening of this type of authority corresponds to the shift from `governing` to governance, from centralized, sure-footed institutional command, control and sanctioning to loose handling of interactions between interdependent actors". The paradigm shift that came with modern flood risk management, as proposed by the European Union and required through its Floods Directive (European Commission 2016), i.e. the move from a discourse dominated by flood defense to one where the management of floods, their probabilities and consequences is in focus (Johnson and Priest 2008) brings similar shifts in responsibility. Whereas Johnson and Priest (2008) do not differentiate between dimensions of responsibility, it is exactly the dimensions liability and care, which are identified as increasingly divided between state and the citizens or, public and private domain. They argue based on the case study of England, that as focus shifts form defense to preparedness, part of the responsibility for flood risk management is transferred to other areas such as land use planning or, directly with the citizens, private risk management behavior, such as avoidance or usage of insurance.

Putting the emphasis on the type of actors involved in governance, the so-called actor constellations, Steurer (2013) proposes a typology of governance into seven distinct types using the study area of sustainable business (or of making business sustainable through governance mechanisms, for that matter). Four of the categories represent types of regulation with various degrees of state (or governmental) involvement, from purely governmental regulation combining hard and soft regulation, through public co-management

between civil society and government, public co-regulation, involving industries and government, to a tripartite co-regulation involving both civil and industrial actors additionally to government. The other three types of governance include the *pure* forms of civil regulation and that of industry self-regulation as well as a private co-regulation. Other governance researchers, such as Stoker (1998) use governance typologies based on criteria such as power relationships, focusing on the interactive character of governance (this particular approach also views governance as a dynamic interactive process instead of a static setup). The types emerging from this perspective are a type of governance based on principal-agent relations, another based on inter-organizational negotiation and a third type that works based on systemic coordination. From international water management or flood management point of view, power dependence, i.e. the fact that parties/organizations involved in governance mechanisms do depend on each other and need to organize resource exchange, negotiate purposes and play by rules of the game occasionally also defined by themselves (Stoker 1998), does play a significant role. And whereas power asymmetries mentioned in reference to trans-boundary water basins (Earle et al. 2010; Wolf et al. 2003) are not the same as the social science power dependence, the two are strongly inter-related. I expect that in case of international river basin management a governance type based on inter-organizational negotiation, perhaps combined with systemic coordination would be met in practice. A principal-agent relation in these terms, on the other hand, might correspond to a setup involving a water hegemon (Cascao and Zeitoun 2010) acting as the principal against its downstream riparian neighbors in the role of the agent(s).

An exciting term used in the social sciences of governance is *meta-governance* or *orchestration*, both denoting *"the governance of governance"* (Meulemann 2008, cited in: Steurer 2013) mentioned before. This term does cover hybridization as well, i.e. forms of governance that imply different combinations of governance mechanisms based on the typology by the governing authority mentioned before. These forms are the kind of governance setups sometimes mentioned in literature as *"governance in the shadow of hierarchy"* (Jessop 2014; Héritier and Eckert 2008). The *shadow of hierarchy* refers to initiating steps in the form of enabling regulation or policy framework by a government (or central authority) for self-regulation; the term has also been used in the form of *looming shadow of hierarchy* to describe the credible threat of sanctions or hard regulation in case of non-compliance or unsatisfactory outcomes of self-regulation. In this form of governance a key role is still played by traditional governments as rule-makers who prescribe policy directions, set the framework for institutions and define the rules of the game for governance actors. Governments do also ensure implementation of policies through control mechanisms and act as a credible threat for retaking governance control in case of an adverse outcome (Héritier and Eckert 2008).

For the purposes of this thesis focus is on a different meaning, referring to "*overseeing, reflecting on and orchestrating different types of regulation"* (Steurer 2013, 402). The definition cited is, again, applied, to the role of governments in governance, described in this case as a role of control but also orchestration, that can be understood further on as a role of *facilitator*, in the restricted sense of recognizing synergies and enabling communication between different governance mechanisms. Taking forward the notion of meta-governance on an international level, a similar role could be expected by multi- or international organizations such as river basin organizations or, why not, intergovernmental organizations, such as the European Union. Jessop (2014) uses the term *multilevel meta-governance* in relation to the European Union, in an attempt to identify changes in reorientation of state power in contemporary international politics. Increasing numbers of European projects and guidelines are seen as entitling the EU to monitor national and regional state activities and partnerships in targeted policy areas (Jessop 2009). According to Jessop (2009), this distinctive form of meta-governance is reflected in a so-called "open method of coordination", a key operating principle of the EU; non-compatible with attempts to interpret its role in terms of traditional criteria associated with sovereign national states. Also suggested by Jessop and along the same line of thoughts, governance exercised by the European Union is identified as a type of *"multilevel governance in the shadow of national government(s)",* whereby the EU represents the *nodal scale* in overall exercise of state power, leaving the formation of the *dominant scale* to the national states (Jessop 2014, 4). Nodal scales – as opposed to scale dominance, related to *"the power which organizations at certain spatial scales are able to exercise over organizations at other, higher or lower scales (…,) – are non-dominant in the overall hierarchy of scales but nonetheless serve as the primary loci for the delivery of certain activities in a given spatio-temporal order or matrix"* (Collinge 1999, cited in: Jessop 2009, 83). Focusing on economic and social policy areas, Jessop finds that the EU has built up the necessary governance and meta-governance capacities enabling it to influence those policies in most areas and on most scales. Some of the features mentioned that give it a special influence are its location at the heart of information flows, "*fiscal poverty"* that reduces public scrutiny, and "*an increasing adoption of European projects and guidelines which entitle the EU to monitor national and regional state activities and partnerships across an increasingly interconnected set of policy areas – thereby giving a means to steer national policy and endow it with greater coherence"*, i.e. to orchestrate (Jessop 2009, 84).

The present thesis focuses on the trans-national level, i.e. institutional capacity, including non-state governance organizations dealing primarily or secondarily with flood management in international river basins. The focus is reduced on flood governance on the highest levels: transnational and regional, only touching on details of flood governance on

national level where necessary for better understanding. Moreover, *regional* throughout the thesis may refer to trans-boundary regions when referring to river basins. We therefore have a closer look at governance – in institutions and mechanism – dealing with flood prevention, protection, preparedness, emergency response (to a lower extent) and recovery, thereby leaning on the EC`s definition of flood risk management (European Commission 2016), corresponding to the flood risk management cycle (Kienholz et al. 2004). Roles played by the ICPDR as opposed to and in completion to that of played by the bilateral water organizations as well as its interaction with the European Union are given attention to. The direction is towards a summarization of lessons learned,

2.4. Collaborative / Adaptive Co-management in Water Basin Governance

The literature on environmental governance partially overlaps with literature on adaptive co-management or, as put by Huitema et al. (2009: 2), “the boundaries between (them) are somewhat vague”. The literature on adaptive co-management in water governance, in its turn, partially overlaps with research on river basin management or integrated water resources management (Huitema et al. 2009). Adaptive management is the outcome of merging two separate concepts: adaptive management and co-management (Plummer 2009). Co-management is basically a concept that “emphasizes the sharing of rights, responsibilities and power between different levels and sectors of government and society” (Huitema et al. 2009). When referring to natural resources, the term implies sharing of both rights and responsibilities for the natural resource or the environment by those using it or having a right for it (Plummer 2009, 1). The concept of adaptive management emphasizes learning, as its name suggests. Structured experimentation is used in a flexible way for achieving development / learning (Huitema et al. 2009). Plummer (2009) offers a definition of both concepts and of the joint concept of co-management in a synthesis that both summarizes current definitions of the concepts and integrates their definitions` development over time in the explanation. Co-management has evolved, according to his synthesis, from a concept of “power-sharing between state and local resource users and the range of possible arrangement”, evolving over time to include a wider range of actors as well as to denote a continuous problem-solving process and arriving in the present to an inherently dynamic co-management process of “knowledge generation, social learning, and adaptation for transformative learning” (Plummer 2009, 1). The hybrid concept of adaptive co-management joins the features that define these two concepts (processes) to form a “governance system involving heterogeneous actors and cross-scale interactions” (Plummer 2009, 1), i.e. a governance system with an inherent dynamics in learning and adaptation combined with the involvement of inter-sectorial actors, representing state, private and civil

domains and different geographical or administrative scales (Huitema et al. 2009; Plummer 2009).

Adaptive (co-) management[2] implies several i*nstitutional prescriptions*: collaboration, experimentation and a bioregional approach to resource management (Huitema, et al. 2009). Collaboration refers to inter-sectorial alignment and cooperation, made necessary by a division of authority over and responsibility for different aspects of resource management between separate governmental actors. Additionally, collaboration refers to the aspect of participation and expresses the necessity for collaboration between governmental bodies with involvement of non-governmental stakeholders, such as individual citizens and stakeholder groups. Experimentation – or, adaptation – offers two separate interpretations. In the first interpretation, experimentation denotes a research methodology (Huitema, et al. 2009), or the iterative testing of policy response upon implementation in the policy or governance field. This part is also connected to policy evaluation: implemented measures are proofed for their efficiency; their evaluation shapes future implementation (Fischer 1995 and Greenberg et al. 2003, both cited in: Huitema et al. 2009). On the other hand it denotes an approach to management or, more precisely, an alternative interpretation of management as experimentation per se. According to this, management is a consecutive hypothesis testing, due to the lack of complete information that characterizes situations leading to management decisions. The authors note that this is not the current reality, but relies on the central planning management /policy approach of the post-World War II era (Huitema et al. 2009). The institutional prescription that ties “river basin management” and “integrated water resources management” to adaptive (co-) management is the focus on bioregional approach, even in cases when a bioregion crosses administrative boundaries (Huitema et al. 2009). This corresponds to the river basin approach in addressing water-related issues and has known quite some success in practice; the ide lies at the base of water resources management in the currently accepted level of knowledge in the water resources domain and is put into practice in river basin agreements and organizations worldwide (Earle et al. 2010; Schmeier 2013). The idea has been successful even in EU-wide water legislation, which relies on the concept of river-basin level management of water resources (European Parliament and Council 2000, European Parliament and Council 2007).

[2] The form adaptive (co-) management instead of adaptive co-management is used by Huitema et al. (2009) to point to an alternative, non-technocratic definition of the notion, that relies on a previous deifnition of adaptive management by Lee (1993) (cited in their paper). Huitema et al. (2009) differentiate between what they call technocratic and non-technocratic definitions of adaptive co-management, pointing to the main difference between them: the former focused on learning through experimentation and learning only, whereas the latter corresponds to a previous definition of adaptive management that contained “both the learning and linkage dimensions”.

2.5. River Basin Organizations – A Short International Outlook

This chapter offers a very brief review of the research that has been conducted by several water management institutional researchers over the recent years. Aaron Wolf and the author collective grouped around the Oregon State University`s Trans-boundary Freshwater Dispute Database (TFDD) have looked mostly at the influence existence of institutions has on river basins. They found evidence, as previously pointed out, that river basin institutions tend to reduce conflict and vulnerability and increase resilience in the face of changes in areas that face different problems related to water resources (quality- as well as quantity-related problems) (Wolf et al. 2003; Wolf 2007). Bakker (2009) reached similar conclusions in her study on flood-related river basin institutions.

Schmeier (2013) uses the available river basin databases[3] to conduct a comprehensive study about river basin organizations (RBOs) and their effectiveness across the globe. She synthesizes based on the RBOs analyzed, the organizational structures most often used. Most RBOs rely usually on a "three-fold organizational structure". This encompasses a high-level decision-making body (a Commission or Council), an intermediate body operationalizing political decisions into implementable activities (most often Committees), and an administrative body fulfilling secretarial tasks (most often a Secretariat) (Schmeier 2013, 91-93). The present thesis uses this synthesized structure for identifying organizational bodies in the case study river basin.

Across the water governance literature, the Danube River Basin and its ICPDR are a common example of well functioning river basin organization (Schmeier 2013, Wolf and Newton 2010). The fact that an international organization such as the ICPDR can aid countries in achieving goals and implementing legislation has been also given special attention to (Wolf and Newton 2010). This fact is analyzed closer in present thesis as well. Further examples that often reoccur in the literature include the Nile River Basin, the Mekong River Basin, the Rhine River Basin as well as the International Joint Commission between Canada and the United States, the latter governing 11 rivers.

The International Joint Commission between Canada and the United States is another one of the success stories often mentioned. The main factors mentioned as origin to the cooperation`s success are independent commissioners, decoupled from politics and therefore able to focus on long-term solutions for the managed river basins as well as joint fact finding and research. The Joint Commission is based on general guiding principles that allow flexible adaptability to new environmental concerns, information or situations (Wolf and

[3] The chapter on RBOs mentions following databses: FDD and its treaty database, the Food and Agricultural Organization (FAO) Treaty Database (FAOLEX), the InternationalEnvironmental Agreements (IEA) Database developed by Ronald Mitchell at the University of Oregon; the UN Database of multilateral treaties deposited with the UN Secretary; and the UNDP Register of International Treaties (UNDP 1996) (Schmeier, Governing International Watercourses - River Basin Organizations and the sustainable governance of internationally shared rivers and lakes 2013)

Newton 2010). The nine Nile riparian states did not manage to establish a common organization; the river basin is the location of ongoing negotiations and struggle for agreement and has been classified as a “problematic” river basin along basins such as the Aral Sea or the Mekong basins (Schmeier 2013). Both the Nile and Mekong are river basins that suffer form the fact that one riparian is way more powerful than the rest of the states in the basin (Schmeier 2013). Riparian states have generally differing expectations regarding Nile`s management, with downstream Egypt basically opposing every upstream riparian states` plans. The current negotiation institution, the Nile Basin Initiative tries to balance member states interest in a struggle to reach a cooperative framework agreement (CFA), i.e. to find a joint river basin governance framework for the river basin`s integrated management (Cascao and Zeitoun 2010; Schmeier 2013). Unlike the Nile states, states of the Mekong river basin have managed to establish a Mekong River Commission. However, there is first of all lack of involvement from upstream riparian states, including the powerful China and, secondly, there is virtually no alignment between policy goals of the MRC and national governments in terms of water legislation. These are only two, but likely the most important factors that hinder effective integrated river basin management in the Mekong basin (Wolf and Newton 2010).

Interesting from the perspective of the case study for this thesis are two other river basins that are managed by one additional organization additionally to the already well-functioning ICPDR: is the Sava River Commission. The Sava is the second largest sub-basin of the Danube River Basin and the four partners of its River Commission are already partners in the ICPDR. The International Sava River Basin Commission (ISRBC) was established in 2003 based on the Framework Agreement on the Sava River Basin, signed in 2001 by the Former Yugoslav Republics of Serbia, Slovenia, Croatia and Bosnia Herzegovina. The Commission has an own Secretariat and specialized expert groups for areas such as river basin management and flood management. The history of the river basin organization is strongly connected to the conflict potential of the area and the fact that external funds were available at the time of the organization`s creation (IP6, 2016; International Sava River Basin Commission 2008). Both of these factors contribute to the fact that a need for clear rules of cooperation was recognized and the initiative formalized.

3 Data and Methods

Two steps were applied for the analysis conducted for this research. In a first step, an analysis of structural components was conducted, with main focus on institutions, but including a scanning of policies and laws, as suggested by De Stefano et al. (2014). This is described below in the sub-chapter referring to policy analysis. The second step was the assessment of the level of integration of Transboundary cooperation work on the bilateral and river basin wide levels, based on the framework proposed by Thaler (2015). This is described in detail in the sub-chapter referring to conceptual framework. Both steps build on policy analysis; the assessment of the level of integration of cooperation work in the area of flood management additionally relied on qualitative research with the use of semi-structured interviews.

3.1. Qualitative Research Design

Semi-structured interviews were the chosen research method for information collection from international and national experts active in the Tisza Basin. On the one hand, this was due to the fact that the research conducted via interviews was primarily qualitative, however both strictly factual and perceived facts were of interest for the subject matter. The semi-structured interview with its main strength, its flexibility (Hofisi et al. 2014) allows posing basically the same or similar questions grouped around a few main thematic areas to all interview participants. The flexible and open format still allows for further themes to be brought in by the interviewee based on the direction of the discussion or for the persons interviewed to elaborate on stories important to them. This was a strong argument for applying such interviews for the present research. One further argument for using semi-structured interviews was the fact that exclusively telephone and web conference was used as a means for the interviews instead of face-to-face meetings. This was partly due to distance and partly due to experts` limited availability. The semi-structured interview form allows for a more normal flow of conversation, not strictly guided by the interviewer`s questions. Their use via phone has been noted to present at least one advantage: reaching a wider range of interviewees while, on the other hand, disadvantages include not being able to see body language or other non-verbal answers or that the situation of the interviewee is unknown to the interviewer (Opdenakker 2006). Having focused on factual experience and fact-related questions, this disadvantage was accounted for.

As written, there are several advantages of semi-structured interviews, such as the flexibility. There is a set of pre-defined questions and the topics discussed are as well prepared in advance and well delimited, however, the interviewee has the freedom to add other points they consider important or express their thoughts/add information additionally to what has been asked. The interviewer has the freedom to dig deeper into side topics based on the evolving discussion. The relatively free conversational interview also allows building rapport between interviewer and interviewee. There are, conversely, several disadvantages as well, of using semi-structured interviews: information gathered with on-standardized questions becomes more difficult to compare and the researcher might fall into the trap of asking suggestive questions. Usage of open-ended questions while trying to build up a relation of trust with the interview partner is highly reliant on the interview partner`s personal (and interpersonal) skills, it`s success is therefore person-dependent.

A pool of 6 experts of international and national interest agreed to be interviewed regarding their work in the studied organizations and projects. The codes IP1-IP6 are used to note references to each of the interview partners throughout results reporting. The experts were chosen based on the primary document analysis of reports and policy; cooperating experts or institutions and persons mentioned in the documents were contacted. The circle of experts interviewed and contacted for informational input was gradually extended based on the initially responsive experts` recommendations. Two of the interviewees were involved as national experts in international organizations and projects and continue being active in the area of water management and, respectively, flood management in their countries` administration. Further two persons interviewed were contacted based on their involvement as international experts in previous and ongoing basin-level cooperation projects and organizations of the Tisza River Basin, whereas another two persons area experts involved in their country`s bilateral water management commissions. The semi-structured interviews conducted with them focused on questions along the lines listed below, based on the interviewees own experience and knowledge:

- flood management
- flood governance institutions and mechanisms
- responsibilities and power sharing between international organizations – with special focus on the ICPDR – and the national institutions
- conflict and conflict resolution regarding trans-boundary floods in trans-boundary cooperation

They were requested to identify the most important points, from their point of view, of flood management cooperation in the Tisza River Basin, to explain the organizational architecture of the international institutions and bodies they were involved with or knew from their work. By asking questions regarding expertise areas covered in each organization mentioned, it was attempted to gain an understanding of the responsibility delimitation between the different organizational levels researched. In a last step, experts were asked on the one hand, to reflect on the *quality*[4] or *ease of cooperation* on a trans-boundary or international level, based on their experience. On the other hand, they were asked to reflect on any further information or aspect they had considered important to mention regarding international cooperation for the purpose of flood management.

3.2. Policy and Institutional Analysis

Policies are considered an important structural component of institutional structures, alongside laws and organizations (De Stefano et al. 2014); they are a ´government`s plan and strategy´ on how to address an issue, a framework or general outlines (Iza and Stein 2009). They set, in theory, a clear direction, which is then codified into laws that set the rules of the game. Policies are then implemented in practice based on the defined laws. As Iza and Stein put it (2009), policy and law go hand in hand and "provide the skeleton that is fleshed out by institutions and management practices". As described in chapter 2.3, policies are seen, as well, as an important element of governance capacity, when looked at in pair with law and ´combined with institutions, implementation, and enforcement mechanisms` (Iza and Stein, 2009). This makes it necessary to analyze the main legal framework of a certain policy area. Analysis of policy documents and non-binding memoranda or declaration texts should help form an outline of main policy directions committed to in a certain area by state governments. The advantage of this approach is that by zooming in from an international level to the national policies, elements of what is defined within this thesis as *integration* are easier to identify.

In pursue of such insight, a comprehensive research of primary documents, including treaties, bi- and multilateral agreements was conducted. A vast pool of legal documents and their annexes, expert and working groups` regulations, activity reports and meeting minutes as well as policy and activity reports of the ICPDR and other bi- and multilateral

[4] More on the definition of what is meant by *quality* is described in detail along with the other criteria used for integration level assessment.

organizations of the Tisza River Basin were scrutinized for relevant information. Some detailed technical questions were addressed to affiliated experts from regional organizations by email. The bigger part of the primary documents studied are available online, whereas part of them was provided by the contacted experts affiliated with different national and international organizations active in integrated water management and, more specifically, in flood management in the region.

3.3. Conceptual framework

The acquired information and interview inputs were grouped around a set of 10 criteria listed in Table 1. The criteria serve as indicators of the level of integration of the flood and flood risk management in the area. The selection of the criteria is loosely based on a set of 18 criteria used in a UN-GEF International Waters Project for a review of legal and institutional frameworks in international river basins (UNDP-GEF International Waters Project 2011) and adopted to a different framework, previously applied to analysis of inter-local cooperation for flood management in Austria (Thaler 2015), which focused on integration and network engagement in selected case studies.

Each criterion can be assigned to certain stages in the so-called risk management cycle that identifies five stages of the risk management (that run repeatedly in cycle, partially running intertwined): risk assessment, risk prevention/reduction, event management and regeneration/learning from the event (Kienholz et al. 2004). The existence of bi- or multilateral agreements, separate bodies for flood management as well as the regularity of their meetings are criteria related first of all to risk reduction. Data exchange, flood hazard assessment methods as well as the vulnerability and damage assessment are related to this element of the risk management cycle, but they are at the core of the risk analysis step. The criteria are directly related to risk assessment and evaluation and, as such, serve as a basis for definition of targets for risk reduction measures. Event management was treated briefly as a separate criterion. This was assessed solely based on primary document research, as experts from the area of disaster management were not contacted. Legal documents were scrutinized, such as treaties and agreements, but bilateral commissions` review meeting reports, regional disaster management organizations activity reports and European project databases were searched for and analyzed as well.

The defined set of criteria was first applied to the selected bilateral co-operations and then to the basin level in an attempt to assess the extent to which the flood and flood risk management work can be considered integrated in the studied area.

Table 1: Criteria for assessment of cooperation work integration level

	Spectra of integration		
Flood risk management catagories	**Stage I** **No integration**	**Stage II** **Semi-integration**	**Stage III** **Complete integration**
1. Agreement	•No form of signed agreement between parties •No informal customary practice for cooperation	•Signed agreement but not entered into force *or* not all parties ratified •Informal customary practice for cooperation may exist	•Signed agreement that entered into force •History of cooperation preceding the current agreement, merely reinforced and regulated by signed agreement
2.Type of Agreement	•Only informal agreement	•Any type of formal agreement, short of a basin commission	•River basin commission
3.Bilateral/River Basin Commission / Working Bodies	No institution	Formal institution	Formal, multi-layered institution (commission and subordinate bodies)
4.Regular Follow-up/Meetings	No meetings of the Commission or its working bodies in the past 5-6 years	•Meetings of Commission in more or less regular intervals, but not on a yearly basis; •Working bodies meeting on a more regular basis than the Commission	•Meeting of Commission in regular intervals, at least once a year •Stated regular meetings (in several weeks or months intervals) of regional specific experts groups
5. Separate Body for Flood Management	•Floods and flood management not specifically mentioned in the agreement/ governing body`s definition (if there is one)	•Floods and flood management included in the agreement/ governing body`s definition	•Floods and flood management included in the agreement/ governing body`s definition *and* •Separate Body for Flood Management in the formal structure of the cooperation

6. Data Exchange	•no data exchange between parties	•daily data exchange as defined by bilateral agreements	•common network of monitoring stations • real-time data access for involved parties
7. Flood Hazard Modeling / Methods	•lack of harmonized data / incompatible data •different flood definitions	•Harmonized / compatible data •Equal flood definitions	•Harmonized modeling methods using the same available data *and* •The same design flood level definitions
8. Flood risk management	•No common management plan •Major risk management measures planned in one country not communicated to neighbors •Differences in protection constructions in shared areas (e.g. height of protection dams varying at borders)	•Existence of flood risk management passages in a common river basin management plan •Common flood risk management plan for a greater river basin created with the joint efforts from the analyzed partners; even if not exclusively on the analyzed cooperation area •Information shared regarding major risk management measures that have an impact downstream •Virtually no difference in protection constructions in shared areas	•Transboundary river basin management plan •Common plan and execution of major risk management measures with impact in both/all countries •No difference in protection construction in shared areas
9.Event Management	•No cooperation in disaster management whatsoever; •Potential prohibition of border crossing for helping forces from neighboring country	•Some cooperation in flood-related disaster management; •Existing official agreement between appointed national or regional authorities	•Completely harmonized disaster relief plan using a common pool of resources

10.Involved Experts` Assessment of Relations (Communication, conflict resolution and partnership)	•no formal or informal cooperation *or* •conflict situation •involved level of state authority different in each country	•working formal and/or informal cooperation •same level state authority involved form each country •"good relations", "good cooperation" •working groups meet more or less regularly •no recognizable or weak commitment of parties	•well working formal and/or informal cooperation •same level state authority involved form each country •"very good relations", "very good cooperation" •working groups meet regularly •strong commitment to the cooperation of the parties involved

1. *Agreement.* This criterion is used for classifying the level of integration of trans-boundary relations on the assumption that formal agreements between states sharing flood threatened river basins is positive in terms of cooperation. Laws or agreements, organizations and customary practices may have a positive impact in a river basin on several levels. The pioneer research and study based on the Transboundary Freshwater Dispute database (TFDD) of basins at risks has found significant evidence of water management related treaties and agreements reducing conflict potential (Wolf et al. 2003), whereas a State of the World analysis on water conflict and cooperation emphasizes the role that international treaties play in *"implicitly spelling out each nation`s rights and responsibilities"* (Earle et al. 2010, 91) thus contributing to water management institutions` success. Stage I integration in this case is defined as meaning that no formal signed agreement or treaty exists between trans-boundary river basin partners. As informal customary practices are mentioned as some form of regional level cooperation in the literature (Earle et al. 2010), excluding their existence at this stage means complete segregation (as opposed to cooperation). Stage II of integration would describe a case where a formal agreement has been reached but not yet agreed upon by all partners, or agreed upon but not yet ratified by all signatories. Informal customary practice for cooperation may or may not exist, as the current thesis focuses solely on formal agreements. Stage III, or complete integration, implies the existence of an agreement signed and ratified by all parties involved/targeted5. Additional evidence of cooperation preceding the treaty currently valid is not a must, but was considered a good indicator of strong integration

2. *Type of Agreement.* The type of agreement has been specified explicitly in the criteria table in order to assign the agreements analyzed here to a certain class of agreement, such as legal document, bilateral cooperation agreement between neighboring states, memorandum of understanding or founding treaty of a trans-boundary institution. According to the currently accepted knowledge on trans-boundary water management it is on a basin-wide scale that water resources management can be implemented best (Ganoulis et al. 2011, Sadoff et al. 2008). As flood management is an important part of integrated resources management, it is assumed in this thesis that the same is valid for flood management in particular. So far, international commissions have proved to be the most effective institutional settings, at least for lakes and rivers (Ganoulis et al. 2011), the present thesis assumes that bilateral or international commissions are a proof of full integration in terms of flood management efforts between two or several partners.

[5] As the method was designed to assess the stage of integration in a first step on the river basin and in a second step on individual bilateral levels, „all partners" refers to all parties involved in the discussion or targeted by an agreement. On a river basin level this includes all countries or all relevant stakeholders of the river basin, whereas in case of bilateral agreements, merely those in the two relevant states.

3. *Bilateral / River Basin Commission / Working Bodies.* A separation by type of the river basin institutions or *institutional capacity* is used, as opposed to the definitions used in previous literature (Wolf et al. 2003; Bakker 2009), which included both international water management bodies and freshwater treaties related to trans-boundary flood events (Bakker 2009, 554). This thesis uses the argument that it is necessary to differentiate between a signed treaty directly put on top of water management bodies such as working groups or expert groups or signed treaties and a river basin (bilateral) water management committee/commission with sub-committees or working groups. Whereas it is widely accepted that there is no ideal trans-boundary water management institution, some forms, such as international river organizations or legally binding treaties are recognized as very formal arrangements (Sadoff et al. 2008). Schmeier (2013) also notes some differences between the forms of subordinate organizational bodies used by a river basin organization. In the present thesis her delimitation of these organizational forms is used, however, no ranking is set up based on it, but differences in organization are merely pointed out and an explanation for their origin is attempted. In general, institutions of a stronger formality are considered within this thesis to be stronger integrated. On the river basin level, the argument used is that similar structures across countries mean similar competencies and responsibilities of the involved experts and other stakeholders of the mutual relation, which acts in a way that enhances the cooperation.

4. *Regular Followup / Meetings*. Treaties and other water management institutions such as bilateral or river basin commissions, as previously pointed out, were found to have a positive effect in terms of conflict resolution by research in this domain. In the present research, regular standing committees or meetings of such water management bodies are considered additional indicators of a more advanced level of integrated management in the trans-boundary area analyzed. The existence and frequency of such meetings is used as an indicator of integration of flood (risk) management cooperation between the analyzed partners. Since there were important bodies identified that were included in the present research, which are no longer working as before or which do not exist in their previous form at all, additionally a time delimitation was used, controlling for the actuality of management bodies` work. If there were no meetings of the body in the past 5-6 years, which is also a good management or planning cycle length[6], the level of integration was considered to be in stage I. Stage II integration is considered to be fulfilled in case of meetings that happen in more or less regular interval. If meetings were held in general once or twice per year but one year seemed to have been left out, the month the meeting was held was checked, as this could indicate whether there was a few months shift and that previous year`s year end meeting was held beginning of next year, instead. Consecutively, meetings held in regular

intervals, at least once a year additionally combined with regular meetings in short intervals (every few weeks or few months) of regional experts groups were considered an indicator of full integration.

5. *Separate Body for Flood management.* Integrated water management principles are more and more generally accepted and in case of the EU they can be found in a piece of law that has been reshaping water management in Europe in the recent years (European Parliament and Council 2007). International water management institutions are usually built around the same focus and environmental questions; the discourse is dominated especially by water quality questions. Research by Wolf *et al.* based on the TFDD offered convincing evidence regarding such institution`s positive impact (Wolf et al. 2003), however, there was no analysis of their structure and of the areas of interest covered. Marloes Bakker took up that gap (Bakker 2009) and found that institutional capacity in the area of flood risk management reduces adverse consequences of flood. In the present thesis focus is on trans-boundary integration through flood management institutions, however, just as in integrated water management, flood and flood risk management seems to be only one small thematic area of the those dealt with by IRM organizations, a sort of "sidecar" of the big "integrated management truck." Therefore it was necessary to check for explicit flood management related articles in the treaties and flood management bodies in the organization structure of water management organizations.

The split eventually is based on following definition of integration staged: Stage I (inadequately integrated) cooperation in flood management is a state defined by no specific mentioning of flood and flood risk management in any of the existing agreements between the analyzed partners. Stage II (semi-integrated) flood management means that flood and flood risk are part of the agreement or water management institution`s definition, whereas Stage III co-operations (fully integrated) additionally fulfill the criterion of working with a separate organizational unit (governing body) for flood management.

6. *Data Exchange*. Water management and its "*sidecar"* flood risk management rely and depend on availability of real-world meteorological, hydrological and socioeconomic data. This is challenging enough when managing floods within one political territory`s boundaries, as all involved relevant regions` information must be collected using the same methodology, compatible measuring instruments and then made available jointly for the planning body or authority. But it becomes and additional challenge to manage floods spreading across political borders. Fast and effective flow of information across borders requires harmonization of flood alert and warning systems between neighbors. Protection of human and environmental safety and health in emergencies such as floods becomes dependent on the

[6] The EU WFD as well as the FD for example require update of water basin and flood risk management plans every 6 years.

data made available between international partners, since upstream data availability plays a crucial role in downstream decision making; trust between partners can also be affected by disparities in their monitoring and data analysis capacity (Wolf et al. 2005; ICPDR 2015).

A time factor was additionally considered in the categorization, with the argument that in case of emergencies such as floods, especially in areas where floods reach the borders of a country to spread further into the downstream riparian`s territory within a timeframe no longer than a few hours, real time data availability or data exchange with high frequency may play a crucial role. Whereas this might be the case of informal data exchange such as casual warning calls between employees of regional water or flood management institutions across the border, only formalized data exchange (through integrated data and information system or formulated in legally binding regulations) was considered in this research. Additional indications of well working informal communication were considered within criterion 10, the personal assessment by experts.

Categorization into the three stages of integration ranges from the extreme (theoretical) case of complete lack of or withholding of information (inadequately integrated), through frequent data exchange, several times a day (semi-integrated) to integrated monitoring systems with real-time data available for experts of both or all international partners involved (fully integrated). In case of the time factor, however, which basically separates stages II and III, the hydrological reality was additionally considered, i.e. whether real time data is indeed required and brings a plus[7].

7. *Flood hazard Modeling.* This header encompasses several different components that were inspected separately. Flood level definitions used by each country on the national level (based on floods recurrence probability) were checked. Additionally the method used for flood series was under scrutiny, checking for cross-border harmonization and potential effects that these have on structural flood protection measures stretching across the borders.

The stages of cooperation integration were defined again to range from non-existence – lack of harmonized / compatible data, different flood definitions – through semi-integration – harmonized/compatible data, equal flood definitions – to full integration – an ideal state characterized by harmonized modeling methods using the same data and equal flood definitions.

8. Flood Risk Management. Damage assessment lies at the heart of risk management based policy making. As risk management is becoming the new accepted approach to flood protection, vulnerability assessment and damage assessment have gained on importance during the past years (Merz et al. 2010). The major shift brought along by risk management compared to flood protection policies previously in use is that flood risk management not only

[7] This point is discussed in detail in the Results section

looks at building up protection against certain design events (e.g against 100-year flood events) but additionally assesses the expected damage to occur or to be exceeded in a certain design flood event, based on the objects exposed. Policies are based on the accepted maximum level of risk in terms of damage on human lives and health, economic loss as well as damage to the environment and the cultural heritage. Damage assessments can be integrative part of a flood action plan or flood risk management plan.

To check the level of integration of partners involved in trans-boundary flood management cooperation, integration levels were delimited in terms of this indicator as follows: if not both (or all) parties involved in a cooperation use flood risk management planning, then the level of integration was assessed to be in stage I, inadequate integration. If both (or all) parties involved used such a method, then the level of integration can be considered to be at least in stage II, i.e. semi-integrated. Stage III, full integration is the (theoretical) case of common vulnerability – and/or damage assessment and additionally a common flood risk management plan for the trans-boundary areas. The reason behind this rationale of the categorization is that the usage of similar policy base should constitute a good premise for similar prioritization in flood protection planning.

Looking at the European Union`s Floods Directive (FD) offers a good overview of what flood risk management should keep under control. The Directive requires as a first risk management measure each state to do a preliminary flood risk assessment and to identify all areas at potentially significant flood risk (APFSR). Based on the preliminary risk assessment flood hazard and flood risk maps that take into consideration damage, its extent and value for all APSFR identified thereby are required in a second step. The hazard and risk maps are only part, however, of the more important management tool required by the FD – creation of flood risk management plans coordinated at the river basin district or of other unit of management`s level (EUR-LEX: Directive 2007/60/EC 2007). The detailed river basin management plans must formulate clear objectives for reduction of the adverse effects of floods on human health, environment, cultural heritage and economic activity (European Parliament and Council 2007; ICPDR 2015). The stated position of the EC is that concerted action is necessary for effective flood prevention and mitigation measures not only between its Member States but should further include cooperation with third countries (European Parliament and Council 2007).

The compatibility of institutions responsible for e.g. implementation of the Floods Directive or for information exchange among the different states was additionally listed, as communication between institutions on the same hierarchical level, as assumed in this thesis, are expected to facilitate better cooperation. Analysis of the extent of integration from the point of view of risk management therefore strongly relies on the definition and tools as prescribed the EC: first stage (insufficient) integration between international partners was

defined to be a stage without common (or coordinated) risk management plan between international partners. On the opposite end the ideal case of a commonly created river basin management plan was placed, as a clear evidence of fully integrated third-stage cooperation in flood management. In between, i.e. semi-integrated cooperation would mean existence of any form of common risk management plan: a water basin management plan that contains parts referring to flood risk management in border areas or, in general, internationally coordinated. A greater river basin flood risk management plan created with joint efforts from all partners analyzed, even if further partners and other river basins or the greater river basin to which the analyzed basin belongs to are targeted.

9. *Event Management*. I argue that complete lack of measures for common event management is a sign of a conflict situation - could be related to a lack of understanding regarding permission for special forces to cross the border in order to grant help or of a lack of will for mutual support from the two Governments. Stage I integration would therefore consist in the complete lack of agreements or any sign of mutual support in case of a flood-related disaster event. On the other end of the integration scale is a completely harmonized disaster relief plan using a common pool of resources. Stages II in between is assessed based on this logic as semi-integrated event management.

11. *Involved Experts` Assessment of Relations.* Each of the experts interviewed was asked, at the end of the interview, to explicitly state their opinion on how well the cooperation between the international partners involved had worked. If more details were requested, they were suggested to assess the informality, potential conflicts from the past as well as the information flow between the partners. The formulation "*quality assessment*" in the present paper is used, however, the word *quality* was not mentioned in the discussion with the experts. Interviewees were asked to assess the ease of cooperation, certain recurring or non-recurring issues leading to conflict or, conversely, those that partners would always smoothly agree upon, the reality of the cooperation smoothness and frequency as opposed to that requested by the official regulations. In the end, specific words or formulations that could indicate good or less successful cooperation were grouped together. Thus, formulations such as "*good relation", "good cooperation", "informal and helpful", "Uncomplicated"* used by experts for describing a certain cooperation were defined as indicators of a cooperation with integration level at least in stage II (semi-integrated). Stage III or fully integrated cooperation was defined to be indicated by more powerful formulations, such as "*very good relation", "very good cooperation", "communicate at any time about any work-related issue*", *"cooperated closely since long"*.

3.4. The Case Study Area

The Tisza River Basin is the largest sub-basin of the Danube River Basin. It stretches over an area of 157 186 km2 covering 19.5% of the Danube Basin. The Basin shelters a population of approximately 14 million people living in five countries: Ukraine, Romania, Slovakia, Hungary and Serbia (ICPDR 2016). The river has its source in the Ukrainian Carpathians, in the Maramaros Alps, at an altitude of 2680 m (Kolakovic 2012). From there the Tisza continues its path into the hilly North-Western region of Transylvania in Romania, serving as a 62.5 km long natural border line between the country and Ukraine. It then meanders into the Great Hungarian Plain and finally joins the Danube 966[8] km away from its origin, in Serbia. This also makes it the Danube`s longest tributary, whereas it is second only, by flow, to the Sava river (ICPDR Flood Protection EG 2009; ICPDR 2016). Its water discharge is around barely 800 m3/s. Marieke van Nood puts these numbers into perspective (2011): compared to the Sava river basin, the Tisza River basin has double the size, it is inhabited by almost double the population of the Sava river basin, but the water discharge is of the Tisza is only slightly above half of that of the Sava river (approx. 800 m3/s vs. approx. 1600 m3/s in the Sava river).

The river basin is divided into two main parts (ICPDR 2007; van Nood 2011):

- The Carpathian Mountains – the mountainous Upper Tisza with its tributaries in Ukraine, Romania and the Eastern part of Slovakia; representing 70% of the catchment area; and
- The wide Tisza Lowlands – lowland parts, stretching across mainly the Great Hungarian Plains and Serbia

The river itself consists of three sections (van Nood 2011; ICPDR 2016):

- The Upper Tisza in Ukraine, upstream of the Ukrainian-Hungarian border
- The Middle Tisza in Hungary. Large tributaries join in this section, such as the Bodrog and the Slaná/Sajó from Ukraine-Slovakia, as well as the Crisul/Körös River System and the Mures/Maros draining the Northwestern Romanian region of Trasylvania as well as parts of the Great Hungarian Plain
- The Lower Tisza is the river stretch southwards from the Hungarian-Serbian border. It is directly fed by the tributary Bega/Begej but also indirectly by other tributaries via the Danube-Tisza-Danube Canal System.

The river basin plays a different, but equally important role for each of its five countries. It provides means and space for agriculture, fisheries, forestry, pastures, mining and energy

[8] Whereas most sources define the river`s length at 966 km, some sites, including the Hungarian Water Authority mentions 962 km in each official document (See e.g.: Belügyminiszterium - Vízügyi Főigazgatóság, 2016)

production. The Tisza River is the main water source for Hungary, a significant source for Serbia and an important source for western Romania and the southeastern part of the Slovak Republic (ICPDR 2007).

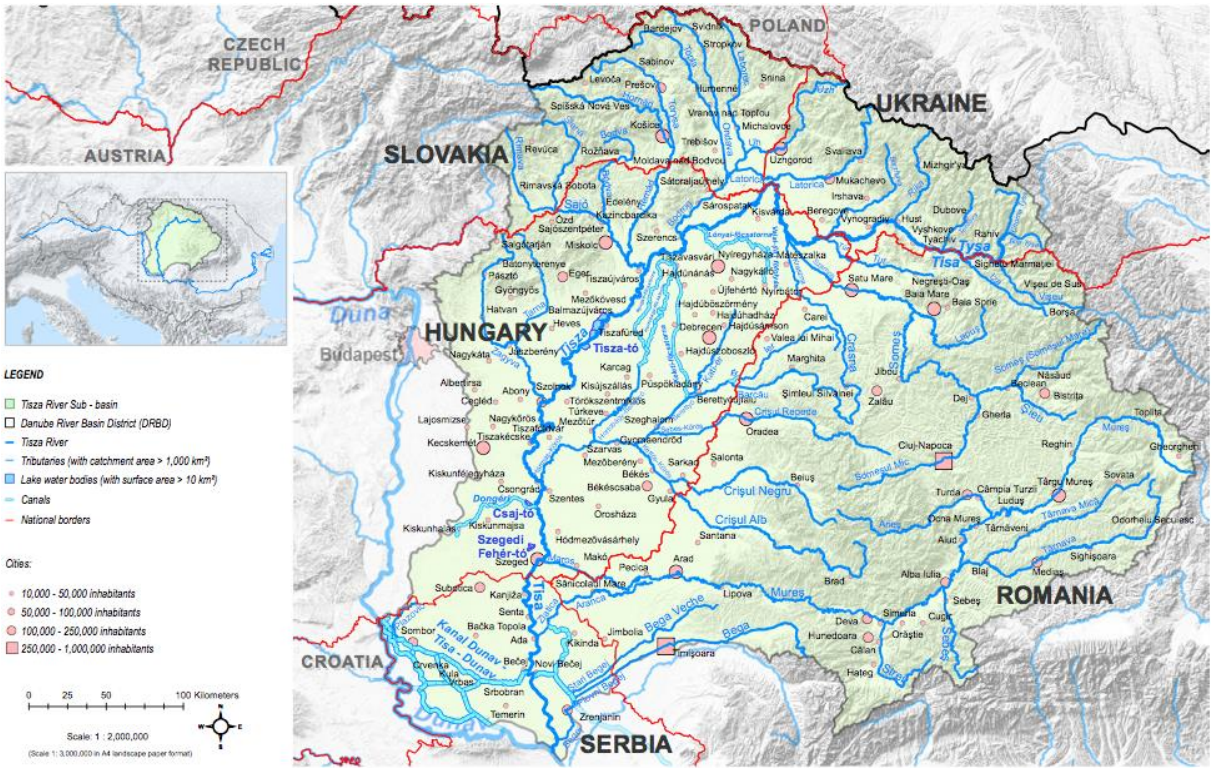


Figure 1: Map of the Tisza River Basin (van Nood 2011)

Climate influences in the Basin are by the Atlantic, Mediterranean and Continental Climates. These impact regional precipitation. Rainfall quantities in the Tisza Catchment increase with the altitude over the sea – highest values are therefore characteristic in the Upper Catchment. About 60% of the Upper Tisza Basin gets more than 1000 mm of precipitation annually. In this area flash floods are common during spring and summer; their effect is intensified by the low infiltration capacity of the soils in the Carpathian Mountains. These floods may, occasionally, cause large inundation on lowland areas (ICPDR 2007; ICPDR Flood Protection EG 2009). The floods generated in Ukraine, Romania and the Slovak Republic are mainly rapid floods and last between 2-20 days. In contrast, floods that reach or form in Hungary and Serbia are, due foremost to the lower gradient of the river in this region, usually longer flood events, lasting for 100 days or longer - the Middle and Lower Tisza floods are known for their length in time. Multi-peak waves catch up on this section of the river and take longer to flow through. Furthermore, it is characteristic for the river section for flood events on the Tisza to coincide with floods on its tributaries. This has proven to be

especially dangerous in the case of Somes/Szamos, Crasna/Kraszna, Bodrog, Cris/Körös and Mures/Maros rivers (ICPDR 2007). The lower Tisza tributaries` catchment areas, e.g. that of the Kraszna or Latorca and Ung rivers, receive precipitations as low as 600 mm/year (Kolakovic 2012). Cyclones with heavy rainfall are result of the warmer Mediterranean and Atlantic climate effects and can be observed occasionally on southern and western slopes (ICPDR 2007).

Characteristic for the river Tisza are its returning, gradually increasing and occasionally extremely high floods. Floods can form almost year-round and result from snowmelt, rainstorms or combination of the two (snowmelt introduced by rainfall). The months of January and February are the months with the lowest levels of rainfall (ICPDR Flood Protection EG 2009; Bakonyi 2010). However, a rise in temperature arrives and perpetuates almost always together with some rainfall, therefore large flood waves more frequently occur in late winter and early spring. In years with large snowfall, a flood wave can form during snowmelt in spring. According to the ICPDRs initial analysis of the River Basin in 2007 (ICPDR 2007) 65% of the floods occur during the warmer period between May and October, with the highest levels of rainfall occurring in June. The remaining 35% of all food events occur in the winter period, starting in November and lasting until March.

Engineering interventions for flood protection on the Tisza River go back to the 19th century and nowadays the effects of human interventions "*can be demonstrated along each stream kilometer of the Tisza as well on each square kilometer of its catchment system"* (Kolakovic 2012, 2). The river flows between embankments almost on its full length, from its source to the mouth, which leads to changed run-off behavior due to narrower embankments. Three barrages, built over the course of the past fifty years, have changed the run-off conditions of the river in the low and mean water range. In spite of the three barrages, the river gradient remains very small. Before the regulation works the slope of the river was hardly measurable and amounted to an average of 3 cm/km; with values around or below 2 cm/km southward from Szolnok (ICPDR 2007; Kolakovic 2012). In spite of construction of barrages as well as the significant reduction in length, the riverbed slope remains very low – a characteristic that contributes to longer persisting floods in the lowland areas of the Tisza. The type of floods that occur especially in the lowland area of the Tisza are those caused by so-called excess water, defined as un-drained run-off. These "*originate from unfavorable meteorological, hydrological and morphological conditions on saturated or frozen surface layers as a result of sudden melting of snow or heavy precipitation, or as a result of groundwater flooding"* (ICPDR 2007, 100). Specific about this type of inundations is the difficulty or impossibility of evacuating the water by gravity, which leads to longer inundation times. This increases risk to agriculture and even infrastructure. This type of flood

occurs most often in springtime due to snowmelt but has been also often observed in summer as a result of heavy rainfall.

Hungary has the highest level of flood exposure within the Basin: 74% of the total flood plain area (21 251 km2) are situated in the country, which also makes up for 16% of the country`s total territory (ICPDR Flood Protection EG 2009). This adds up to the fact that since the 19th century large territories were reclaimed from the river. The river was straightened, dams and reservoirs were built; the original 1419 km length of the Tisza has been shortened to the current 866 km. Territories gained through river regulation were turned into agricultural land or habitable area. 5% of Hungary`s current population lives on land reclaimed from the river (ICPDR 2007; Bakonyi 2010). On the other hand, the aridity factor[9] in the Tisza River Basin has its low at 0.2 in the Carpathian Mountains (at the eastern border of the basin) and its high at 1.4 in the middle of the Great Hungarian Plain (ICPDR 2007), which makes Hungary both the most flood- and most draught-prone area of the River Basin.
The initial analysis of the Tisza River Basin by the ICPDR points towards land use changes as a major factor that have influenced the Tisza River`s runoff patterns (ICPDR 2007). In particular the gradual shift from flood-tolerant land uses such as forests, meadows and fishponds to more intensive modern agricultural production over the past century have increased the demand for tightly-regulated water levels and protection from the otherwise normal seasonal inundation. Development of agriculture – supported by crop intervention payments and other agrarian policies – took the direction towards arable agriculture. This form of agriculture demands low levels of the nearby waters, which in time led to further land use changes, facilitating the industrial and urban constructions extension on land reclaimed from the river. The subsequent flood protection constructions of higher dykes and river bed regulations have led unavoidably to increased flood risk by reduction of water retention capacity. Furthermore, as a result of the cutback on retention capacity, downstream areas became more and more confronted with higher number of flood events (ICPDR 2007). However, there is a further effect observed on the flood plains of the lowland section of the river. Through the shift from small animal farming - cattle and sheep grazing on the floodplains – towards industrial farming, involving closing of animals into massive farms and returning floodplains to natural forestation, the water discharge ability of the river was considerably decreased (Kolakovic 2012; Főigazgatóság 2015).

In the twelve years between 1998 and 2010 alone there were six disastrous flood waves relatively close in time to each other, which does not fit into the historical pattern of the Tisza catchment. These have contributed to a reconsideration of flood prevention measures first of all in the countries affected – Hungary and Serbia – but also on an international level. However, this was not the first flood wave or flood wave series in the

[9] Defined as the relation of annual potential evaporation to mean annual precipitation (ICPDR, 2007)

Tisza River Basin with major consequences on flood protection. An extraordinary flood wave event in 1855 with tragic and disastrous consequences had led to a reconsideration of flood protection measures in the 19th century. Eventually significant engineering measures had followed in the form of the Vasarhelyi Plan (ICPDR 2007; Kolakovic 5-7 Sept 2013).

The year 2000 was the year of two major disasters related to waste sludge leakage stemming from broken dams of two mining companies on Romanian territory. In January 2000 a tailing pond at a facility near Baia Mare burst after a longer rainy period. As a result, over 100 000 m3 of waste water containing up to 120 tons of cyanide and heavy metals were released into the Lapus river. The waste sludge was transported to the Somes River and finally reached the Tisza, causing major devastation in the wildlife of the river. Two months later, in March 2000, another tailing pond dam burst around the same region close to the Ukrainian border. This event led to 20 000 tonnes of sediments being released into the Novat River, a tributary of the Viseu and Tisza rivers (ICPDR 2016). The event caused some political distress in the region finally dealt with a specially created task force, the Baia Mare Task Force. In a strange twist the spill`s effect on the river was eventually diminished by the floods that followed the accident and dissolved the hazardous waste (UNEP/OCHA 2000).

The Tisza River Basin Analysis (ICPDR 2007) lists over 20 major flood events for the period between 1879 and 2006, almost half of them with trans-boundary potential[10]. This information is consistent with the fact that water transfer is quite unilateral between countries in the TRB, due to geographical differences between riparian countries. 51.8% of the water quantity arising from precipitation falls in Romania, almost 84 % of this water is transferred to Hungary`s and about 13% to Ukraine`s territory. 27% of the water quantity from precipitation occurs in Ukraine and is transferred to almost 89 % to Hungary`s territory, whereas only 6.4% and 0.8% of the water quantity from precipitation in the DRBM occurs in Hungary and in Serbia. Slovakia receives about 14% of the same quantity and transfers that entirely into Hungary, additionally playing transmitter role for water quantities flowing between Ukraine and Hungary (ICPDR 2007, 13). Flash floods occurring in the upper catchments of the Tisza and its tributaries during spring snowmelt, especially on the territory of Ukraine bring possible water level rise of 8-10 m. Flood waves reach the Ukrainian-Romanian border within 6-10 hours; the Ukrainian-Hungarian border is reached within as little time as 12-36 hours.

The income levels vary quite significantly between the countries. This implies that central governments may have different challenges to cope with – states with a lower development level might struggle with different issues on a local level than those with a

[10] The event description provided in the Tisza River Basin Analysis (ICPDR, 2007, p. 101-102.) was used for categorization into trans-boundary or local events. The wording „trans-boundary potential" is used here to denote cases in which a flood event in an upstream country, on tributaries or upstream section of the Tisza travelled into down-stream countries (Hungary, Serbia) and caused flood events or overlapped with an on-going flood event or other cross-boundary flood or flood protection events. One particular example is the 1974 blasting of protection

higher development level. This poses a challenge, in its turn, on the extent to which international cooperation can work. Table 3 offers a short overview of main economic indicators focusing on GDP per capita in the Tisza countries and the role that agriculture plays in each of the countries[11].

Table 3: Main economic indicators of the Tisza River Basin Countries

Country	**Population (Millions, 2013)**	**Main Economic Sectors (% of total gross value added, 2013)[12]**	**GDP per capita (€ per capita, 2013)[13]**	**Share of Agriculture in total Employment (2012)[14]**
Hungary	9 908 798	Agriculture: 4.8% Industry: 26.0%	9 900	6.6
Romania	20 020 074	Agriculture: 6.4% Industry: 34.3%	7 100	31.4
Slovakia	5 410 836	Agriculture: 3% Industry: 26.7%	13 300	2.2
Ukraine	45 372 692	Agriculture: 11.8% Industry: 22.7%	2 318	n.a.
Serbia	7 181 505	Agriculture: 11.4% Industry: 25.4%	4 100	14.8

dykes on the rivers Black and White Körös, located in most of their length on Romanian territory in order to protect the near-border Hungarian city of Gyula.

[11] Agricultural policy and the extent to which a country prioritizes protecting its agriculture and agricultural yield (not in terms of trade protectionism) could play a role in the extent to which flood protection measures referring to land use reallocations form agricultural land to wetland (so-called flood plain restorations) can be considered by a planning institution

[12] Ukraine: EUROSTAT values for 2014

[13] EUROSTAT values for 2013; Ukraine: 2014; Serbia: 2013

[14] EUROSTAT, 2012; Serbia: 2013

4 Results and Discussion

4.1. Development of basin-wide agreements and institutions with flood management relevance

The Tisza River Basin`s (TRB) countries share a long history of cooperation. Papp (2008) offers a short historical overview of international (mostly bilateral) water management agreements for the Central and Eastern European region from a Hungarian point of view. He mentions the first trilateral and several bilateral agreements in this region focusing on flood protection and water regulation works in trans-boundary areas, that were signed as early as following the First World War within the framework of the **Comission Technique de Regime des Eaux du Danube (CRED,** Permanent Technical Commission for the Water Regime of the Danube**)** established through the Trianon Treaty (1920) and in place between 1924-1938. After 1938 bilateral agreements followed (Papp 2008). However, the first bilateral agreements were also established under auspices of the CRED; their main focus was flood risk and ownership of land in trans-boundary water areas. (Papp 2012, Papp 2008). Further worthy of mention are **COMECON**`s **Water Management Leaders Conferences** (or interstate conferences) which had a Working Group dealing with water management problems of the Tisza river in 9 thematic areas and even published a Tisza Master Plan. Papp (2008) considers this an early international water management agreement on the Tisza. Other sources note that the COMECON`s interstate conferences were purely consultative and acted in an advisory capacity for its executive bodies (Library of Congress Federal Research Division 2016). Later in time, a **multilateral Agreement on the Protection of the Tisza and its Tributaries** was signed in 1986 in Szeged (Papp 2008).

In a more recent time, all five riparian countries of the Tisza River have adhered to the **UN-ECE Convention** on the Protection and Use of Transboundary Watercourses and International Lakes signed in Helsinki in1992[15]. The countries sharing the Tisza river basin are contracting parties of the **International Commission for the Protection of the Danube River Basin (ICPDR)** and have signed the **Danube River Protection Convention** (DRPC, 1994) (ICPDR Secretariat 2016). Since its establishment in 1998 (year of coming into force of the DRPC), the ICPDR has become the basis for cooperation in the Tisza River Basin; further extending cooperation grounds. After the floods of the year 2000, all Tisza states were involved in the **Tisza Forum**, specially created for addressing floods and consequences of the flood (ICPDR 2016).

[15] Whereas the UNECE Water Convention is mainly an environmental and watre quality- focused protocol, it does contain one very important line referring ot the development of environmentally sound water-construction

Table 2: Timeline of significant institutions and agreements in the Tisza River Basin

Institutions/Agreements	
Year	**Institution/Agreement**
1924-1938	Comission des Eaux du Danube (CRED) -part of the Trianon Treaty - annuled by the Paris Treaty
1949-1991	COMECON - Water Management Leaders` Conferences -leaders` conferences: purely consultative; acted as an advisory body for executive bodies; -created the first Tisza Master Plan
1986	Agreement on the Protection of the Tisza and its Tributaries - multilateral agreement
1992	UN-ECE Convention on the Protection of the Danube River Basin
1994	Danube River Protection Convention
1998	´- Coming into force of the DRPC - Establishing the International Commission for Protection of the Danube River Basin (ICPDR)
2000	Tisza Forum - focused on flood management and coping with the effect of floods
2000	EU Water Framework Directive is issued
2004	Memorandum of Understanding towards a River Basin Management Plan for the Tisza River supporting a Sustainable Development of the Region -Establishment of the Tisza Group
2007	EU Floods Directive is issued
2010	Danube Declaration -flood protection reaffirmed as permanent high priority task of the ICPDR; -commitment of non-EU states to the implementation
2016	Danube Declaration Water Management in the Danube River Basin: Integration and Solidarity in the most international river basin in the world - reaffirmation of the goals committed to earlier and commitment for usage of synergies between EU WFD, FD and nature protection legislation - EU Strategy for the Danube Region invited as a strategic
Planning Documents for the Tisza Basin	
2007	Tisza River Basin Analysis
2000	Long-term Flood Action Programme for Sustainable Flood Risk Prevention in the Danube River Basin
2009	Flood Action Plan for the Tisza River Basin
2011	Tisza River Basin Management Plan

works and water-regulation techniques. This idea corresponds to the generally adopted direction of less engineerial water-regulation and flood protection measures since the 1990s

The **ICPDR** is a river basin commission *par excellence*, grouping a total of 14 cooperating states and the European Union as a separate partner. The main goal of the ICPDR is to implement the DRPC. The structure and working grounds of the ICPDR are discussed in more details in the next sub-chapter.

As the **European Union** is the fifteenth contracting party of the ICPDR, there is a strong cooperation between the two organizations – additionally to its initial role, the ICPDR is the body supporting the states in implementing parts of the EU`s Water Framework Directive and Floods Directive implementation in the Danube River Basin (ICPDR 2015). The **Water Framework Directive** (**WFD** – Directive 2000/60/EC) of the European Union, adopted in 2000 and entered into force the same year, aims at establishing a framework for protection of all water bodies on the territory of the EU, in order to ensure a "good status" of those waters and, respectively, to hinder their deterioration (European Parliament and Council 2000). All member countries of the ICPDR, including those which were at the time not members of the EU, had agreed to make efforts for implementation of the WFD – an important commitment for which the ICPDR as a cooperation forcing river basin organization holds the merit for. The ICPDR has brought together countries of the Danube Basin, both EU and non-EU members, and facilitated their steps towards a common political commitment of reaching the goals entailed in the EC`s WFD. The Danube River Basin Management Plan – the initial one published in 2011, as well as its update published in December 2015 – are the result of this effort and at the same time a fulfillment of their legal obligation towards the EU under article 3, §4-5 and article 13, §3 of the WFD for the countries members of the EU (European Parliament and Council 2000). These require member states to coordinate the implementation of the requirements of the WFD and may, for this purpose, use the framework of other international agreements. Creation of common management plans with non-member states in case of river basins stretching over boundaries is part of this obligation[16] (European Parliament and Council 2000). The ICPDR fulfills the role of facilitating this cooperation work between countries sharing a river basin and gathers information from all Danube countries in order to edit the common management plan to help them fulfill this obligation.

The EU water policy has reached one further milestone with the introduction of the so-called **Floods Directive** (FD – Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks) in 2007. This Directive is complementary to the WFD, according to some observers a *correction* of the missed opportunity to integrate water quantity – specifically floods – with water quality and

[16] The article does contain the lindering remark that where the creation of a single, river basin-wide management plan is not possible, *the plan shall at least cover the portion of the international river basin district lying within the territory of the Member State concerned* (European Parliament and Council, 2000, article 13, paragraph 3)

environmental considerations[17]. The legal document references the WFD and formulates further requirements for its member states referring to management of flood hazard and associated risks. Once again this legal tool of the EU for improvement of flood protection policies within its territory turned out to be a good motivator for non-EU countries involved in other cooperation mechanisms with EU countries: non-EU members Serbia and Ukraine have both committed to implement yet another EU Directive in their national legislation. Among the obligations listed for member states is the creation of a preliminary flood risk assessment by the end of December 2011. Based on the preliminary flood risk assessment the states had the obligation to create flood hazard and flood risk plans until December 2013. The next step of the implementation required creation of flood risk management plans for all river basins with a deadline in December 2015 – same as the first revision date of the water basin management plans[18]. Article 8 §3 of the FD obliges[19] the EU member states, similarly to the WFD, to create common flood risk management plans in case of trans-boundary river basins, even when those extend beyond the borders of the EU (ICPDR 2015). The ICPDR was chosen as motor for the fulfillment of this task as well as the central coordination and editing point for all riparian countries – including countries whose territory falls within the catchment area even if not situated directly on the riverbank – of the Danube. The 1st Danube River Basin Flood Risk Management Plan published by the ICPDR in December 2015 thus gathers the information provided by each of its contracting parties and fulfills the mentioned requirement.

The Tisza River, as a sub-basin of the Danube Basin stretching across five countries` territory, has enjoyed some interest, similarly to the Sava and Drava rivers. The Council of Europe`s XIIIth Conference of ministers responsible for regional/spatial planning (CEMAT) held in Ljubljana in 2003 marked an event that represents an important milestone for the Tisza cooperation. In a regional development conference, the responsible ministers of Hungary, Romania, the Slovak Republic, Ukraine, and – at the time – Serbia and Montenegro have signed an Initiative on Sustainable development of the Tisza river basin. Although focused specifically on regional development, the document contains common objectives that are regular elements of integrated water basin management, ranging from territorial cohesion, reduction of environmental damage and protection of natural resources and heritage, through open access to information and down to limiting the impact of natural

[17] Two of the experts interviewed (IP2 and IP3) have stated similar views in this direction: that the EU had missed the important factor floods when drafting its WFD before and in 2000 and then, as a result of multiple flood events with an important impact in Germany and other EU states between 2000-2006 realized its mistake, which eventually led to inclusion of flood management in this later directive. In their view, the directive was in the expert community more than welcome at this time.

[18] The Directive states that regions defined within the obligations stated in the FD may or may not coincide with those defined under the WFD. In case of the TRB, these are the same.

[19] Again, with the lindering remark „where this is not possible, paragraph 2 shall apply for the parts of the international river basin falling within their territory (European Parliament and the Council, 2007, article 8, paragraph 3.)

disasters through preventive action. The ministers further gave their agreement "*to promote the objectives of the initiative by setting up a joint commission, aiming to ensure effective cooperation in the Tisza river basin"* (Council of Europe 2014). The Commission was never created, however, environmental ministers and high representatives of the five countries sharing the Tisa Basin signed at the first ministerial meeting of the ICPDR countries in December 2004, a **Memorandum of Understanding** (MoU Towards a River Basin Management Plan for the Tisza River Supporting a Sustainable Development of the Region), this time focused on water management. Within the MoU, the countries have *committed to an international integrated Tisza River Basin cooperation development* that was to be *in line with the objectives and provisions of further international and regional environmental obligations, conventions and programmes, including EU policies* (MoU 2004). Whereas the MoU created an official basis for the cooperation work between the five countries for the more detailed work on the sub-basin level, the bodies and structures used for the work were those of the ICPDR. This was expressed in the MoU in the form of an *invitation* towards the ICPDR to embed all activities of the TRB into its structures and mechanisms. Implementation steps of the MoU included a Tisza River Basin Management Plan the countries had agreed to prepare by 2009 – a voluntary action, not required by national or EU legislation. This was not an obligation within the WFD, as a Management Plan for the Danube River Basin already comprises the Tisza River Basin and management plans on international basins smaller than 4000 km2 are not mandatory.

As a follow-up step, the five states and the ICPDR established the **Tisza Group**, which aimed to become a platform for strengthening coordination and information exchange related to international, regional and national activities in the Tisza River Basin. This commitment was fulfilled; joint research work produced several common publications. The countries committed to conduct an analysis of the catchment area and prepare a Tisza Analysis Report, a first step towards common management plan, which was published in 2007 and offered a comprehensive overview of the Tisza River Basin. The report served as a basis for the countries` common Tisza River Basin Management Plan, completed and accepted by 2010.

The ICPDR had established in 2000 a long-term **Action Programme for Sustainable Flood Risk Prevention in the Danube River Basin**. As part of the efforts within this Action Programme, 17 Danube sub-basin level flood action plans have been published until 2009. The Tisza Basin Flood Action Plan (Flood Action Plan for the Tisza River Basin – FAP TRB) was elaborated as part of this program. The work on the action plan was coordinated through the relatively newly established Tisza Group. The FAP aimed at a "*long-term and sustainable approach for managing the risks of flood to protect human life and property, while encouraging conservation and improvement of water related*

ecosystems" (ICPDR FP EG 2009, 1). The FAP TRB was considered an interim and important step towards fulfilling the requirements of the Floods Directive, i.e. a first step towards preparation of the flood risk management plans (ICPDR 2009). For the action plan`s preparation inputs from involved countries were used that summarized the state of the art of flood protection in each of the countries at the time of publishing. It further comprised an overview of each country`s flood management plan and targets set for the period 2009-2015 in terms of flood risk reduction and management as well as an inventory of measures planned for achieving those targets.

The **2010 Danube Declaration** signed at the ICPDR`s Ministerial Meeting put flood protection once again on the agenda of the ICPDR. The ministers re-affirmed flood protection`s role as permanent task of high priority for the ICPDR and committed themselves to implementing the EU`s FD throughout the Danube Basin (including the non-EU countries). Existing and potential synergies with the WFD and the DRBMP were to be used (ICPDR 2015). Three of the five Tisza countries are currently members of the European Union – Hungary and Slovakia had been members since 2004, Romania joined in 2007. Serbia is a candidate country, whereas Ukraine has been and remains a *priority partner of the EU* (European Union External Action 2016; ICPDR Secretariat 2016). As partners of the ICPDR, Serbia and Ukraine have both committed in 2010 to implement in their national legislation the requirements of the WFD and of the FD. This fact is pointed out as a "*major achievement"* of the ICPDR and *"something extraordinary"* by several of the interviewed experts (IP1, IP3, IP4), pointing to both the ICPDR`s capacity to act as a pushing force but also to the involved countries` commitment to the protection of the Danube River Basin and cooperation in terms of flood management, strong enough to commit for goals that go beyond legal requirements. One part of this commitment is delivery of a common management plan for international catchment areas and both countries have so far delivered – they have both contributed in the preparation of management plans as required by the WFD. The Danube Basin level FRMP 2015 has as well been created with the cooperation of Ukraine and Serbia.

The **2016 Danube Declaration** of the ministerial meeting of the ICPDR has reaffirmed the commitments, included the EU`s Danube Strategy (EU SDR) as a strategic partner and once again underlined the importance of flood risk management as a policy area of high relevance for the ICPDR partner states. The Danube Region Operative Flood Management and Cooperation Programme of the EU SDR is a framework resource the ICPDR states plan to use in future flood management work basin-wide. Notable point of the new commitment is the promise of effectively combining implementation efforts for EU`s FD and WFD, as well nature protection regulations, fully using available synergies (ICPPDR 2016).

More detailed plans and projects can and are in place on a lower, national and regional level for both water quality and flood protection. Pairwise each of the countries have bilateral water commissions that deal with specific problems and detailed technicalities, such as common implementation of early warning systems, coordination of protection level on border sections, alignment of flood protection constructions, conflict management or detailed negotiations. Some details regarding these are described in the following subchapter.

4.2. Trans-Boundary Institutions in the Tisza River Basin

This sub-chapter offers an overview oft he existing basin-level an bilateral organizations that have been established in the Tisza River Basin with the involvement of all five or at least two of the Tisza states.

International Commission for the Protection of the Danube River (ICPDR)	Romanian-Hungarian Hydrotechnical Commission
	Joint Hungarian-Ukrainian Water Management Commission
Tisza Group	Joint Hungarian-Serbian Water Management Commission
	Bilateral Water Management Commission
(International Commission of the Tisza River Basin)	Working Bodies for Romanian-UkrainianShared Water Basins - Working Groups for Tisa

Figure 2: Trans-Boundary Water Management Institutions in the Tisza River Basin

4.2.1. Basin-Level Institutions and their Structure

The most significant institution of the Danube River Basin continues to be the **International Commission for the Protection of the Danube River**, or ICPDR, established to help implement the joint goals formulated by Danube River Convention`s signatory partners. The ICPDR is comprised of the national Delegations of all contracting parties; political representatives of the governments and responsible ministries of each signatory state. A list of observers participates in the ICPDR´s work, influencing agenda setting and policy adaption by the organization. The group of observers comprises 23 organizations and includes NGOs, organizations representing private industry, and intergovernmental organizations. The work of the ICPDR is supported by a relatively small Permanent Secretariat, which is based in Vienna and provides administrative support for the organization.

Bodies of the ICPDR include

- the Ordinary Meeting Group – political decision body, meeting once a year in winter
- the Standing Working Group – political guidance body, meeting as well once a year

during summer and

- the Technical Experts Groups and Task Groups, groups that conduct scientific work and provide technical guidance documents and backup.

The presidency of the ICPDR is passed on in a yearly cycle between the contracting states, in alphabetical order. The delegations of contracting parties participate in the Ordinary Meeting Group, described as political decision body and of the Standing Working Group, carrying decision power within ICPDR for all key aspects dealt with within the organization. The delegations, including the heads of delegations and the national members of the EGs, have the role of aligning with and obtaining necessary inputs from national or occasionally territorial institutions other than those directly involved in the Danube/Tisza cooperation. The Expert Groups (EGs) report back to the Secretariat, which is also responsible for all publications of the ICPDR. Currently seven expert groups (EGs), formed by national experts of signatory states (civil servants of state institutions responsible for water policy implementations) and observer organizations, conduct and coordinate the technical work that lies at the base of the work done by the ICPDR. These are the Expert Groups for: *River Basin Management, Flood Protection, Pressures and Measures, Accident Prevention and Control, Monitoring and Assessment, Information Management and GIS,* and, finally, *Public Participation*. Under the current setup of the ICPDR structure, the **Flood Protection Expert Group (FP EG)** is the leading working body that deals with flood protection issues on a river basin level and orchestrated flood management policies in partner states. Table 2 contains the list of competent authorities that are responsible for the implementation of FD and WFD on ICPDR Tisza states` national level.

Table 3: Competent Authorities for Floods Management in the Tisza Countries **(**ICPDR 2015**)**

Country	**Institution Responsible for WFD Implementation**	**Institution Responsible for FD Implementation**
Hungary	Ministry of Environment and Water	General Directorate of Water Management *Subordinate to*: Ministry of Interior
Romania	National Administration “Apele Române“ (Romanian Waters, NARW) *Subordinate to:* Ministry of Environment, Waters And Forest	National Administration “Romanian Waters“ (NARW) *Subordinate to:* Ministry of Environment, Waters and Forest

Country	Institution Responsible for WFD Implementation	Institution Responsible for FD Implementation
Serbia	Ministry of Agriculture, Forestry and Water Management	Ministry of Agriculture and Environmental Protection
Slovak Republic	Ministry of the Environment of the Slovak Republic	Ministry of the Environment of the Slovak Republic
Ukraine	State Committee of Ukraine for Water Management *Subordinate to:* Ministry for Environmental Protection of Ukraine	The State Emergency Service of Ukraine State Agency on Water Resources of Ukraine *Subordinate to:* Ministry for Ecology and Natural Resources of Ukraine

The Expert Groups` work is well organized, strictly structured. As put by an interviewee, *"there is nothing ad-hoc about their work"*; there are Terms of Reference and mandates adopted by the Commission; up to three regular meetings are held within one year – these are complemented by remote cooperation. Reporting is done to the ordinary and standing working groups twice yearly. Direct coordination is done through the Secretariat.

The **Tisza Group** was established following the 2004 signature of the Memorandum of Understanding. Representatives of the five Tisza countries` water management responsible ministries committed to respect and implement the sustainable development goals formulated within the MoU. The Tisza Group meant to work in a similar fashion to the ICPDR and deliver the same content work on the Tisza River Basin level as done for the Danube Basin by the ICPDR. It was embedded into the structures of the ICPDR and never acted as a stand-alone institution (IP4, IP3), being described to have "*worked in the same way as the other Expert Groups of the ICPDR, so the five countries were contributing to materials for the Tisza Group through its experts"* (IP3). Until 2013 funding was available via the ICPDR and whereas all expert and task groups were shared with the ICPDR, there was one person located in the permanent secretariat in Vienna, dedicated to coordinating the Tisza Group`s work.

In 2013 funding through EU projects ended and the the ICPDR decided to seize supporting of the Tisza group through separate resources. Lack of funds (IP3) and, to a lesser extent, reluctance of partners to use ICPDR resources for sub-basin specific work (IP4) were mentioned as main reasons for the interruption of the Tisza Group`s work as conducted until 2013. Hungary, having appointed the Danube Regional Strategy`s goals as

national priorities, volunteered to take the Tisza Group`s work forward and has taken several steps in this direction since. At present, the Tisza Group`s work is coordinated from Hungary through resources and funding provided by the Danube Region Strategy but the Group still reports to the Secretariat and to the ICPDR during its standing and ordinary meetings (IP2, IP3, IP4). To solve the biggest hindrances to cooperation work in the Tisza River Basin, such as missing funds and reliance on ICPDR structures for Tisza-specific areas (having caused political dissatisfaction by non-Tisza partners as well as additional work for experts of the EGs (IP4)), the *idea* of a Joint Tisza River Commission was born.

The **Tisza River Commission (TRC)** does not exist; it is a vision of a river basin organization similar to the Sava River Commission, relying on member fees of the partnering states that fund own working bodies to cover technical work in the water management areas that constitute the foundation of policy-related cooperation – to then trickle down into practical projects – in a river basin. Hungary, motivated by its exposed position in the Tisza Catchment, is a strong advocate of the TRC idea. A so-called Tisza office was established in Szolnok after 2013; this has been pointed out by some of the interview partners to be an attempted River Commission Central office or a separate Tisza Group coordination point. However, the office`s authority is not accepted by all partners. This is a clear message, accepted by the involved parties and has led to plans regarding establishment of an actual Tisza Commission to be given up on for the foreseeable future. The invoked motives are diverging and range from disinterest, disapproval of the plan in general, lack of available state funds for further membership fees and down to potential political motivation. As an interview partner summarizes:

"Slovakia is not interested, as they have a very little percentage of the catchment, almost insignificant. (…) Romania… 2/3 of the catchment area is in Romania therefore they want to be able to decide what to do. And they do not accept someone from the outside tell them what to do in Transylvania[20]. Ukraine… they have no money at the moment for the Commission. As for Serbia – they are potentially interested, but due to lack of funds, they will always take sides with Romania and be against a commission." (IP6) Other interview partners (IP3, IP5) offer a more practical explanation as to why a Tisza Commission is not realizable in the near future: lack of funds and personnel nationally and a potential redundancy of water-management and flood related work when monitoring and reporting activities within a TRC and the ICPDR will overlap. As IP5 points out,

"for the ICPDR there is a membership payment. Every country pays for it, it is on Danube basin level, and that (note: the payment) *is quite big. If we go separately then Romania`s view is that it will exit the ICPDR. Because you can`t pay both here and there. And it is*

superfluous to do for both the work, because basically it is the same work." (…). And others, Serbia, as far as I know, are also against it. They have the Sava, and have enough problems already with that, because they cannot finance it" (IP5). The initial state of a functioning Tisza Group within the ICPDR`s structure is still seen as an option to return to, *"the ICPDR is the kind of neutral environment that some of the partners need"*(IP4). In the history of cooperation of the Tisza Region the Tisza River Commission would be a first and a major step towards integration.

4.2.2. Bilateral Agreements, Trans-boundary Water Commissions and their Structures

An overview of all features of the bilateral agreements analyzed based on the criteria described in the methodology can be seen in Tables A1 and A2 of the Annex, which summarize the institutional framework and main features of the flood management cooperation work on individual bilateral relation level. In each of the cooperation cases studied there is a formal, legally binding agreement signed between the parties, which contains explicit references to flood defense / flood management cooperation.

Hungary-Romania (HU/RO)

The first bilateral agreement between Hungary and Romania was signed under the auspices of the CRED in 1924 – it was called Hungarian-Romanian Water Regime Agreement (Papp 2008). The existence of such a long cooperation history was pointed out by IP5 and IP6 as a significant success factor for the on-going water management cooperation between the two countries. The second trans-boundary agreement was signed in connection with both states´ COMECON-membership in 1950. In 1986, the "Bucharest Convention between the Government of the Republic of Hungary and the Government of Romania on the regulation of issues related to hydraulic structures on waters which form or cross the border" was signed and the two countries established a Hydro-meteorological Sub-commission (Papp 2008, ICPDR 2015).

Relevant for the current bilateral cooperation is the 2003 Agreement between the Government of the Republic of Hungary and the Government of Romania on the collaboration for the protection and sustainable use of the trans-boundary waters that builds on the 1986 agreement and entered into force in 2004. Under the current agreement Romania and Hungary operate a bilateral water management committee, called the Romanian-Hungarian Hydro-technical Commission[21]. Three permanent sub-commissions, divided upon different thematic areas carry out the common work: sub-commissions for flood

[20] Transylvania is a historical region of Romania that belonged to Hungary until after the first World War and then partially during the Second WW. The Tisza tributaries and most oft he Romanian part of the Tisza Catchment Area lie within the boundaries of the historical region.

[21] Comisia mixtă româno-ungară hidrotehnică (RO) or Román-Magyar Vízügyi Bizottság (HU)

defense, for water management and hydrometeorology, for water quality. A fourth expert group completes their work, called the Expert Group for Water Framework Directive Implementation (Government of the Republic of Hungary and Government of Romania 2003). Romania and Hungary do not have the river Tisza specifically mentioned in their bilateral agreement; the trans-boundary rivers covered by their agreement are the Tur, Somes/Szamos, Crasna, Barcau, Ier, Crisul Repede, Crisul Negru, Crisul Alb (the three Körös) and Mures/Maros – all of them part of the Tisza Catchment Area.

As for most bilateral agreements, yearly meetings are agreed upon by the Commission based on its rulebook, i.e. delegations of the two countries meet on a yearly basis, additionally to the regular sub-commissions` meetings. Interview partners have confirmed that the meeting and update schedule has been respected in the past years and the cooperation has been described as a well-working, harmonic one.

Interview partners (IP5 and IP6) have called the Romanian-Hungarian commission "very regulated" – 11 regulations or rulebooks[22] complement the agreement and were approved to be binding along with the bilateral agreement by both parties. These regulations, or rulebooks, guide and exactly define all features and details of the trans-boundary cooperation, the ways of working and responsibilities of all sub-commissions. There is, for example, a Regulation referring to protection against trans-boundary floods (including floods on national territory that have an effect downstream in Hungary) and one that prescribes frequency, location and ways of monitoring activities for water quantity and quality. Communication between the two partners, recognized as one of the – or the most – important factors when it comes to trans-boundary floods or other hazards, is regulated in a separate rulebook. Channels of communication, frequency of communication in different scenarios as well as content of communication are precisely defined in the official rulebook. In spite of the strong formal, regulated character of this cooperation, its partners have pointed out the fact that informal cooperation works particularly well. As expressed by one interview partner, "*Of course, this is not just a work relation, but also human relation. I can call anytime my colleagues… you don`t have to contact officially the (...) counterpart, you can do it in a very fast and easy way. And if there is any questions or request from them, we also do it very fast. (…) I like this cooperation a lot because it works very well*" (IP5). Unique about the Hungarian-Romanian cooperation is the fact that after negotiations that lasted about a decade, the two states` representatives managed to agree on a Drought Regulation – ratified as a legal document by both countries` governments in 2004. This has little to do with flood management; however, the ability to reach agreement in such a sensitive matter was mentioned by two of the interviewed partners as extremely difficult (IP4 and IP5) and suggest

[22] "Regulation" refers to legally binding rulebooks that regulate the daily work and different periodical tasks within the frame of the trans-boundary cooperation.

a strong cooperative character in the two state`s relation.

The Hungarian-Romanian cooperation does not miss clash points: delimitation of the territory included in the bilateral agreement has been mentioned by two of the partners as a sensitive topic. Water reservoirs located in the mountainous areas of upstream Tisza tributaries are currently not included in the agreement territory, therefore information exchange referring to them is not mandatory and the downstream Hungary does not have a say in water level maneuvers using these reservoirs.

Hungary-Serbia (HU/SRB)

As in the case of other former countries part of the so-called East Bloc, Serbia and Hungary also share a long history of cooperation rooted in earlier times, when Serbia was part of the greater Yugoslavia. The initial Agreement between the Government of the People`s Republic of Hungary and the Government of the Federal Republic of Yugoslavia in the field of water management issues had originally been signed in 1955 and kept its validity unchanged until the regaining of independence by former Yugoslavia`s states. After that, Serbia continued along the lines of the same agreement in its cooperation with Hungary (ICPDR 2007, Alsó-Duna-völgyi Vízügyi Igazgatóság 2016).

The cooperation`s main institution is the Joint Hungarian-Serbian Water Management Commission, with five representatives from both countries23. A commission and two sub-commissions focus on separate competency areas: flood protection, water management and water quality (Alsó-Duna-völgyi Vízügyi Igazgatóság 2016, Magyar Vízügy 2016). Meetings of the bilateral Commission are held by agreement yearly, completed by regular meetings for the sub-commissions. According to interviewed partners, the cooperation does work in practice regularly as well. Currently a new, modern agreement text is being aligned by the two countries, which should replace the 1955 agreement and reanimate cooperation.

The two partners agreed on a new Hydro-technical cooperation rulebook (2007), and the age of their initial agreement seems not to have stood in the way of numerous cooperation projects (first and foremost EU Interreg as well as EU IPA projects-funded) between Hungary`s Lower-Danube Water Directorate and the Serbian National Hydrometeorology Institute – the direct implementation partners (ADUVIZIG - Lower-Danube Water Directorate 2013).

Common funding of flood management infrastructure investments is not a topic between the two countries – the option was dismissed as “not open for discussion” by interview partners. Current flood protection investments by Hungary directed at increasing the floodplain available as well as building flood reservoirs above the Serbian border (within the New Vasarhelyi Plan) are of great interest for Serbian water management authorities. Not

[23] Magyar-Szerb Vízgazdálkodási Bizottság

sharing plans for the reservoir construction in advance with the Serbian counterpart has been noted by one of the involved parties as a point that would have offered potentially more open handling ways.

Hungary-Ukraine (HU/UA)

Hungary and Ukraine had a trans-boundary water agreement with the Soviet Union in place as early as the 1940s, following the Second World War (1949) (Papp, Magyar Víz- és Szennyvíztechnikai Szövetség 2012). This Soviet agreement lost its validity after fall of the Soviet Union. However, after regaining its independence, Ukraine entered a new bilateral agreement with Hungary within two years (1993). This agreement was replaced in 1997 by the currently valid agreement that “established a new model of co-operation” (Papp, 3). The cooperation is based on this bilateral agreement and is led by the Ukrianian-Hungarian Transboundary Water Management Commission, built up by both Hungary and Ukraine`s governmental representatives (and their deputies) meeting at regular intervals (Magyar Vízügy 2016). There is a division of the competencies into three expert groups, including an expert group for Flood Risk Management (besides the expert groups for hydrology and water management and for water quality and protection). The EG for Flood Risk Management`s responsibilities include management, maintenance and yearly inspection of canals, dams and other flood protection structures as well as verification of further construction plans (Papp 2012).

The two partners have had a good relationship concerning flood risk management, starting from the 1990s and into nowadays. Common projects yielded a network of flood reservoirs on the Ukrainian territory of great importance to Hungary, however, serving flood protection purposes for both countries. Outcomes of common projects also include a complex hydro-meteorological monitoring and forecast network (telemetering system) between Ukraine and the Upper Eastern Hungary as well as coordinated flood protection construction development and renewal (Dajka 2013). The common network of automatic monitoring stations and forecast system is one of a kind in the Tisza Basin for at least two reasons. Firstly, it is the result of a common project that was funded by the two countries together. Hungary, having recognized the danger stemming from an information lag when it comes to the fast-moving floods that approach the country from Ukraine, contributed to the realization of a joint system, including automatic gauging stations and data transmission system, early in the 1990s. A second development stage was completed in the recent past Secondly, the fact that Hungary has access to Ukraine`s water monitoring system ensures that real-time information is reachable to both Hungarian and Ukrainian water authorities. The Upper Tisza Water Directorate of Hungary and the Zakarpathian Water institution are tightly cooperating especially when it comes to floods. Bad communication after the 2000 floods has led to dam heights being unevenly constructed on the Ukrainian border. Ukrainian

authorities have lifted the height of their protection dams on their riverside in an attempt to avoid future devastation by extreme floods. An alignment with Hungarian water authorities was omitted, which eventually led to uneven protection level on the two banks of the Tisza. Height differences between protection constructions on the two banks of the river were as high as 1 meter, partially even more. The bilateral cooperation has yielded in this case a project initiative that proposed common modeling of water discharge and flood hazard in order to harmonize design flood levels. Design flood levels were successfully harmonized during 2013 and dam sections on the border area were aligned. The project was connected to Hungarian efforts to shift from calculation method of design flood events based on the time series of water levels to those based on water discharge instead.

Romania-Ukraine (RO/UA)

Romania and Ukraine have signed in 1997 the Agreement between the Government of Romania and the Government of Ukraine about cooperation in the field of water management on trans-boundary watercourses[24]. Romania and Ukraine share common borders on two separate fronts – the Tisza constitutes Romania`s Northern border to Ukraine, whereas the shared river of bigger importance is the Danube, on the South-Eastern part of Romania. The two countries share a part of the Danube Delta as well as a navigable part of the Danube towards the Black Sea. An agreement for trans-boundary waters therefore comprises relations on both of these rivers. Following the initial agreement common working groups were established to carry out the cooperation work, divided on river basins: a Working Group to resolve issues of Tisza River and its tributaries in the border area, a WG for Siret-Prut in the border area and a third WG focus on the issues of Danube on the common border area. Thematic areas such as water resources management, water quality assessment and ecological monitoring, flood defense and hydro-meteorological information exchange are covered by each working group in their geographic responsibility area. The specificity of the Ukrainian-Romanian bilateral cooperation is reliance on working groups divided by river catchment areas – the single such delimitation in the Tisza River Basin.

The agreement requires regular meetings of the Joint Commission as well as regular meetings for the working groups. The latter is regulated by rulebooks referring to each working group`s functioning. Four rulebooks are currently valid that define flood collaboration, data exchange, water quality analysis on border sections and, not surprisingly, accidental pollution hazards that cannot be avoided. This amount of regulation is significantly less than those setting the framework for Romania`s cooperation with Hungary. The working

[24] Acordul între Guvernul României şi Guvernul Ucrainei privind cooperarea în domeniul gospodăririi apelor de frontieră (signed in Galaţl on September 30th 1997).

groups meet in fairly regular intervals and cooperation in the thematic areas functions well. The Bilateral Commission does not meet yearly; the last occasion when the Commission congregated lies back in 2012. The working groups do meet in regular intervals, as defined in their rulebooks.

Romania-Serbia (RO/SRB)

The two countries have entered a bilateral agreement as early as 1955, during a time when Serbia was still part of the greater Federal Republic of Yugoslavia. The agreement serves as a legal framework for cooperation between Romania and Serbia until today, as there has been no formal agreement signed by the two parties to replace or amend the old one. There are, however, currently ongoing negotiations for a new agreement to re-organize water management cooperation. The institutional framework on national or bilateral level is there – the organization into sub-commissions around water management topics offers the framework for bilateral cooperation. There are three sub-commissions: for water quality, for flood defense and ice and a subcommittee for hydro-meteorology and quantitative water management. Trans-boundary rivers and river basins covered by the agreement are the Danube, Nera, Moravita, Aranca, Bega Veche, Bega Channel, Timis and Caras.

Research on this cooperation indicated some cooperation on the regional level, limited to the region and localities located around the common border. Involved parties are regional organizations such as regional administration of Timis County on the Romanian side and local administration of municipality of Zrenjanin on the Serbian side.

Regular meetings are part of the agreement between the two countries. Nevertheless, the interviewed partners have described the cooperation as less successful and active one. The last meeting of the Joint Commission was held in 2012.

4.3. Delimitation between the ICPDR and Bilateral Commissions in the River Basin

The **ICPDR** defines itself as a ***cooperation platform***. As such, it does have a dispute settlement assistance capacity, the use of which, however, was rarely or never required in practice. All interview partners that are or had been involved in the ICPDR`s work have pointed out that the atmosphere at meetings as well as in regular work situations has been a very technical- and solution-oriented, friendly and productive one. This is reinforcing the ICPDR`s own statement that *„the atmosphere at meetings is focused on facts and characterized by mutual respect and a common acknowledgement of the ICPDR's objectives and tasks*“ (ICPDR 2016). As officially stated and reinforced by interview partners, conflicts are taken to interstate, bilateral level where states do work on ensuring proper dialog for reaching consensus. On the other hand, as one interviewee pointed out, involved partners

already have a feeling regarding the issues that cause stir – unless required otherwise by common interest or for goals of specific projects, these are not picked up (IP2).

Based on the interview partners` description of the cooperation work in the framework of the ICPDR, catchment-level planning and strategic documents, such as the now compulsory management plans, are a patchwork of national level plans and strategies put together into river basin level summaries. For activities or outputs of the ICPDR (or of its bodies), such as projects, analyses, data compilations or planned reports/publications, information based on standardized requests is gathered from all parties. Local delegations carry the responsibility of alignment and follow-up in their home countries, whereas EGs coordinate the work on content areas. The Secretariat fulfills the role of supporting the creation and dissemination of standardized questionnaires used for information gathering from all involved parties. The information collected in this way is then put together in the Secretariat in the form or template required. As described by one of the interviewed experts, *"what the Secretariat then does is to take these country reports or materials and put together a final report. So basically this is an editing task/service"* (IP3).

Key aspects dealt with within the ICPDR have been initially set by the cooperation work`s foundation document, i.e. the Danube River Protection Convention and comprise sustainable water management, conservation and improvement of surface and ground waters, pollution control and hazard reduction from nutrients and hazardous substances and control floods and ice hazards. Flood management is treated as a "side topic", even if a significant one (IP4, IP3). The Flood Protection Expert Group is the working body responsible for flood management policy directions within the river basin, i.e. the *"***orchestration of basin-wide** *flood protection* **measures***"* (ICPDR 2016).

In spite of being carried by political players such as ministers or state secretaries and civil servants of state institutions, the country delegations to the ICPDR do not have *decision authority* in the sense of being entitled to take binding political decisions in ICPDR meetings that automatically transfer to national or bilateral levels. As pointed out by an interview partner (IP1), it is "*a very sensitive issue"* to have delegations vote on an issue and decisions of the ICPDR be taken back to national or bilateral level "*without actually telling governments or bilateral commissions what to do*". Another partner (IP3) reinforces the statement that the head of delegation cannot return into their countries and forward instructions to the responsible minister on what should be done. This interview partner formulates the decision power in a simplified way: the Ministry – or the minister at the head of the ministry – responsible for directive implementation is the center of a two-way communication. Both bilateral commissions and ICPDR delegations align with the head of the responsible ministry before representing their countries` interest within the ICPDR / bilateral commissions and then report back to the head of delegations. National policy makers and bilateral

commissions, if we focus on international cooperation work, can take suggestions but no directions and have basically the last say in terms of decisions regarding planning and project implementations. Any decision, commitment or recommendation of the ICPDR has to be taken back to the national level and put into a legally binding document (a law or a government resolution) in order to become binding. This involves approval by the responsible ministry and then by the government. The ICPDR does not interfere with states` internal affairs, as pointed out by several interview partners (IP1, IP3). It also does not interfere with typically bilateral issues, as these are left for the involved states to clarify through their strictly regulated framework.

The **Tisza Group**`s main task, similarly to the "mother organization" ICPDR has always been integrated water management on basin level (IP4, IP1). Flood management has been playing a secondary, nevertheless very important role within the Tisza Group, due to a great extent to the pollution hazards increased by floods (such as during the floods in the year 2000) (IP4). With one person assigned full-time to supporting the Tisza Group within the Secretariat, the Tisza group enjoyed separate attention – the support, pressure, coordination and editorial work provided by the Secretariat was now doubled on Tisza Catchment level. During its initial years, until funding stopped in 2013, an important amount of analysis, planning and coordination work had been conducted on the Tisza River Basin. The Tisza Analysis Report (2007) was the result of a unique analysis of geographical, administrative and water policy analysis of the basin. National agencies and water management institutions cooperated and the document contained very detailed summary of geographical, hydrological and water management information referring to the basin. As pointed out by IP4 involved in the work surrounding this publication, the Analysis also contains the most detailed basin level inventory of flood management structures available at the time in the river basin (see also ICPDR 2007, Chapter 7). It further contained a summary of middle and long-term flood plans for each of the five states, providing the kind of detailed overview for the Tisza Catchment area that allows the Flood Protection Expert Group (FP EG) to maintain an overview and successfully orchestrate of flood planning policies on the Tisza sub-basin level.

An important delimitation that crystallized during conversations with the experts is one that basically summarizes per definition differences. Bilateral agreements and commissions offer a highly regulated framework for *daily work*. The level down to which regulations are negotiated and agreed upon is extremely detailed; regulations shape the daily work of technical staff and experts, administrative clerks and politicians affiliated to or involved in the bilateral commissions` work. At such detailed level policy is agreed upon (ideally in yearly Commission Meetings) but also actively implemented and reviewed. On the other hand, the ICPDR is, although working as well in a highly regulated way, i.e. far from an ad hoc manner, declaredly less focused on details. Even within its politically filled bodies such as the

standing and ordinary meetings, *policy commitments that merely set the direction* of actual state and inter-state level policies are the usual. This difference has been highlighted by interview partners in statements such as "*if you want concrete cooperation, you need to go to the bilateral level – there you have data exchange and all on a daily basis"* (IP5), or, referring to handling of an environmental issue, *"sometimes it feels like the ICPDR is not fighting the real, practical problems. The practical solutions can be found on the bilateral level"* (IP6). This creates the impression that in spite of highly appreciating the work done by the ICPDR, these partners feel more confident about the less general and more down-to-earth, visible type of work that produces immediate outputs.

The ICPDR partners in international *projects* its members are involved in, occasionally being the driver of those projects. Some projects are basin-wide and involve all members, whereas regionally or, grouped around sub-basins, members do work project-based as well. The type of the projects with flood management relevancy varies greatly – from projects meant to clarify and harmonize methodology used for risk calculation and risk mapping, through some meant to provide system tools down to projects that deal with practical flood protection. The more concrete the project, usually, the less partners are involved. Many of the topics involve scientific research – in this case the ICPDR coordinates, through its Expert Groups, scientific research cooperation internationally. Annex Table XX contains a list of selected (completed or ongoing) projects with flood risk management relevancy of the past years in the area.

4.4. Spectra of integration

The present thesis looks, firstly, into the relations between countries in the constellation of water - and more specifically, flood – governance involving the river basin level organization ICPDR, bilateral commissions and the relations these have with the national governments in terms of policy making and implementation. Secondly, the role played by the European Union is given special attention, in terms of its role as a governance actor in the ICPDR – partner states – bilateral water management commissions – triangle, who influences policy through multiple channels, such as legal obligations, and funding mechanisms.

There is a strong formal characteristic of each of these relations – the text of the bilateral agreements formulates the cooperation framework, expresses commitment and delimitates all thematic areas to be addressed in a common work on trans-boundary areas. This legal framework is then "filled in" with concrete, formal legal papers (rulebooks) that define sets of rules agreed to by both partners regarding the smallest details of the cooperation work. The rulebooks – in some cases abundant in number – that complete the agreements define rules that range from information exchange to border crossing for

monitoring purposes and travel costs during common meetings. Among other topics, the ways of working and the frequency of meetings for each subordinate body as well as the frequency of data exchange and monitoring activities are included as well.

Whereas *formally* all five case studies fulfill the criteria to be classified between strong semi- and full integration, the relation between HU/RO is at the same time the oldest formal one and has been described at the same time as “the most modern” (IP 6); new version of the agreement was signed in 2003, after publication of the Water Framework Directive. It has as well been called the “most regulated” (Papp 2008) one, nevertheless, in a presumably positive sense, underlined as well by the experts involved in this cooperation (IP5 and IP6). Serbia carries negotiations with its neighbors Hungary and Romania at the present in order to renew the water treaties originally signed in the 1950`s and still active today. The HU/SRB and RO/SRB relations do formally rely on this old agreement, which suggests that some of the thematic areas currently covered do not rely on a formal base; newer rulebooks presumably play in their case a significantly higher role.

Regular Follow Up Meetings are a requirement formulated by each agreement. In practice the reality is a different one, influenced by several factors, from economic or political issues a country is dealing with to priorities set by central governments. The relation HU/RO is kept on a daily basis. Besides the cooperation in fieldwork between the regional Hungarian water directorates and the regional Romanian water basin administration Somes-Tisa, the national delegates of the subcommittees meet as well with a yearly frequency. The Hydro-technical Commission that reviews their work usually times their meetings after the subcommittees` yearly sessions. Experts involved in this relation reported yearly activity and the review meetings` protocols available online show that in cases when a meeting cannot be organized at its planned time, the next cycle is shorter, i.e. the meeting is simply shifted. The relation is also very transparent; protocol and other documentations often can be found online. The relations HU/SRB and RO/SRB are being kept up, as well, with yearly meetings of the Commission and, in case of HU/SRB, the subcommittees. Ukraine is an outlier in this sense. In spite of valid formal agreements and bilateral commission with Hungary and Romania (HU/UA and RO/UA), at least six years have passed since the last RO/UA standing meeting and several years since the last HU/UA meeting. The working groups do meet and keep up daily cooperation work. The HU/UA cooperation does rely on daily cooperation between the territorial water management authorities, on the one hand due to common monitoring systems and on the other hand due to the rapidity with which water events occurring in Ukraine reach the Hungarian border. The sluggishness of the Commission meetings involving the Ukrainian counterpart are explained by the interviewed partners through the political turmoil that the country has been experiencing since 2011 and its dire economic conditions that keep it from fulfilling its obligations. Four of the interviewed experts

(IP1, IP6, IP3 and IP5) have mentioned Ukraine`s current state and the lack of resources caused thereby as a negative factor in terms of preserving a good cooperation with Ukraine – whether referring to bilateral or multilateral (ICPDR-level) cooperation.

A *separate body for flood defense/flood management* has been set up in four out of the five bilateral agreements` framework. This has the form of sub-commissions for RO/SRB (ice defense explicitly included), HU/RO and HU/SRB and the form of an expert group for HU/UA. Romania and Ukraine (RO/UA) operate in a different manner, having designated working groups instead of commissions, and on the level of shared water basins, in an integrated river basin management approach, instead of expertise area split. The coordination and supervision of the bilateral work is under national authority in all study cases.

Data Exchange is a strongly regulated and extremely important point of trans-boundary water management cooperation. Placing the focus on flood management, data exchange gains even stronger significance, both for hazard scenario modeling and for early warning purposes. Each of the bilateral relations mentioned above does include a legally binding rulebook that sets the framework for data exchange. Even in the case of RO/UA- or RO/SRB-cooperation is characterized by the fact that the Bilateral Commission does not respect its obligation to meet in a yearly frequency - the working groups and sub-commission, respectively, do continue with their daily and periodical routine works. Data transfer rules set up years ago continue to be conducted. Nowadays information is kept on servers, easily reachable if shared by a person with the server connection information. Based on the interview partners` assertions and primary documents (meeting protocols) the chosen means of data exchange in case of bilateral cooperation relies on server data access. Data exchange works without noteworthy hindrances – once again the difficulties are met a step earlier during negotiations between cooperating country delegations and are usually connected to delimitation of area and object for which data exchange should be granted (see RO/HU regarding relevancy of water reservoirs for trans-boundary relation).

An outlier in the positive sense in terms of data exchange in the Tisza Region is the HU/UA relation. Hungary – its regional water directorate that cooperates with Ukraine`s Zakarpathian water authority – has access to real-time data from designated automatic gauging stations. Hungary and Ukraine jointly possess an automatic distance hydro-meteorological measurement and monitoring system. Real-time access in parallel to both Ukrainian and Hungarian data is accessible and the network of measurement and monitoring stations has not only been implemented in a joint Hungarian—Ukrainian project, but the Upper-Tisza Regional Water Directorate of Hungary (FETIVIZIG) collaborates continuously with their Ukrainian counterparts from the Zakarpathian Oblast in order to ensure maintenance and functioning. Hydro-meteorological data is accessible for the larger public

through a simple interface on the FETIVIZIG website (Figure 1). Historical time series data can be requested through a separate form.

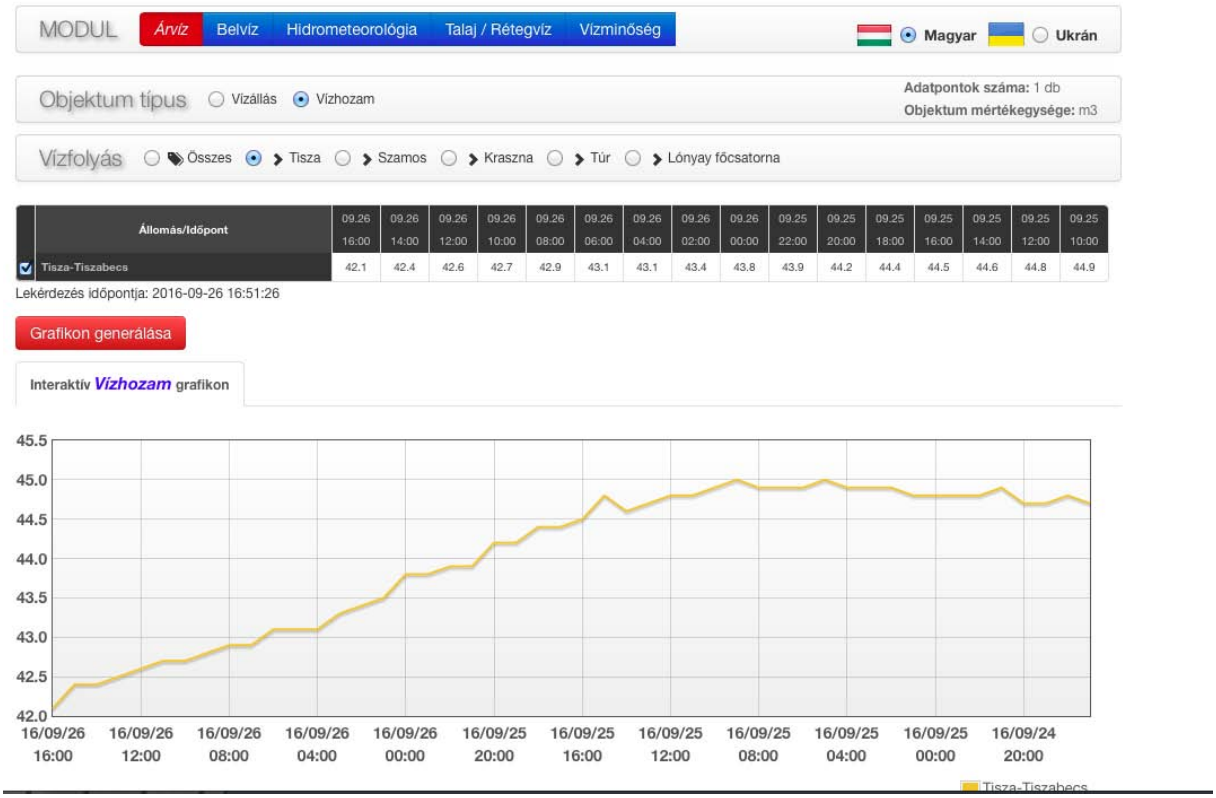


Figure 3: Online Access to automatic measurement data from Hungary/Ukraine[25] Pictured: water discharge on the Hungarian side at Tisza-Tiszabecs on 16.09.2016

Data harmonization is mostly given. As explained by an involved interview partner the harmonization of methods referred first and foremost to the basics: such as the data used for statistics, i.e. water levels or water discharge. Since the redefinition of the Hungarian legal design flood level (MÁSZ – Mértékadó Árvízszintall Tisza countries use the sameunderlying data for time series and their statistics. Methods used for modeling using this information are various; on a national level for hazard and risk mapping the same method must be used by all regional bodies. In the river basin, however, no such harmonization exists between involved states. Single research programs have been conducted most notably between Hungarian and Ukrainian partners for the design flood level harmonization and alignment of dam heights on border areas as well as between Serbian and Hungarian partners for similar purposes; common hazard modeling projects were done also on the Hungarian-Serbian near border sections of the Tisza.

The most important feature of the EC`s Floods Directive is the shift from flood protection to *Flood Risk Management* and, as previously mentioned, requirement of a river

basin level approach for coping with flood risk. The ICPDR Secretariat worked along with its partners on the Danube River Basin Flood Risk Management Plan that fulfills the FD`s requirement referring to international river basins – all five of the Tisza countries have cooperated on this endeavor. The plan sets five objectives: avoidance of new risks, reduction of existing risks, strengthening resilience, raising awareness and the solidarity principle. These objectives "*focus on reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity"*; considered aspects of flood risk management for each of the objectives are prevention, protection, preparedness, including flood forecasts and early warning systems (ICPDR 2015, 27). Measures that are planned for implementation in order to reach the objectives set through the management plan have to be included in the plan.

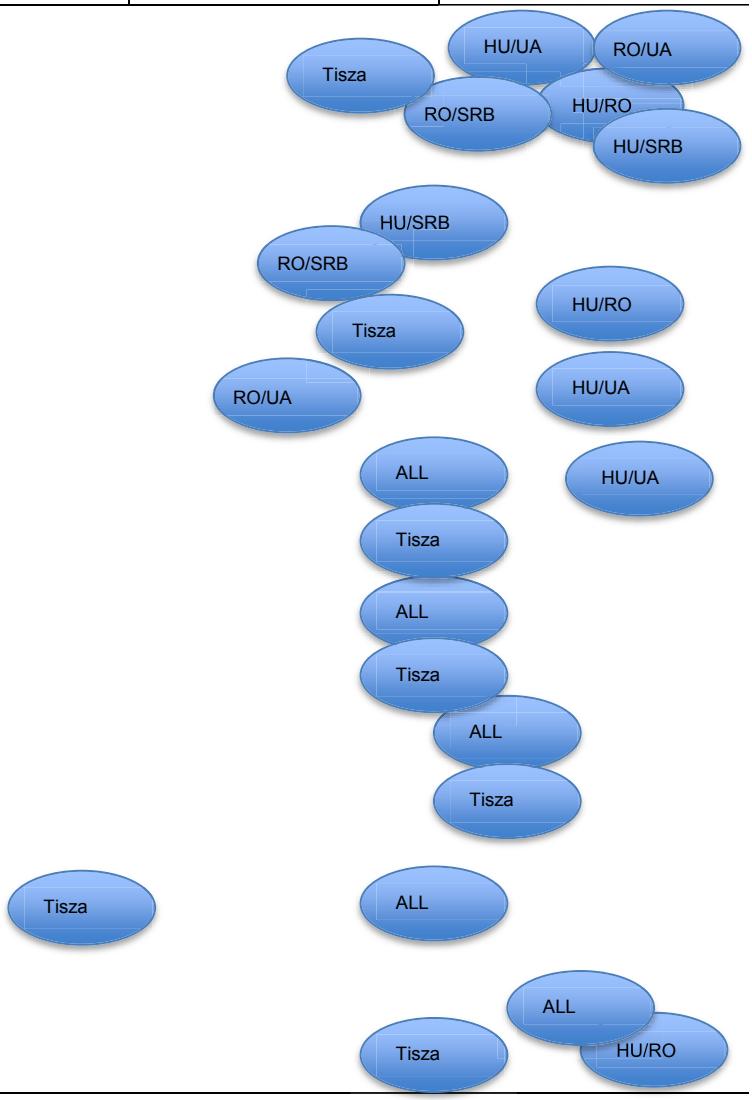
The level of detail used in the DRBMP by the ICPDR is the strategic level, i.e. measures with trans-boundary effect and measures applicable in more countries of the basin such as awareness raising, warning systems or ice protection measures. Table A4 of the Annex contains a list of all measures committed to within the DRBFMP by the four Tisza countries analyzed in this thesis. The flood risk management plan does offer a good overview of what each country plans in their flood risk management. Notable about this list of measures is that it corresponds to the main direction understandable from interviewed experts` statements. It can be recognized, that e.g. Ukraine and Hungary clearly have had an issue with their common design flood level definitions and measures in this direction are included. Or, to highlight one further example, Hungarian experts have admitted needing more effort to improve their public consultation and information methods (IP2). Measures planned by Hungary as listed I the DRBMP (See also Table A4) in this direction are, indeed, mentioned in the list. One further point all experts interviewed seem to have agreed about regarding national flood risk management plans during the interviews was that there is one main direction within the EU: that of implementing FD requirements. Thereby a shift form structural flood protection towards flood plain management and more environmentally acceptable measures is also sensible. In spite of these, basically each country builds on their existing infrastructures, one could say, each of them "picks up from where they are" in their implementation – in spite of one FD and one main direction, clearly put into a frame by the ICPDR and its basin overarching FRMP, the measures are not the same. Needs of the countries as well as the level of existing flood protection and flood management infrastructure is different, therefore measures must be such as to lead in the end to achievement of the objectives. There cannot be a complete overlap of implementation plans. This is clearly reflected by the DRBMP, that contains a very wide range of *best practice* measure examples. However, no clash points were noted by the countries in their flood risk

[25] Source: https://www.fetivizig.hu/hun/tavmero.net

management planning; the so-called “preference” for certain measures is explained by their existing infrastructure rather than resistance or reluctance against a different set of measures.

Table 4: Level of Integration of RBOs in the Tisza River Basin based on selected criteria

	Stage I No integration	Stage II Semi-integration	Stage III Complete integration
1. Agreement 2. Type of Agreement			
3. Institutions 4. Separate Body for Flood Management 5. Regular Follow-up Meetings			
6. Data Exchange			
7. Flood Hazard Modeling / Methods			
8. Flood Risk Management			
9. Event Management			
10. Involved Experts` Assessment			



Event management agreements and harmonization has not been dealt extensively within the present thesis. RO/UA and RO/HU have two signed formal agreements in the form of Rulebooks for flood event collaboration. Mentioning this kind of features in the bilateral water agreement is an important factor. Nevertheless, the practical collaboration in its details regarding the Who?-s When?-s and How?-s of flood event intervention on border territories

is down to the regional branches of disaster relief organizations. Formal, legal agreements are kept between national inspectorates (or other institutions) for Emergency or Disaster Relief. Floods directive implementation is subordinate to the Ministries of Environment in Slovakia, of Environment, Waters and Forest in Romania, which coordinates the NARW. Hungary is the only country out of the four studied in the Tisza Region where the water management institutions responsible for FD implementation are subordinate to the Ministry of Interior, the same ministry that coordinates disaster relief. In Ukraine the Floods Directive is similarly to the other Tisza countries in the responsibility of the Ministry for Ecology and Natural Resources. Executive tasks are shared by the State Emergency Service and the State Agency on Water Resources of Ukraine (Table 2).

Conclusions drawn regarding level of integration in the Tisza River Basin are shown in Table 2 - the image is quite clear. The cooperation bubble “Tisza” refers to the four-country cooperation integration in the Tisza Basin. Tisza-specific ICPDR initiatives as well as other basin-wide projects were considered for this cooperation. There are several points of the synthesized result table that require further in-depth analysis and argumentation. One cannot accept the categorization table as displayed, without giving special attention to specificities of each of the pairwise relations, leading to differences in the extent to which two states cooperate in flood management. Whether due to political or economic situation, in which case policy recommendations could be concluded upon, or, due simply to hydrology of the basin, which would suggest entirely different recommendations, since the starting situation can`t be influenced.

4.5. Discussion of the Spectra of Integration

4.5.1. Agreements and Types of Agreement

As expected, the pairwise cooperation between countries in terms of water management (and, implicitly, flood management) does show some variation. Whereas there is a written, formal and binding agreement in each of the cases, experts mention the agreement between Hungary and Romania, signed 1986 and renewed 2004 or the one between Hungary and Ukraine, modified and reaffirmed as well in the early 2000s as more modern – having had remodeled the way trans-boundary cooperation is done between the countries. On the other hand, Serbia for example is still in process of negotiations with its partners for renewing the agreement valid since 1955. Nevertheless, the fact that the cooperation does work based on a new Hydro-technical cooperation rulebook signed in 2007 and the two partners are fairly active cooperators, was interpreted as a signal that the

agreement is at least equivalent to the more modern ones signed between the other partners.

What is notable about each of these co-operations for water management is the longevity of. Two of the interviewed partners have pointed out the significance of the fact that a partnership is very old. Institutions and the people involved in those institutions are aware of the common history, which leads to a build-up of trust. IP3 points out that the relation with colleagues from the counterpart country within the bilateral hydro-technical commission is *"not just a work relation but a personal relation"*. As suggested by Putnam and colleagues (1993), "voluntary cooperation is easier in a community that has inherited a substantial stock of social capital, in the forms of norms of reciprocity and networks of civil engagement" (Putnam et al. 1993, 167). Social capital in this context refers to "features of social organization" meaning "norms, and networks, that can improve the efficiency of society by facilitating coordinated actions" (ibidem). Whereas this argumentation refers to the effects of social capital in voluntary forms of cooperation, the arguments do have their place in a more general setup as well. Lin`s work about social capital uses a simple premise regarding this notion: "investment in social relations with expected returns" (Lin 1999, 30). Information, influence on social *agents* (counterparts, in our case) and *social credentials* are three factors that are used to explain the mechanism that leads social capital to exert positive effect in terms of cooperation. Social capital or trust should facilitate the flow of information. Influence on agents can be exercised based on social ties, thus influencing decisions, whereas social credentials refers to an "individual`s accessibility to resources through social networks and relations" (Lin 1999, 30).

Referral by two of the interviewed partners to ease of cooperation in a very informal way suggest the applicability of this theory. Two of the partners (IP5 and IP3) mention informal telephone calls with partners from the other side of the border mainly relying on long, informal relation between them. IP3 adds that the informal, fast intervention in case of smaller questions is reciprocal. Similar inputs were received for the larger circle of ICPDR experts and even delegation members. IP2 mentions that there are *"more and more familiar faces"* on conferences and points out the role of *"coffee breaks"* for expert knowledge exchange and networking. Such indications underline the role of trust in information sharing and informal cooperation additionally – or complementary – to formal cooperation.

4.5.2. Institutional Setup of and Frequency of Meetings of River Basin Institutions

All but one of the cooperation relations involves a separate body for flood management, in the form of a working group or a sub-commission. While most cooperations, including the ICPDR, rely on working groups or sub-commissions for expertise areas such as

water quality and ecological monitoring, flood defense, hydro-meteorological information exchange, the Ukrainian-Romanian Joint Commission coordinates the work of working groups centered around the three major shared watersheds: the Tisza and the Siret-Prut watersheds as well as the Danube-Delta-Black Sea (synthesized details in Tables A1 and A2 in the Annex). This involves each working group having to work with experts on at least three topics – water quality, water resources management and flood defense – each required to cover all of these thematic areas. The Working Group for resolving issues on Tisza River is therefore the responsible body for flood defense in the RO/UA relation. As rulebooks generally refer to rules on thematic areas, one could argue that in case of the RO/UA agreement better specialized rules and practices can be put into place on a river basin level, as the same expert group deals with one river basin on the whole river basin management pallet of areas. The organizational structure relying on expert groups, chosen by the ICPDR and the HU/UA bilateral organization, as well as the one relying on working groups, chosen by RO/UA bilateral organization are, as pointed out, signals of an expert-based cooperation, with increased technical input from cooperating states´ sides and reduced burden on the organizations themselves (Schmeier 2013, 93). On the other hand, sub-commissions focused on technical areas, as in use by the orgnaizations for cooperation between Hungary-Serbia (HU/SRB) and Hungary-Romania (HU/RO) could suggest a politicised discussion of technical issues, with higher level invovlement in issues of technical relevance (Huitema et al. 2009).

Susanne Schmeier`s categorization of different organizational bodies (Schmeier 2013, 91-94) of river basin governance mentions expert and working groups and, as a separate level of organization, organizational bodies for linking national water resources governance to the RBO level. She notes that expert and working groups *"bring together expertise from member states in order* ***to coordinate*** *(****rather than to implement****) river basin governance"*. This form of RBO bodies therefore seems to be most common in RBOs oriented towards coordination at a high technical capacity level. (Schmeier 2013, 93) This observation does match very well the ICPDR expert groups` responsibility delimitation, which involves mainly oversight and coordination to ensure river basin level coherence of policy direction. In case of the bilateral commissions` bodies, there is some differentiation.

On the other side are the organizational bodies linking national water resources governance to the RBO level, that in the case of Schmeier`s study of worldwide RBOs "accord a high importance to economic development on the basis of the river`s natural resources. National Commissions thus seem to emerge especially in implementation-oriented RBOs" (Schmeier 2013, 93). The tasks of a Commission/Technical Committee in the cited categorization include the "operationalization of high level decisions into work plans and programmes, projects"; those of the expert/working groups is a more expertise related

one in which technical advice is given through them from the member states to the RBO. National commissions, on the other hand, fulfill the role of “administrative, functional or technical linkage of RBO to member states”. In spite of the different naming and partially, structuring of the subordinate bodies, in all cases these seem to fulfill the expertise grouping and coordination role described as typical for expert/working groups. Romania and Ukraine opted in their collaboration for a working groups structure centered on shared river basins and not subordinated to a Council / Bilateral Commission. On the other hand, the working groups meet regularly and hold the trans-boundary cooperation up in spite of very rare meetings by the national delegations. Meetings of national delegations involve governmental representatives and the heads of each RB WG from both states (and additional experts – from national and international level e.g. from ICPDR) – this points to an implementation-orientation, as described above. This kind of cooperation involves less administrative effort and offers a more direct path between bilateral discussions and implementation. The synthesized results of Table 3 that shows the categorization into levels of integration based on institutions, follow-up frequency and separate body for flood management shows the conclusion based on the integration levels defined in the methodology. This does not mean that definition of integration levels using different points of view would not yield a different result.

Table 5: Subordinate Organizational Bodies in the Tisza Region Cooperations

Bilateral Cooperation	**Organizational Form**
HU/RO	Sub-commissions for expertise areas
HU/SRB	Sub-commissions for expertise areas
HU/UA	Expert groups for expertise areas
RO/UA	Working groups for river basins
RO/SRB	Sub-commissions for expertise areas
DRB (ICPDR)	Expert Groups for expertise areas

Regularity of follow-up meetings for bilateral flood management organizations has proven to be a tricky feature to look into. On the Tisza River Basin level meetings of the ICPDR`s bodies have been considered. Whereas the Tisza Group has seized to be a separate but integrative body of the ICPDR, it still exists and its activity is on the agenda of every ICPDR meeting, which are known to take place regularly, as defined by agreements. Focusing on the bilateral levels, however, not all of the cooperations studied have the necessary framework for the Bilateral Commission to meet on a yearly basis. The Hungarian-Romanian Hydro-technical commission meets on a yearly basis and the sub-commissions meet indeed twice yearly, as the initial agreement and the rulebooks have prescribed. In

spite of similar provisions in the respective agreements, Romania`s bilateral commissions involving their Serbian and Ukrainian counterparts haven`t met for several years. It is far-fetched to interpret a lack of political will in these cases and, as pointed out by the interviewed expert, there is no such reason behind it; irregular meetings seem to be caused rather by a lack of assigned resources. It also cannot be automatically deduced that these cooperations work less well. Basically there might be less political commitments by the heads of delegations to the bilateral commissions, but the evidence shows that expert and working groups do still meet on a fairly regular basis. Base of the practical side of bilateral cooperation are the so-called formal rulebooks that define frequency of meetings, delimit responsibility areas and set the frame for all activities involved in daily or cyclic work. Territorial organizations subordinate to the national level institutions continue direct cooperation and involvement in projects with their territorial counterparts from the other side of the border. In these two cases as well, the European Union`s Interreg and IPA projects play an important role, facilitating and funding common trans-boundary projects, from very small ones, such as building rehabilitation, building of bicycle roads on top of common flood protection levees or bigger, research-oriented projects.

4.5.3. Data Exchange

Focusing on the role of information and on-time information exchange, the ways and frequency of data sharing in the region has been separately analyzed. As all functions of daily cooperation on the bilateral level, data exchange is, as well, regulated by rulebooks that define exactly the details such as modes of transmission, frequency of data exchange and, not last, type of data, depending on the water levels at all times. The most common way of data sharing is the use of server access to data by both involved parties. This has been greatly simplified by the technical advances since the 1990s. The amount of information that is shared specifically for flood management is significantly little – only a few hydrological and meteorological variables are exchanged (IP3, IP5, IP6).

One important factor is also the area limit for which hydro-meteorological data must be exchanged under a bilateral agreement. Particularly whether water reservoirs should be included or not is an important question – Romania and Hungary are currently negotiating on this point and the same subject does play a role in the Hungarian-Serbia relation as well (IP5, IP6). Hungary acts in the two relations in two separate roles: once as downstream country that needs as much information as possible whereas against Serbia the information offered is currently restricted as well to certain water bodies and does not include all water reservoirs (IP5, IP6). The arguments for and against at are almost the same: more data to be transmitted does represent extra work for the experts in the country that has to provide it and it is usually a strategic question to provide enough information for cooperation but not too

much information that could, in a final eventuality lead to strategic disadvantage (IP6). The controversy around the negotiations about inclusion of water reservoirs in the bilateral relation is centered around the question regarding the potential influence these can exercise on the water quantity that is left to flow across the border especially in case of reservoirs located farther away form the border area. Decision about these is argued to be a matter of national water management with little to no effect on water quantities flowing into the neighboring country.

There are, again, no major outliers in terms of data exchange, except for the case of Hungary and Ukraine, which jointly own a network of hydro-meteorological telemetering system. Data provided by those measuring stations can be accessed real-time by both countries and is available online (as shown in Figure 1); measurements are available in two-hour frequency. This lies in contrast with the other cooperation relations – it was close to impossible to find publicly available hydro-meteorological time series. Notable is also the difference in measurement frequency: the rulebook defining data exchange frequency between Hungary and Romania defines 12-hour intervals or slightly shorter intervals in case certain flood level limits have been exceeded. Similar intervals for measurement data exchange seem to be the norm for other cross-border measurements sharing (IP3, IP5).

The question that automatically arises is whether Ukraine and Hungary are the only countries that were willing to go the extra mile to develop such a fundamental tool for water management. As Wolf and colleagues point out, a reliable, shared database is “crucial for decision making downstream” and it gains further importance in case of floods, when it is irreplaceable for protection of human and environmental health and safety. They go on to point out that a lack of information exchange leads to tensions between water users (Wolf et al. 2005, 91). Similar cases of conflict due to withheld hydro-meteorological information have been registered e.g. in the MENA region, involving Egypt (Earle et al. 2010). Looking at the hydrological and meteorological characteristics of the Tisza basin probably offers a simple answer to this question: as previously pointed out, the Upper Tisza in Ukraine is well-known for flash floods that form very quickly as a result of heavy rains in the mountainous area and reach the Hungarian border within 6-8 hours. It does not take advanced mathematics to realize that the generally accepted data exchange frequency would not be sufficient in this case. As IP6 has put it, *“For flood hazard warning communication plays the most important role! It is a question of hours, even days that the downstream country can prepare for what is coming. To prepare human and material resources for when the flood wave is coming – this all depends on timely information. So the most important is: getting the required information form the neighboring country”* (IP6). This is probably not the only factor that led the countries

to set up such a network, but most likely the most important one[26]. Additionally, Hungary contributed financially to the project that was started in the 1990s, and the maintenance of the network was, for a while, in Hungarian experts` responsibility based in the Upper Tisza Regional Water Directorate. A second project was implemented until 2013 with the aim to extend the existing network and its system. FETIVIZIG and the Transcarpathian (Zakarpathia) Industrial Administration of Melioration and Water Management partnered the project, which was funded by EU INTERREG and CBC funds (see Annex A5). One possible question that arises in this case is whether due to the power asymmetry between Hungary and Ukraine, determined by the hydrological position within the basin, which places Hungary in the downstream role whereas politically more stable and from an economic point of view significantly better off than Ukraine (Hungary`s GDP per capita is almost threefold that of Ukraine`s – see Table 3). These power asymmetries could point towards a so-called water hegemon role (Cascao and Zeitoun 2010) of Hungary, which would allow it to significantly influence the outcomes of water management endeavors in the river basin. Cascao and Zeitoun use the water hegemon framework to analyze water resource allocations in several catchment areas. As they point out, the more powerful basin state (hydro-hegemon) can exploit their advantages in different ways such, to make sure that basin-level outcomes are in their favor. They do point out, however, that this does not necessarily lead to an inequitable outcome and the hydro-hegemon can actually take the lead in the basin and eventually create a more optimal outcome for all parties involved, in cases when this brings perceived gains for the hydro-hegemon (Cascao and Zeitoun 2010, 28). The framework, as noted, was applied to water resources allocation and not specifically in flood management or information sharing context. Nevertheless, its economic state and geographical position would qualify Hungary for such a role in the Tisza Basin. Slovakia has a more advanced economy, both in terms of GDP per capita, which is significantly higher than Hungary`s, as well as in terms of the diversity of their economy, however, as previously pointed out, Slovakia does not play a major role in the Tisza River Basin and has very limited interest in the basin. Hungary, on the other hand, is *"sitting at the bottom of the sink"* (IP3) and does play the most important role in keeping the Tisza integration project rolling (IP4, IP5, IP6) – which does make Hungary a benevolent hegemon, if indeed one.

4.5.4. Flood hazard Modeling / Methods

Currently there is no basin-wide harmonization regarding the models used for flood hazard calculations within the Tisza River Basin. Partially the same and partially different

[26] The common measurement network is mentioned in several presentations and conference proceedings oft he Hungarian Government, Foreign Ministry and Water Directorates. It has as well been mentioned by almost all interviewed partners fomr the Hungarian side, as it is really one-of-a-kind in the region. Such presentation always include the time factor as one of major importance.

models are used, these were detailed in the initial Tisza Basin Analysis in 2007. Whereas the models used have possibly changed since then, it was not the aim of this thesis to go into this level of detail; every national flood risk management plan / risk maps or atlas specifies the model(s) used.

A harmonization to the details of the method used is given on a national level between the regional water management bodies, in order to guarantee consistent national hazard and risk maps as well as planning documents. However, a major achievement of the past ten years in the Tisza Basin is that all five Tisza countries use the same logic for water level time series. Until 2013, four Tisza states – all, but Hungary – were using the water levels corresponding to the Q1% water discharge for their water level time series. Hungary, on the other hand, was using H1% water levels as basis for their calculations. According to the experts interviewed (or contacted with this technical question), this does lead to some height differences in water levels between the countries, but not in a significant range. Hungary started a project of redefining their so-called “MASZ”, the legally defined design flood level and the law defining the new obligatory MASZ was published in the Hungarian Legal Monitor in January 2013. The MASZ redefinition included a joint project of Hungary and Ukraine, that offered the framework for common flood risk modeling and a redefinition of design flood levels by experts of the Hungarian FETIVIZIG the Ukraine`s Transcarpathian Hydrometerological Center. The outcomes of the project were those planned: common risk graphs, a commonly defined MASZ and agreement regarding the required heights for flood protection on the border areas. This led to height modification requirement of up to 1-1,5 m on common border sections, which were executed within a different project.

The question whether such a project had been executed or is planned with their neighbors Romania and Serbia was answered by Hungarian experts via email with the information that a request and documentation has been shared with the bilateral cooperation partners, but no such project is underway. Two important points are to be noted, however, regarding these relations, which play a potentially significant role. First, before the described project was started, there was already a significant difference between the left and right banks of the Tisza protection on Hungarian-Ukrainian border areas, due mainly to Ukraine`s chaotic flood protection developments after the disastrous floods in 2000-2002 (IP6). This has caused a setup in which cooperation was the only conflict avoiding and constructive way out. As pointed out by Cascao and Zeitoun, “(…) some forms of `cooperation` can be based on coercion, or temporary submissiveness” (Cascao and Zeitoun 2010, 29), which seems to have been the case for cooperation on this particular subject. Trans-boundary river bodies on the Serbian and Romanian border, on the other hand, do not show such significant or almost any differences, as pointed out by a contacted expert, therefore active handling is not as urgent as it was in case of the Hungarian-Ukrainian common water border. Second, there is

an institutional complication on Hungarian side, which makes a technical cooperation of the same extent potentially difficult. As opposed to the Ukrainian cooperation implementation, in which solely the FETIVIZIG is involved as project implementation partner, the Romanian trans-boundary cooperation is split on the Hungarian side between three regional water directorates. On of the three directorates is additionally the one conducting the main part of the Tisza cooperation with the Serbian partners. Such a setup could lead to coordination difficulties and resource bottlenecks. Hartmann and Spit have found indication towards such an effect when tasks of implementing FD on a national level is split between decentralized institutions (Hartmann and Spit 2015), a result that could apply to project implementation work in general.

4.5.5. Overall Flood Risk Management Planning

A Tisza River Basin flood management plan has so far not been elaborated; planning of flood risk management for the Tisza Basin is done only indirectly, as the main planning outline for the Danube River basin is valid for the Danube`s sub-basins as well, and those include the Tisza. The Tisza River Basin Management Plan (TRBMP) published in 2011 by the ICPDR had contained an important chapter regarding flood management using wetland-related measures which emphasizes the importance of a basin-wide planning that should give back space to the rivers in the above-mentioned way (van Nood 2011). The Danube River Basin Flood Management Plan (DRBFMP) has been published in December 2015; all Tisza states have contributed their parts into the planning document. The plan is basically a synthesis of planned measures on national level, but does define a clear direction on the river basin level, including direction for flood management. A separate part is dedicated to flood management integration into river basin management; the plan in general focuses on the "*best potentialities for synergies* (Note: of flood management) *with other aspects of water management, provided that adequate strategies are implemented".* The new integrated flood risk management promoted by the ICPDR (and the EU, through its FD) focuses on prevention, protection and preparedness (including forecasting). This sets a framework for an environmentally connected flood risk management that *"makes space for the river"* in those areas where economic goods and human health are not endangered as a result of the allowed levels of flood. This approach relies broadly on ecosystem services such as the role wetlands and floodplains play in water retention (ICPDR 2015, 77). Tables A4 and A5 in the Annex contain some further isolated projects for common flood risk maps creation (Serbia and Hungary) as well as some details on the common research and structural measure for harmonizing design flood levels (Hungary-Ukraine, previously mentioned in chapter 4.3.1.4.).

A current project proposal entitled JOINTISZA, submitted for funding by the EU Danube Transnational Programme aims to restart work for the 6-years cycle renewal of the

TRBMP in the Tisza River Basin. The project was proposed and is aimed for implementation with the implication of 17 partners from the water sectors and ministries of the five Tisza states, as well as international organizations. Leading partner is the General Directorate for Water Management of Hungary (OVF). The project does have, similarly to the initial TRBMP, a planned work package to focus on implementing synergies between WFD and FD (IP4; (Vaci 2016)

4.5.6. Event Management

A brief inventory of the event management agreements has shown that this step of the risk management cycle is regulated on a national and, at most, on a bilateral level. The focus was kept on state actors such as national emergency agencies and their regional organizations – practical cooperation or mutual help in case of floods takes place at this level. Such a delegation of authority (but also responsibility) reminds of the institutional prescriptions of adaptive management: polycentric governance (Skelcher, 2005 cited in: Huitema et al. 2009). In theoretical models of adaptive co-management it is suggested that a management system should have multiple centers of control (polycentric). On the other hand, it would require a nearer analysis on each state`s event management to clearly identify whether this is a polycentric management structure that enables regional organizations to autonomously organize their activities, including cooperation with territorial agencies across the border. A point to add here is that the responsibility for event management lies in the Tisza states, except for Hungary and, partially, Ukraine, within a different state authority than responsibility for FD implementation. This corresponds to a splitting of responsibilities for separate stages of the risk management cycle between different state actors. Such a separation may or may not, depending on the inter-sectorial collaboration in reality, mean. a fragmented authority structure in terms of integrating cross-border event management activities with other flood management related cross-border projects. Armitage et al. (2007) have shown authority structure fragmentation to be a barrier in implementing adaptive co-management effectively, which might be the case in the TRB.

4.6. Discussion of Interaction between ICPDR, bilateral water commissions and the European Union within the Tisza River Basin Flood Governance or Meta-Governance

An important part of the research for the present thesis was the mapping of interactions between the three major institution-actors in the Tisza River basin in terms of flood management or flood governance: ICPDR, bilateral water management organizations and the European Union. An analysis of the interactions on this level without further

differentiating between each institution`s individual organizational bodies is indeed a very simplistic analysis. Nevertheless, it is the level of detail that allows for understanding the basic interactions and can be used as a discussion starter for further research.

The decision authority between ICPDR delegation, state level minister responsible for floods management (and FD implementation) and the heads of bilateral delegation can be seen as shown in Figure 3, in a simplified manner.

The figure summarizes in a simplified way how within the framework of EU`s WFD and FD, both of which have to be implemented by states (or have committed to implement as partner states or states in accession), interactions of domestic water and flood management function with ICPDR and bilateral Commissions` view on those two matters. States have the authority of implementation within their territory: the ministry responsible for implementing the two directives has decision power, which is put into laws through the state`s government. As members of the ICPDR, each of the states sends their delegations into meetings with other heads of delegations within the ICPDR and maintains contact on a regular basis with the organization. On ICPDR level decisions are met for future policy directions and the heads of delegations commit with regard to those policy directions. Any inconsistencies or clashing points are taken back to domestic level by the heads of delegations. In case required, these enter bilateral discussion with the neighboring partner the potential clash points occurred with.

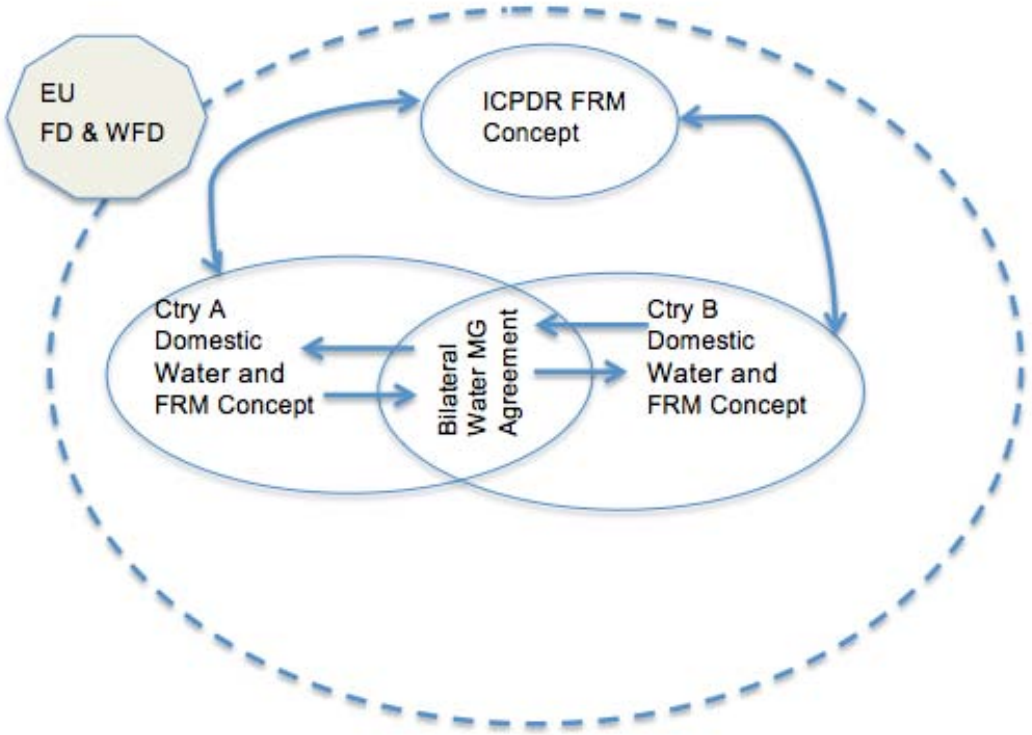


Figure 4: Decision Authority Relations regarding Flood Risk Management

The interaction between ICPDR, the EU and bilateral water management institutions fits the theoretical model of multilevel governance, which “involves the institutionalization of reflexive self-organization among multiple stakeholders across several scales of state territorial organization” (Jessop 2014). Two implications are involved by this definition: first, state actors would pull their resources together and act as a network for achievement of the collectively agreed aims and objectives, on behalf of the network as a whole. Second, “multilevel governance typically involves tangles hierarchies and complex interdependence”. In this sense, the EU functions less as layered hierarchical supranational state and more as a nodal point “in an extensive and tangled web of governance operations concerned to orchestrate economic and social policy in and across many different scales of action with the participation of a wide range of official, quasi-official, private eocnomic interests, and representatives of civil society” (Jessop 2014, 6-7).

The EU as an international organization (IO) does play a significant role in shaping flood risk management in the region. The FD as well as the WFD both set a few targets and fixed points or tools of the implementation, such as hazard and risk maps as well as the river basin and flood risk management plans. The final choice for the way of implementing the two directives, however, is down to the member states that continue to keep their sovereignty over policies within their borders. Abbott and his colleagues (Abbott et al. 2010) categorize this type of policy making by IOs as orchestration, an “emerging form of international governance” (Abbott et al. 2010, 1). Orchestration is mentioned in the literature as a concept rooted in the New Public Management Theory, as opposed to “old global governance” (Schleifer 2013). Looking at the features that are mentioned by Abbott and colleagues as leading to use of orchestration as a public management tool (Abbott et al. 2010), one cannot accuse about the EU having a lack authority. Sanction mechanisms are active within the EU for member countries that don`t reach goals and members in accession can have their EU accession delayed until targets are met. Decision making capacity is also given, however, the EU does lack the capacity to act as an “old governance organization” that could “invoke the (domestic) model of hierarchical authority based on hard law and enforceable agreements” (Abbott et al. 2010, 3). I.e. the EU itself cannot implement policies or force states to act as prescribed in the most detailed level on their sovereign territories. Therefore it chooses to go for the softer version of policy making in some areas, such as water management through directives, giving time and delegating decision power for members to find the pace and tools for implementation that best matches their initial situations.

An analysis of the question of responsibility in the case of European flood risk management, briefly formulated within the governance literature review can be addressed at this point. Two points can be suggested to bring a shift in responsibilities. Firstly the shift from flood defense to flood risk management, which transfers part of the responsibility from

government to the individuals affected by floods, as suggested by Johnson and Priest (2008). Secondly, a shift in responsibilities might be connected to the choice of directives as a legal framework for flood risk management policy implementation. First, as seen in the decision authority and sanctions constellation, European flood risk management is far from becoming a case for governing without government. Flood management does remain central to states` responsibility area. Even considering the European Union as a sort of state authority –as suggested but also dismissed by Jessop (2009) - the legal framework provided by the WFD and FD and the reporting and review cycle included in them do provide a proper control mechanism by the EU as the central authority. Countries still maintain a wide freedom in implementing the floods directive as no standard implementation way is given (Hartmann and Spit 2015). However, states remains powerful; the how`s and what`s of the flood risk management are still appointed by the EU and not by the states, neither by international organizations. Any decision taken and committed to by the states at the international level is related to the policy direction determined by the two directives. Therefore Pelizzoni`s (2014) liability condition of a "state that knows what to ask for, and how to apply controls and sanctions", mentioned before is applied here, however, with regard to the EU as interpreted as a "state authority".

Taking a closer look at international projects done on the river basin level it becomes clear that most of it relies at least partially on EU funds. Over the years, Tisza states have profited from "accession funds" and so-called "good neighbors funds" of the EU, aimed at enhancing pre-accession states fitness for joining the EU as well as at improving relations with neighbors of EU states at the outer borders of the EU. The EC and its Directorate General for Environment have participated, with involvement from universities and institutions with water expertise in a major project aimed at streamlining and harmonizing methods used for flood hazard and risk mapping (FLOODSITE Project 2009). These features of the EU lead to the thought advanced in the New Governance Theory, formulated e.g. by Abbott and Snidal (2009): IOs can act as directive or facilitative orchestrators. The EU falls in this particular case into the latter category, i.e. it advances "its regulatory goals through the full `web of relationships` characteristic of New Governance - `convening, facilitating, legitimating, negotiating, publicizing, ratifying, supervising, partnering and otherwise interacting" (Abbott and Snidal 2009, 573). Its role as orchestrator is consistent with its acting as a nodal point for knowledge, funding and network. The open method of coordination, the implemented form of EU-specific meta-governance mentioned by Jessop (2009) is recognizable in the same features. The basic outline of water (and flood) management is prescribed by the EU, as shown before, through clear policy papers and the two framework directives mentioned and the EU states are given considerable freedom in implementation.

The funds, projects and the greater group of framework programmes serve towards fulfillment of this role of the Union

The ICPDR, the actual international organization made up of states and including non-state actors, such as NGOs, could serve a similar purpose. One could argue that the ICPDR itself is orchestrating the water and flood management policy. This is precisely the role it played in its early years and partially plays still today. It is a dialog and cooperation platform where heads of state do come together to learn from each other, to listen to each other`s plans and to discuss. As one interview partner noted, one role of the ordinary and standing meetings of the heads of delegations is not lastly to find out what the neighbor is doing. Such examples include Serbia that was eager to find out about Hungary`s ambitious measures package that planned to build several water reservoirs along the Tisza above the Serbian border and the two partners ended up discussing details of these plans in the bilateral commission. However, over time, the organization setting the ultimate goal and putting tools and means to the availability of the states has gradually become the EU, with the ICPDR acting as an intermediary. This is the status quo which seems to have come about gradually, with the increasing role the EU plays in water policy in the region as well as generally. Since its establishment in 1994, most partners of the ICPDR countries have become members of the EU. Restricting the circle to the Tisza basin, the image zooms in on three states that became members in 2004 and 2007, respectively, as well as two more, that either are “on the waiting list” or queuing to partner with the EU and take advantage of funds available in order to keep up with their more advanced brother, Western Europe. This power and role shift in the relation of the ICPDR to the European Union has given birth to a setup that could be identified with the governance in the shadow of hierarchy, briefly described in the introductory chapters of this thesis. The ICPDR has become “teeth” (the better translation into English s “fangs”), as described by one of the interview partners, referring to the fact that sustainable water management and the achievement of goals set by the ICPDR has started working better since some of the achievables set out within the ICPDR`s work fulfill the secondary function of reporting tools for directive implementation sent to the EC.

The highest level of integration on a river basin level seems to be reached within this organization. This, in spite of the fact that as shown in Figure 3, the ICPDR itself does have neither a decision authority, nor a strict control over its partners. As pointed out by another interview partner (IP3), the ICPDR “has so-to-say received `teeth` after several of its states joined the EU”, as sanctions can be applied against them when targets are not met; the remaining states that aim to join at some point can also be pressed from Brussels through pre-accession criteria. This feature of an indirect control through the EU reminds of the theory of “governance in the shadow of hierarchy” addressed in the second chapter: countries do have an agenda assigned: FD must be transposed into domestic law and,

additionally, there are fixed points that need to be achieved within their flood risk management, but with a considerable freedom in the mode of implementation. Risk maps are required, but land use is under domestic authority; flood risk management planning should be done, but the exact task list is up to each country`s decision, and so is the responsibility divide between state agency actors. The activities undertaken by the states on an international river basin level e.g. through the ICPDR are, as well, self-governance activities. There is, nevertheless, a reporting and conformity obligation towards the European Commission on at least Danube River Basin level – the activities are therefore completed under the l"ooming shadow of hierarchy" (Héritier and Eckert 2008) of the EU. On the other hand, the EU does play the role of a nodal point (Jessop 2009) – the very reporting tools and know-how base available for and required to be used on the larger basin level is available for the ICPDR`s and bilateral organizations` activities on smaller scales.

Notable within the ICPDR is the role played by the Secretariat in bringing partners together. The role of the Secretariat and the way it is viewed in the group seem to coincide: the Secretariat exists only through the will of its partner and is basically a *service provider*, as it was chosen through the partners to be platform of mandatory and voluntary cooperation and therefore the chosen motor of required basin-wide reporting. It exists therefore *"because the countries want (*note: it*) to exist"*, It also provides the kind of support and services the ICPDR`s members require from them. As one interview partner pointed out (IP2), the Secretariat does not provide any funding as this is not part of its tasks, but puts effort into resource mobilization and actively pursues EU-funded or other projects for application by its partners. When asked about motivation or cooperation cycles, several of the interviewed partners have mentioned the Secretariat as the organizational body that keeps the ball rolling after meetings are over and initial enthusiasm of partners and experts is pushed aside by realities of their other daily work. An acknowledged merit of the Secretariat is that it manages to mobilize states` delegations to deliver on their promises long after the enthusiasm of the common meetings have passed, it "keeps the ball rolling". Interview partner 3 formulates this as follows (IP3):

„the usual problem is that when we were there, everyone was enthusiastic and was promising everything. And then, when they returned home, they got overrun by what was left back home: the work and the new work, so then it became more difficult to get from them the things/materials they committed to do or send. This was then supported by (note: the Secretariat), *they knew how to push them to still deliver"*

The Secretariat, with its fairly modest personnel, manages to follow up on commitments and press the experts to provide deliverables promised by their state representatives. The role it fulfills corresponds to the role of an RBO Secretariat per definition briefly described here previously. The interview partners express the essence of the Secretariat`s existence:

being appointed by International partners in order to assist them in fulfilling the goals also set by them. On interview partner has stated that the ICPDR Secretariat exists as long as the partners of ICPDR need it, being there to support them in their cooperation, otherwise “it has no further sense”. Officially, the ICPDR Secretariat does not fulfill other role than a pure administrative one – organization of meetings, editing and translation services, as noted by Schmeier (2013) and official descriptions by the ICPDR. However, the informal role that crystallizes based on interview partners` declarations, reaches farther than that and has a lot to do with the motivation cycle mentioned earlier.

5. Conclusions

Within this thesis an attempt was made at drawing a detailed mapping of flood risk governance mechanisms, i.e. the international institutions that shape and implement flood management policy in the Tisza River. The goal was to identify the level of integration reached in the river basin in terms of flood management policy and planning as well as the influencing factors of the integration levels reached. The results have shown that the river basin is mainly free of conflict and there is a reliable platform for cooperation as well as for conflict resolution. The formal (and legal) institutional framework for cooperation is available and has been shaped to work well over the past years. The European Union`s water management policy has played a significant role and so did the Danube riparian states` community that created the ICPDR.

The *first hypothesis* proposed that states that cooperate in general with each other in terms of belonging to the same organizations, same customs and free trade agreements, would have automatically a better cooperation in terms of their flood management and vice versa. The research found that transboundary cooperation in the Tisza River Basin is a well-working constant, but there are indications that some points of the cooperation in flood risk management display a stronger level of integration on bilateral than on river basin level.

- The fact that three out of five Tisza states are EU members plays an important role in terms of exercising authority especially within the ICPDR; indications of governance by the ICPDR in the shadow of the EU´s authority have been shown, whereas both the EU and the ICPDR act as facilitators of self-governance by the Tisza states
- However, EU membership of states involved in cooperation does not necessarily imply a higher level of integration.
- Concerning better integration of two EU states than mixed states no conclusive evidence could be found. Furthermore, the bilateral organization involving Ukraine and Hungary scored in a number of areas – including data exchange and flood risk management – higher in terms of its level of integration than the bilateral organization involving two EU member states: Hungary and Romania. A possible explanation found was related to power asymmetries between the countries and the role played by Hungary as a “benevolent hegemon”.

The first hypotheses could therefore not be confirmed.

The *second hypothesis* proposed in the thesis stated that the type of flood management more likely to be applied nationally is historically determined and moves in old patterns; this was expected to potentially lead to conflicts in flood management internationally – usually in the same topics.

- Flood risk management in the regions seems to comply with the general direction set on river basin (Danube) level by the states partnering in the ICPDR; this policy direction also corresponds to the WFD and FD delimited framework. Each Tisza state does shape individually its flood risk management and flood protection measures according to their individual needs.
- Where a pattern in choice of measures seems to emerge, the explanation found is connected to hydrological or geographical characteristics. Differences in the choice of measures are defined by the gap between the goals set within the common planning framework and each state flood management`s status quo, but there is no clear “pattern” that could be shown, in direction of solely structural protection measures or solely reservoir construction.
- Conflicts stemming from the type of measures to be implemented could not be identified.

The second hypothesis of the thesis was therefore also proven predominantly false. Conflicts in the river basin are rare, if any, and mostly related to the organizational form to be used for the river`s management, especially concerning a preservation of neutrality of the leading organization.

Potential reasons identified for a lower level of integration in terms of flood management on river basin level as opposed to bilateral levels are connected to funds availability as well as potentially a lack of political will, while Tisza states focus on preserving their national sovereignty. The currently existing institutional framework of the ICPDR does include the Tisza River Basin, however, organizational bodies focused exclusively on the river basin, such as an own Joint Tisza Commission would constitute a more advanced integration of the river basin`s governance framework. Considering the factors that have kept the states from establishing such a Commission, the future of Tisza River Basin cooperation might require another organizational structure than that of a traditional joint commission.

5.1. Directions for further research

The form of a fitting organization or a commission working based on rules defined in a participative and politically balanced manner is one research outlook that is opened by this thesis. The most integrated form of cooperation for the Tisza River basin would be a basin level river commission, similar to those for the Danube – the ICPDR, or the Sava River Commission. Such an organization would on the one hand represent the level of cooperation for water resources management planning that corresponds to the bioregional borders and is expected to be beneficial in terms of methods harmonization and coordinated basin level planning. On the other hand, it would create an own organizational structure dedicated for

the needs of the Tisza River Basin and therefore solve the difficulties that arise from the need to share organizational structures of another entity. However, due to the fact that there is quite high resistance from the Tisza states against establishment of such a river basin organization due to reasons related to financial and sovereignty considerations as well as the reluctance of having one dominant state in the Basin coordinating water management policy, the need for elaborating another organization form is recognized.

Other points opened for further research include the stakeholder configuration in the Tisza Basin Governance and lower level regional collaboration for flood risk management, i.e. an analysis of the co-management structures. The current thesis took the approach of considering states as single entities, without going into the depth of actors` setup or the division of responsibility for different functions of flood risk management on the regional level. A more detailed analysis of the actor constellation and responsibility division could offer insight into the orchestration function fulfilled by the EU and the ICPDR. The role played by other actors, such as international NGOs that certainly play an important role in discourse setting for policy as observers within the ICPDR has been only briefly touched upon, so has the role played by national institutions designated to implement policies and offer scientific input that is fed back into expert groups` policy-setting work. An analysis of these factors in a comparison across countries of the Tisza River Basin is one further step into identifying levels of regional cooperation within and across states.

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Annex

Annex 1: Summary of Criteria Used for Spectra of Integration

Table A1: Bilateral Cooperation Summary based on defined criteria for Hungary and its neighbors Ukraine, Romania and Serbia

	HU/RO	HU/UA	HU/SRB
1. Agreement	Bilateral agreement for the protection and sustainable use of trans-boundary waters; Both countries partners of the ICPDR	Bilateral Agreement on water management issues related to frontier waters Both countries partners of the ICPDR	Agreement between the Government of the People`s Republic of Hungary and the Government of the Federal Republic of Yugoslavia Rulebook of Hydro-technical Cooperation Both countries partners of the ICPDR
2. Type of Agreement	Formal, signed agreement Initial agreement since 1986; currently agreement entered into force in 2004 Legally binding for both parties (Guvernul Romaniei 2004)	Formal, signed agreement since 1997, entered into force in 1999 Legally binding for both parties (Magyar Kormány 1999)	Formal, signed agreement that entered into force in 1955 and kept its validity for cooperation between Hungary and Serbia after the fall of Yugoslavia Currently valid rulebook: signed 2007
3. Bilateral/River Basin Commission/Working Bodies	Romanian-Hungarian Hydro-technical Commission (form: bilateral water committee) Working bodies on responsibilities: *Sub-commissions (SC) + one Expert Group (EG)* • SC for coordination and Development of Cooperation work • SC for Water Management and Hydrometeorology • SC for Water Quality • SC for Flood Protection • EG for Water Framework Directive	Joint Hungarian-Ukrainian Water Management Commission. Working bodies: expert groups (EG): • EG for Flood Protection / Water Damage Mitigation • EG for Water Quality Control • EG for Hydrology and Water Management	Joint Hungarian-Serbian Water Management Commission. Working bodies: a commission and two sub-commissions: • Commission for Water management • Sub-commission for Flood Protection • Sub-commission for Water Quality

4. Separate Body for Flood Defense/Management	Separate DSC for Flood Protection (Comisia Hidrotehnică Româno-Ungară 2014)	Separate expert group for Flood Protection	Separate Flood Protection subcommittee
5. Regular Followup/Meetings	Yearly regular meetings of the Hydrotechnical Committee; location alternates between the two countries;	Yearly regular meetings of the governmental representatives;	Meeting in regular intervals, at least once a year
	Extraordinary meetings upon requirement	Extraordinary meetings upon requirement (117/1999. (VIII.6.) Korm. Rendelet 1999)	
6. Data Exchange	Transmission of hydro-meteorological data between partners regulated within HU-RO Hydro-meteorological Committee; Daily (and partially, half-daily) exchange of hydro-meteorological information (telegrams and phone); Long term forecast information exchanged regularly (FTP server) (Comisia Hidrotehnică Româno-Ungară 2014)	Common Monitoring Network for Water Levels and Quality; Real-time data access of both countries to the measurement information;	Transmission of hydro-meteorological data between partners regulated within HU-SRB Water Management Committee; Daily transmission of hydro-meteorological data
7. Flood Hazard Modeling / Methods	Water discharge models for Tisza tributaries made available yearly by RO for HU; Water discharge models for downstream Tisza and Mures tributaries made available yearly by HU for RO (Comisia Hidrotehnică Româno-Ungară 2014) **HU**: hazard maps and risk maps for high - HQ30, medium - HQ100 and low probability floods scenarios - HQ1000. **RO**: hazard maps and risk maps for high - HQ10, medium - HQ100 and low probability floods scenarios - HQ1000	Harmonized and commonly accessible data; Commonly defined MASZ (legally defined flood level to protect against in HU) **UA:** Floods definitions: medium probability floods: HQ10-20, low probability floods: HQ 100-200	Common modeling of Lower Tisza Flood Events – project realized in 2011-2014 (Alsó-Tisza-vidéki Vízügyi Igazgatóság 2011, Kolakovic, et al. 2014) **SRB** Flood definitions: medium probability floods HQ100, Low probability floods HQ1000

8. Flood risk management planning	No common river basin /sub-basin management plan. Both countries contributed to ICPDR DRB FRMP	No common river basin /sub-basin management plan. Both countries contributed to ICPDR DRB FRMP	No common river basin /sub-basin management plan. Both countries contributed to ICPDR DRB FRMP
	HU: TRB split into six regional organizations of the Hungarian Water Directorate (OVF – HWD); five separate flood risk management plans according to EU FD **RO**: TRB split into four regional organizations of the Romanian Water Administration (Administratia Nationala – Apele Romane; RWA); split on sub-river basin level; four separate risk management plans	Common flood risk management plan for a greater river basin created with the joint efforts from the analyzed partners; even if not exclusively on the analyzed cooperation area Common project for evening out the heights of structural flood protection measures at the borders - commonly defined MASZ (authoritative flood level for which protection measures are legally binding)	The common model for common interest sections of the Tisza River allows for modeling of outcomes from different flood risk management measures planned
9. Event Management	HU-RO Disaster Management Authorities have a bilateral cooperation agreement and meet yearly (IGSU - Romanian General Inspectorate for Emergency 2016);	HU-UA Disaster Management Authorities have a bilateral cooperation agreement and meet yearly	Common agreement on cooperation and mutual assistance in the event of disasters (Magyar Kormány 2013) signed between the two Ministires of Interior:
	The Common Hydrotechnical Committee`s Regulation on Information flow determines information flow during floods Flood Emergency Management is subordinated to the RWA in **RO** and to the HWD in **HU**; emergency management plans defined by regional water directorates on river basin level;		• Joint exercises • Data and information flow during disaster events reglemented • Exchange of experience on forecasting, preventing and assessing disasters

Table A2: Bilateral Cooperation Summary based on defined criteria for Romania and its neighbors Ukraine and Serbia

	RO/SRB	RO/UA
1. Agreement	Agreement between the Government of the Federal Republic of Yugoslavia on the hydro-technical issues from the hydro-technical systems and watercourses on the boundary or crossing the state boundary New agreement currently being negotiated; both countries partners of the ICPDR	Bilateral agreement in the field of management of trans-boundary watercourses; Both countries partners of the ICPDR
2. Type of Agreement	Formal, signed agreement, that entered into force in 1955 and kept is validity with Serbia	Formal, signed agreement that entered into force in 1997
3. Bilateral/River Basin Commission/Working Bodies	Bilateral Water Management Commission Working bodies: three subcommittees; division by water management topics • SC for water quality • SC on hydrometeorology and quantitative water management • SC on flood defense and ice	No common water management commission. Working bodies: three working groups; division by river basin (Romanian Ministry of the Environment 2013) • WG for Tisa • WG for Siret and Prut • WG for the Danube
4. Separate Body for Flood Management	Floods defense and ice subcommittee	Flood and flood management explicitly mentioned in the bilateral agreement; Each of the river basin WGs deal among others with the topic of hydro-meteorological data and information exchange as well as flood protection and flood management measures
5. Regular Follow-up / Meetings	Joint meetings in irregular intervals; the cooperation has been revived in 1998. The last Commission Meeting was in 1993.	Joint Meeting of Commission in fairly regular intervals (about once every 2-4 years) (Romanian Ministry of the Environment 2013); Last Commission meeting: 2012 The working groups meet in fairly regular intervals.

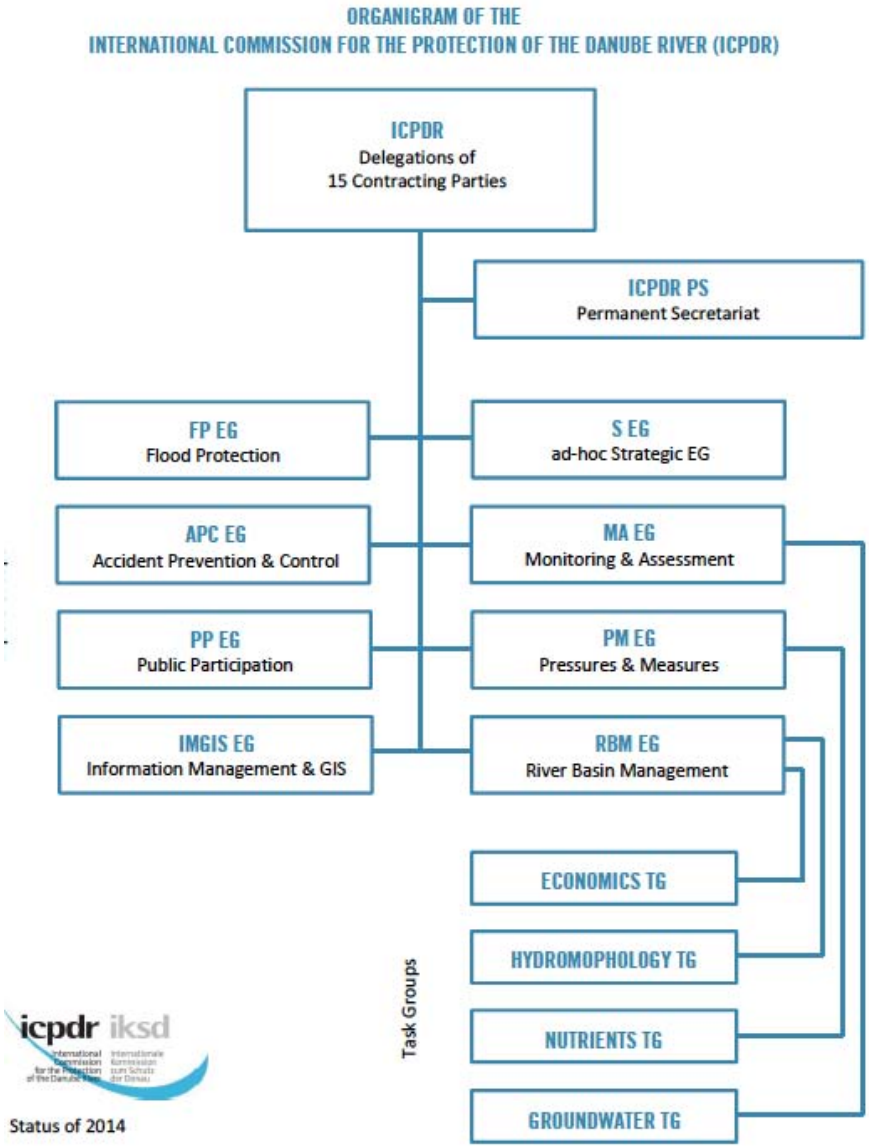
6. Data Exchange	Data exchange between parties defined through regulations that complete the bilateral agreement	Exchange of information is regulated under an internal Rule book Yearly exchange of information and data (yearly meetings of the experts of the WG for Tisa) Operative information exchanged on daily basis
7. Flood Hazard Modeling / Methods	Level of harmonization unknown For national level information see HU/SRB and HU/RO	Yearly meetings of Tisa WG for information exchange regarding modeling of past flood events and water runoff (Romanian Ministry of the Environment 2013)
8. Flood risk management		No common river basin /sub-basin management plan. Both countries contributed to ICPDR DRB FRMP
9. Event Management	No signed formal agreement between RO and UA national emergency management institutions, but planned (IGSU - Romanian General Inspectorate for Emergency 2016) *but* **Regional level** Common Strategy for Action in Case of Disaster in the Serbian-Romanian Transboundary Region (Timis Country Prefecture Romania 2013) focused predominantly on flood intervention **RO:** Timis County Emergency Inspectorate **SRB:** Zrenjanin Municipality Emergency Situations Department	No signed formal agreement between RO and UA national emergency management institutions, but planned (IGSU - Romanian General Inspectorate for Emergency 2016) Some areas of cooperation in case of emergency between RO-UA (e.g. ambulance usage in border areas (AGERPRES - Romanian National Press Agency 2015));

Table A3: River Basin level cooperation summary based on defined criteria

	Tisza River Basin
1. Agreement 2. Type of Agreement	Danube River Protection Convention - formal, signed agreement, signed in 1994 and ratified in 1998 Memorandum of Understanding Towards a River Basin Management Plan for the Tisza River – formal, signed memorandum signed in 2004
3. Bilateral/River Basin Commission/Working Bodies	International Commission for Protection of the Danube River Working bodies: 7 expert groups (EGs) Tisza Group No separate working bodies
4. Separate Body for Flood Management	Flood Protection EG of ICPDR functioned as EG for Tisza Group and continues to do so
5. Regular Followup/Meetings	ICPDR: Joint meetings of heads of delegations twice yearly EGs: regular meetings twice yearly Tisza Group: reports to ICPDR during half-year meetings
6. Data Exchange	Data required on RB level provided by states to Secretariat through the EGs (non-mandatory character)
7. Flood Hazard Modeling / Methods	Data underlying flood statistics relies on Q1%, i.e. the „one in hundred year“ return period floods expressed as water discharge Methods and models used in Tisza countries differs
8. Flood risk management	DRB-level: Common Flood Risk Management Plan of the Danube River Basin Flood hazard maps and Flood Risk Maps: input from TRB included TRB-level: open commitment by the Tisza Group; no such management plan exists as of yet

9. Event Management	No basin level agreement for flood event management
10.Involved Experts` Assessment of Relations	ICPDR: friendly („circle of friends“), very pleasant, friendly atmosphere, efficient („small staff, cheap, but manages to do a lot“ (IP6)), harmonic, productive Tisza Group: overall - mostly positive; Difficulties through missing funds and institutional framework; Political resistance against higher integration in TRB (=Tisza Commission) Critique for both: “practical cooperation” works better on the bilateral level

Annex 2: Organigram of the ICPDR (ICPDR, 2014)



Annex 3: Measures planned in the Tisza Countries in FRMP 2015

1. Measures to Avoid New Risks	HU	SRB	RO	UA
1.1. Avoidance				
1.1.1. Measures to prevent the location of new or additional receptors in flood prone areas, such as land use planning policies or regulation				
	New regulations on the flood risk areas on land use planning (less valuable land use);New regulations on the flood risk areasin the field of construction (water resistant construction)	Delineate "water land" and include this land category in land registries and municipal spatial plans;Implement results of flood hazard and flood risk mapping in spatial plans	Definition of legal, organizational and technical framework for FD implementation (improving legal framework for implementation), preparation of studies, projects and programmes, including transfer of know-how and experience exchange to support implementation of the FD at basin and national level;Reviewing and updating plans for FRM (redefine APSFR, update hazard maps and flood risk, taking into account the flash-floods and climate change effects, review and update flood risk management plans at basin, sub-basin and national level);Coordination of territorial planning strategies (developing plans at national, county,	Complicance of approved flood areas;Complicance of egislative documents related ot the territorial development

			regional and urban plans with FRMP) (implementation of a coordinated system of inspection and control of the application of legal and technical regulation on relocation, location, execution of the existing and new construction in floodplains, coordinated update of the landscape plans at national, local and county level by implementig FRMPs, implementation of a coordinated system of institutional collaboration for population relocation)	
1.2. Preparedness				
1.2.1. Emergency Event Response Planning / Contingency Planning				
	Renewal of flood protection structures	Study of climate change impacts	Monitoring, forecasting and warning systems improvement	Development and approval of yearly plans on emergency response;

	Recalculation of design flood levels		Ensuring human, financial and material emergencies and stimulate volunteerism (purchase/use of mobile flood protection systems, ensuring necessary human and financial resources for adequate management of emergency situations caused by floods)	Application of plans and solutions of commissions on technologic and ecological secure and emergency; Confinement plans development
1.2.2. Other preparedness -Other Measures to Establish or enhance preparedness for flood events to reduce adverse consequences				
	Communication of flood risk	Permanent monitoring and inspection of erosion control and flood protection structure	Develop and/or review of flood defense plans in conjunction with other management plans related emergencies	Determination of potentially dangerous hydro-technical structures
	New regulation of the financial circumstances	Permanent monitoring of erosion processes and the state of torrential rivers	Flood exercises simulation with inter-institutional participation (simulation exercises involving all county institutions with responsibilities in the management f flood risks)	Modeling of the possible emergency situations
1.3. Protection				
			Measures to restore retention areas (flood plains, wetlands, etc.); Natural water retention measures in urban/populated areas ("green" gutters and channels, drainage systems, etc.); Natural water retention measures by changing or	

			adapting land use practices in agriculture and forest management, afforestation of additional areas near reservoirs; Surveillance, monitoring the behavior, expertise, strengthening interventions, rehabilitation and maintenance of watercourses and maintenance of hydraulic works (improving surveillance, works behavior and control, measures to modernize and strengthen the hydraulic works, maintenance existing flood protection infrastructure	
1.4. Other				
		Update and apply principles and methods of flood-resilient construction; Update the Cadaster of erosion and torrents and the Cadaster of Water Structures; Include all data in Water Information System of Serbia		
2. Measures Reducing the Existing Risks				
2.1. Prevention				
2.1.1. Removal or Relocation (measures to remove receptors from flood prone areas, or to relocate receptors to areas of lower probability of flooding and / or lower hazard				

	Removal or relocation of dykes	Re-assess legalization of illegally built structures on flood-prone areas; Remove structures illegally built on flood-prone areas	Coordination of territorial planning strategies (developing plans at national, county, regional and urban plans with FRMP) (implementation of a coordinated system of inspection and control of the application of legal and technical regulation on relocation, location, execution of the existing and new construction in floodplains, coordinated update of the landscape plans at national, local and county level by implementing FRMPs, implementation of a coordinated system of institutional collaboration for population relocation)	Settling out of population form the flood hazard area; Change of land use
2.1.2. Reduction (measures to adapt receptors to reduce the adverse consequences in the event of a flood action on buildings, public networks, etc.)				
	Training local defense leaders, municipality responsible groups; Update or create local defense plans; Update regional localization plans	Local flood protection measures (on single or group of buildings), wherever possible; Reassessment and modification of vulnerable infrastructure (esp. road and railroad crossings on rivers)	Natural water retention measures in urban/populated areas ("green" gutters and channels, drainage systems, etc.); Measures to reduce water levels increase transit capacity by raising bridges, measures to ensure the drainage capacity, increase transit capacity of the minor riverbed: desilting works and reshaping riverbed, dikes relocation, restoration and	Construction of flood protection structures in compliance with approved programs

			increasing of the mitigation volumes in existing reservoirs and polders); Measures for increasing population resilience (adaptation and implementation of protective measures at various objectives, wet flood proofing, dry flood proofing berms/local levees and floodwalls); Adapting construction, infrastructure and existing defense structures in terms of climate change (recalculation design levels of current flood protection systems, heightening of existing dikes, optimizing operation of existing reservoirs to increase retention/mitigation capacity	
2.1.3.. Other prevention (other measures to enhance flood risk prevention- may include flood risk modeling and assessment, flood vulnerability assessment, maintenance programs or policies, etc.)				

	Flood modeling; Land use changes on the catchment area; Education	Regular upgrade of the General Flood Defense Plan for the Republic of Serbia; Preparation and regular upgrade of the Annual Flood Defense Plans for municipalities; Update/preparation of technical documentation for all existing flood protection structures (incl. data on water estate); Update/preparation of flood defense manual; Establish efficient bilateral cooperation with all neighboring countries, including common actions on trans-boundary rivers during flood and ice defense; Plan and implement the ice control measures, economically feasible and tailored according to river specific conditions; Flood risk modeling; Flood vulnerability assessment	Definition of a legal, organizational and technical framework for Flood Directive Implementation (improving the legal framework on the implementation of the FD), preparation of studies, projects and programs, including transfers of know-how and experience exchange to support implementation of the FD at basin and national level; reviewing and updating plans for flood risk management (redefine/update APSFR, update hazard maps and flood risk, taking into account the flashfloods and climate change effects, review and update flood risk management plans at basin, sub basin and national level	Elaboration of flooded areas; Elaboration of confinement plans; Development of automated monitoring and modeling systems
2.2. Protection				
2.2.1. Natural flood management/runoff and catchment management (measures to reduce the flow into natural or artificial drainage systems, such as overland flow interceptors and /or storage, or infiltration, etc. and including in-channel, floodplain works and the reforestation of banks, that restore natural systems to help slow flow and store water				

	Divert the excessive water amount to surrounding sub-catchments if possible, to enhance storage capacity; Increase the floodplain and riverbed storage capacity usage	Sustain existing wetland and inundated areas; Investigate the possibilities for economically feasible restoration or enlargement of natural retention areas; Sustain existing forests and afforest new areas, especially in hilly and mountain areas prone to erosion; Create green space in new urban areas, to enhance water infiltration; Revitalize drainage channels	Measures to restore retention areas (flood plains, wetlands, etc.), to rehabilitate the banks of the watercourses (vegetative protection), restoring natural lakes; Natural water retention measures in urban/populated areas "green" gutters and channels, drainage systems, etc., collection and storage of rainwater in underground tanks, permeable paving, green rods, bio retention areas, seepage canals, green areas, etc.; Natural water retention measures by changing and adapting land use practices in agriculture and forests, management (maintaining areas occupied by meadows and pastures, cultivation practices to conserve soil, terracing slopes curtains snubs for protection, improve management of forests in floodplains, afforestation mountain areas (in the upper basin), afforestation of additional areas near reservoirs	Cleaning of water draining systems, riverbeds and main channels; Elaboration and implementation of floodplain management plans; Elaboration of soil chiseling on amelioration systems
2.2.2. Water Flow regulation (measures involving physical interventions to regulate flows such as the construction, modification or removal of water retaining structures (e.g. dams or other online storage areas or development of existing flow regulation rules), and which have a significant impact on the hydrological regime)				

	Creating of polders for floods, flash floods and inland water; Operation of polders; use of mobile protecting Constructions; Optimization of reservoir operation; Relocation of dikes (space fro the river); Designation of natural retention areas where applicable	Investigate possibilities for construction of dry flood-retention reservoirs on large international rivers (Danube, Sava and Tisza) in order to reduce peaks of extreme floods); Use existing reservoirs and retentions for flood management, according to specific regulation rules; Explore possibilities and cosntruct new flood retention capacities on smaller rivers	Measures to reduce watre levels (increase transit capacity by resizing bridges, measures to ensure the drainage capacity, increase transit capacity of the minor riverbed: desilting works and reshaping riverbed, dikes relocation, restoration an dincreasing of the mitigation volumes in existing reservoirs and polders); Measures to improve retention capacity basin level by making polders and small lakes (made in the upper basin)); Measures to improve retention capacity at basin level by increasing safety awareness in large existing construction / increase mitigation capacity of reservoirs face to design capacity ;	Construction of mountain storage reservoirs; construction of polders
			structural protection measures (planning an dreliazation) - construction of new reseroirs for flood peak mitigation, making derivation works, bed stabilization measures - recalibration of riverbeds, fences, shore defenses, tabilizing the river bed, protection measures along watercourses through works of local dikes, measures to	

			reduce runoff on slopes and torrents improvements	
			Adapting construction, infratsurcture and existing defense structures in terms of climate change (recalculation design levels of current flood protection system, heightening of existing dikes, optimizing operation of existing reservoirs to increase retention/mitigation capacity	
2.2.3. Channel, coastal and floodplain works(measures involving physical interventions in feshwater channels, mountain streams, estuaries, coastal waters and flood-prone areas of land, such as the construction, modification or removal of structures or the alteration of channels, sediment dynamics management, dykes, etc.				
	Removal of obstacles as debris mass, summer dikes, improperly placed Artificial objects; Protection of banks against erosion	Levee system or lowland rivers; restoration of structures damaged during the 2014 flood; Completion and reconstruction of flood protection level of the most important areas, using combination of permanent structures and mobile protection; Implement sediment management measures to maintain river conveyance capacity	Measures to reduce water levels; increase transit caapcity by resizing bridges, measures to ensure drainage capacity, increase transit capacity of the minor riverbed: desilting works and reshaping riverbed, dykes relocation, restoration and increasing of the mitigation volumes in existing reservoirs and polders; measures to improve capacity retention basin level by making polders and small lakes (upper basins); Measures to improve retention capacity at basin level by increasing safety awareness in the large existing construction / increase mitigation capacity of	Increasing of soil-reclamation canals` capacity; Construction of falls and riffles on rivers and channels; Riverbed regulation; Construction of protective structures

			reservoirs face to design capacity, maintenance work for the safe operation of existing hydraulic structures and related equipment; Structural protection measures (planning and realization), construction of new reservoirs for flood peak mitigation, making derivation works, bed stabilization measures - recalibration of river bed, protection measures along watercourses through works of local dykes, measures to reduce runoff on slopes and torrents improvement	
2.2.4. Surface water management (measures involving physical intervention to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or through sustainable drainage systems (SuDS)				
	N/A	Prepare/update design of second flood defense lines; Reconsider capacity of urban drainage systems	Measures to reduce water levels; increase transit capacity by resizing bridges, measures to ensure the drainage capacity, increase transit capacity of the minor river bed: desilting works and reshaping riverbed, dykes relocation, restoration and increasing of the mitigation volumes in existing reservoirs and polders	Increasing of the storm sewage system capacity; Increasing of pumping stations` productivity
2.2.5. Other Protection (other measure to enhance protection against flooding, which may include flood defense asset maintenance programs or policies				

	N/A	Regularly maintaining flood protection structures, as well as erosion and torrent control structures; Purchase and repair of machinery, tools, materials, equipment and communications needed for flood defense units and emergency management units	surveillance, monitoring the behavior, expertise, strengthening interventions, rehabilitation and maintenance of watercourses and hydraulic works (improve surveillance, works behavior and control, measures to modernize and strengthen the hydraulic works, maintenance existing flood protection infrastructure)	Support of favorable water regime for the water objects; Surface water monitoring; Elaboration and implementation of the programs on development and improvement
2.3. Preparedness				
2.3.1. Public awareness and preparedness				
	N/A	Strengthening the capacity of professionals and institutions responsible for flood management and emergency management	Measures for improvement monitoring, forecasting and flood warning; Flood simulation exercises with inter-institutional participation; Ensuring human, financial and material emergencies and stimulate yolunteerism (purchase / user of mobile flood protection systems, ensuring necessary humand and financial resources for adequate management of emergency situations caused by floods)	N/A
3. Measures Strengthening Resilience				
3.1. Preparedness				
3.1.1. Flood Forecasting and Warning				

	Renewal or early warning systems	Improve the system of hydro-meteorological monitoring, forecast and early warning (more automated precipitation and gauging stations, use of radars and satellite imagery, contemporary forecast models); measured data avilable to relevant services in real time; improve the alarm systems and systems for using timely warning to population at risk, especially on river basins without structural flood protection; upgrade the international exchange of meteorological and hydrological data	Measures for improvement of monitoring, forecasting and flood warning	Provision of reliable maintenance of the automated information measuring system; development and advance of the automated information measuring system; construction of the Modeling systems; introduction of the modeling systems and of the notification systems
3.1.2. Emergency Event Response Planning / Contingency Planning (measures to establish or enhance flood event institutional emergency response planning)				
	N/A	Preparing of plans for protection and rescue in emergency situations, including catastrophic floods on the state level, municipality level, etc.	Develop and / or review of flood defense plans in conjunction with other management plans related to emergencies (review of the flood defense plans with multidisciplinary correlation); ensuring human, financial and material emergencies and stimulate volunteerism	Development and approval of yearly plans on emergency response; application of plans and solutions by commissions on technological and ecological security and emergency
3.1.3. Public Awareness and Preparedness				

	PR methods and education to increase the awareness of the population; increase participation of inhabitants in flood prevention activities and concrete flood protection works on dykes during floods	Training exercises	Adequate public information activities and promoting public participation; Active education/training of the population (brochures, leaflets, media communication)	Notification of municipalities concerning flood areas; trainings for authorities and population
3.2. Other preparedness (other measures ot establish or enhance preparedness for flood events to reduce adverse consequences				
	N/A	Update / build scientific base for flood management; Preparation of studies and designs	Flood simulation exercises with inter-institutional participation; implementing an adequate insurance policy	Determination of potentially dangerous hydro-technical structures; Modeling of the possible emergency situations
3.3. Recovery and Review				
3.3.1. Individual and societal recovery (clean-up and restoration; health and mental health supporting actions, incl. stress management; disaster financial assistance, incl. disaster legal assistance, disaster unemployment assistance; temporary or permanent relocation; other				
	N/A	All enlisted measures	Ensuring human, financial and material resources in case of emergency situations; Response in emergency situations (intervention measures to stabilize critical points, measures limiting the flooded areas. improving action and cooperation of the authorities involved in emergency management	Carrying out the after-flood examination and preparation of inspection certificate about the flood protection structures` technical status of hydro-technical structures and building; repair works on damaged hydro-technical structures

				and buildings
3.3.2. Environmental recovery (cleanup and restoration activities (with several sub-topics as mold protection, well-water safety and securing hazardous materials containers); Other				
	N/A	All enlisted measures	Damage assessment and restoration (improving damage assessment process-methodology, standards for cost, probability-damage curves, provisionally reparation all types of infrastructure affected by floods to ensure their minimum functionality, restoration / rehabilitation of damaged infrastructure and property (incl. water quality monitoring), offering medical and psychological assistance to people affected by floods	Assessment of damages; recovery measures identification; carrying out of recovery works
3.3.3. Other recovery and review (lessons learned from flood events; Insurance Policies, Others)				
	N/A	Study of a 2014 flood, reconsideration of flood management concept and proposal of new developments; Preparation of grounds for wider implementation of flood insurance	Documentation of analysis (improving the post event analysis - causes, development, effects, etc. feedback - lessons learnt)	Analysis of the flood origin; Analysis of the actions during flood
4. Awareness raising measures				
4.1. Preparedness				
4.1.1. Public Awareness and Preparedness				

	PR methods and education to increase the awareness of the population; Increase participation of inhabitants in flood prevention activities and concrete flood protection works on dykes during floods	Introduction of water management issues into schools (from elementary school to university level); Preparation of flood leaflet, film, TV broadcasts, etc.; Flood hazard and flood risk maps available in WISS; Exercises	Flood simulation exercises with inter-institutional participation; Adequate public information activities and promoting public participation; Active education/training of the population (brochures, leaflets, media communication)	Notification of municipalities concerning flood areas; Trainings for authorities and population
4.1.2. Other preparedness				
	N/A	Continuous data exchange between institutions in charge for flood defense; Municipal authorities capacity building and training	N/A	N/A
4.2. Prevention / Protection				
				Determination of potentially dangerous hydro-technical structures; Modeling of the possible emergency situations
5. Measures implementing the Solidarity Principle				
5.1. Protection				
5.1.1. Natural flood management/runoff and catchment management				

		Establish efficient bilateral cooperation with all neighboring countries, including common actions on trans-boundary rivers during flood and ice defense	Measures to restore retention areas (flood plains, wetlands, etc.); Natural water retention measures in urban/populated areas; Natural water retention measures by changing or adapting land use practices in agriculture and forests management (maintaining areas occupied by meadows and pastures, cultivation practices to conserve soil, terracing slopes, curtain, shrubs for protection), improve management of forests in floodplains, afforestation mountain areas (upper basin), afforestation of additional area near reservoirs	Elaboration and agreement of the common measures on decreasing of the floods` negative effect
5.1.2. Water flow regulation (measures involving physical interventions to regulate flows, such as the construction, modification of removal of water retaining structures, and which have a significant impact on the hydrological regime				

	Adjusting the design flood levels on border rivers	N/A	Measures to improve capacity retention basin level by making polders and small reservoirs; Measures to improve retention capacity at basin level by increasing safety degree of the large existing construction / increase mitigation capacity of reservoirs face to design capacity; Structural protection measures; Adapting construction, infrastructure and existing defense structures in terms of climate change	Agreement of the design flood levels on the design sections
5.1.3. Channel, coastal and floodplain works				
	N/A	N/A	Measures to improve capacity retention basin level by making polders and small reservoirs; Measures to improve retention capacity at basin level by increasing safety degree of the large existing construction / increase mitigation capacity of reservoirs face to design capacity; Structural protection measures; Adapting construction, infrastructure and existing defense structures in terms of climate change	Agreement of the working projects and construction works for protective structures on the boundary territories
5.1.4. Surface Water Management (measures involving physical interventions to reduce surface water flooding, typically, but not exclusively, in an urban environment, such as enhancing artificial drainage capacities or through sustainable drainage systems)				

			Measures to reduce water levels (increase transit capacity by resizing bridges, measures to ensure the drainage capacity, increase transit capacity of the minor reverbed: Desilting works and reshaping riverbed, dikes relocation, restoration and increasing of the mitigation volumes in existing reservoirs and polders)	
5.1.5. Other Protection (other measures to enhance protection against flooding, which may include flood defense asset maintenance programs or policies)				
	Trans-boundary cooperation with the neighboring countries; Participation in international cooperation; Participation in international projects, researchers; Renewing the existing international flood management contracts (e.g. ice breaking)		Coordination of territorial planning strategies (developing plans at national, county, regional and urban plans with flood risk management plans) (..., coordinated update of the landscaping plans at national, local and county level by implementing FRMPs, implementation of a coordinated system of institutional collaboration for population relocation)	Agreement of the other measures in the frame of trans-boundary cooperation
5.2. Preparedness				
5.2.1. Emergency Event Response Planning / Contingency Planning (Measure to establish or enhance flood event institutional emergency response planning)				
			Develop and/or review of flood defense plans in conjunction with other management plans related emergencies	Elaboration of the joint plans of action during floods and confinement plans

5.2.2. Public Awareness and Preparedness				
			Adequate public information activities and promoting public participation; Active education/training of the population (brochures, leaflets, media communication)	Experience exchange; Trainings for population
5.3. Recovery and Review				
5.3.1. Individual and Societal Recovery				
			Ensuring human, financial and material resources in case of emergency situations; Response in emergency situations (intervention measures to stabilize critical points, measures limiting the flooded area using secondary flood defense lines; measures to drain flooded areas, improving action and cooperation of the authorities involved in emergency management)	Mutual Assistance during the recovery works fulfillment
5.3.2. Environmental Recovery				

			Damage assessment and restoration (improving damage assessment process (methodology, standards for cost, probability- damage curves), provisionally reparation all types of infrastructure affected by floods to ensure their minimum functionality, restoration / rehabilitation of damaged infrastructure and property (including water quality monitoring), offering medical and psychological assistance to people affected by floods	Common risks and damages assessment
5.3.3. Other recovery and review				
			Documentation and analysis (improving the post event analysis (causes, developments, effects, etc.), feedback-lessons learnt) Implementing an adequate insurance policy	Other measures

Annex 4: Selected Projects List

This is a list of important projects of the past years in regards to flood risk management. It is far from a complete and comprehensive list, however, it offers an overview of all those projects that involved all or most Tisza countries and brought a contribution considered vital for the integration of flood risk management efforts, as defined by this thesis.

Table A5: Selected projects in the Tisza River Basin

Project	Description	Partners	Areas covered
1. FLOODSITE	Research project with pilot areas for measures implementation funded within the Sixth Framework Programme of the European Commission 2004-2009	37 Research institutes and partner organizations from 13 European countries	Assessment of flood hazard and flood risk; Improvement of modeling and analysis methods for flood defense system Improvement and harmonization of methods for evaluation of societal consequences Pilot studies – Tisza Basin pilot study for: • Development of RB based, precautionary and sustainable flood management strategies; investigation and analysis of previous floods • Raising public awareness and public participation by risk communication, stakeholder involvement, etc., using techniques developed by FLOODsite • Fostering international cooperation
	Project Outcomes: guidance documents for flood inundation modeling, risk estimation, flood damage evaluation, sustainable flood management practices, etc. For the Tisza pilot study: Guidance document for sustainable flood management strategies		
1. Danube FLOODRISK	Transnational Danube-wide project focused on flood risk reduction measures. Builds on the experience and knowhow from the EC`s FLOODSITE Project Aim: the develop uniform flood risk maps for the Danube River defining flood hazards and vulnerability	All most relevant organization from Danube states that are responsible for flood risk management: 19 institutions, central public bodies, universities, research institutions and operational agencies, NGOs Lead: Romanian Ministry of Environment Important partner: ICPDR - Flood EG	Risk assessment, risk mapping, stakeholder involvement and risk reduction by adequate spatial planning • Communication and information • Data and methods harmonization • Stakeholder involvement and end user integration • data collection and management • Risk & hazard maps production • Risk management and planning methods integration

Project	Description	Partners	Areas covered
	Project outcomes: Danube FLOODRISK Atlas (part of the ICPDR Flood Action Programme)		
2. EFAS; Danube-EFAS	European Flood Awareness System; the Danube region-specific forecast system Danube-EFAS is no longer in use	33 partners[27] National Hydrological services and associated partners; such as Civil Protection Authorities, associated to their National or Regional Hydrological Service Ukrainian and Serbian partners are included: State Emergency Service f Ukraine and Republic Hydrometeorological Service of Serbia EFAS experts regularly report to the ICPDR	EFAS uses the hydrological model LISFLOOD on processing hydrological and meteorological data collected from its partners to monitor and and forecast floods; it works as an early warning system
	Password-protected EFAS web Interface		
3.Hungarian-Ukrainian Common Flood Protection Development Programme (Dajka 2013, KEEP EU Cooperating - Interreg and ENI CBC Partners Web site 2014)[28]	EU Funded project with Hungarian and Ukrainian Governmental participation; several projects described within one common title: Part of the EU Danube Region Strategy Pilot project for Flood Risk Management *and* EU`s programs for Good Neighbors (CBC)	Partners: Hungarian and Ukrainian Prime Ministry and water and flood management institutions of both countries, such as FETIVIZIG (Upper-Tisza-Regional Environmental and Water Directorate) Transcarpathian Hydrometerological Center	Starting situation: water Protection constructions Executed in Ukraine after the 2001 floods led to higher flood risk in Hungary[29] but also to height differences of flood protection constructions at the border.
	Outcomes (Dajka 2013, KEEP EU Cooperating - Interreg and ENI CBC Projects 2013, KEEP EU Cooperating - Interreg and ENI CBC Partners 2012)**:** join effort for creation of common flood risk graphs and common MASZ (design flood levels) along the HU-UA sections of the river; accepted by both Governments` officials Laid the technical foundation for the parameters of reservoirs planned and under implementation in both countries Other technical constructions for flood risk reduction – generally enhanced flood safety in Upper Tisza Region		

[27] The state of the art in 2013 – this is the most current information, available on the EFAS official website in 2016

[28] Közös magyar-ukrán árvízfejszlesztési program

[29] According to the models used in the common project, water levels in the scenario of a flood water quantity as in 2001 with dam breakage would have been higher than the existing protection dams with as much as 40-130 cm in different river sections (Dajka, 2013)

Project	Description	Partners	Areas covered
	Development of a modern hydrological forecasting system Update of existing flood risk maps[30] or flood localization plans		
4. Improvement of the joint HU-UA telemetering system in the interest of flood protection at a catchment area level (KEEP EU Cooperating - Interreg and ENI CBC Projects 2013)	Conversion of telemetric system into a process control system; join Hungarian-Ukrainian flood control centers` creation	Upper-Tisa-Regional Environmental and Water Directorate Transcarpathian Industrial Administration of Melioration and Water Management	Conversion of the telemetric system into a process control system Development of a common Ukrainian-Hungarian rangefinder system Communication – IT development of flood control centers
	Outcomes (KEEP EU Cooperating - Interreg and ENI CBC Projects 2013, Dajka 2013): Online accessibility of operative telemetered data Joint monitoring system adding additional 15 automatic monitoring stations (68 in total, including stations from a previous common project) Modern flood risk prediction system for the Upper Tisza Increased necessary time-advance for flood defense due to the conversion of the telemetric system into a process control system Increased confidence and authenticity of data as a result of the ISO standard introduction at the Subcarpathia Water Directorate		
5.TRMODELL	Tisza River Modeling on the Common Interest Section of Hungary and Serbia	Supported by the IPA Cross-border Cooperation Programme, Ministry of Education and Science of the Republic of Serbia, ATI-VIZIG (Lower Tisza Water Management Directorate Hungary)	Focus: model improvement. Flow calculation with HEC-RAS models of common interest section of Hungary and Serbia. The model allows for integrated river management modeling flow behavior of the river on the entire section of the river in Hungary and Serbia; special focus on flood water impacts[31]
	Outcome: Common model allowing for modeling of integrated river basin management on Hungarian and Serbia section of the Tisza River Calculation of all considered water management (e.g. flood plain restoration measures) and structural flood protection constructions` effect on flood hazard and flood extent		
6. CROSSWATER	Harmonized Activities related to extreme water management events – especially flood,	Supported by the IPA Cross-border Cooperation Programme Partners: ATI-VIZIG Hungary and a Hungarian	Sensitivity analysis of flood prone areas in South-Hungary and Vojvodina Region on Serbia; Structural flood protection

[30] "Árvízlokalizációs tervek" has been translated as flood risk maps. However, this had referred in the source document to maps created in 2002, before the EU Floods Directive, therefore it does not refer to the same documents, but to a comprehensive electronically accessible maps-based simulation tool and potential flood protection constructions catalogue. Therefore the preferred translation is that of *flood localization plans* (Dajka, 2013)

[31] (Alsó-Tisza-vidéki Vízügyi Igazgatóság 2011, Kolakovic, et al. 2014)

Project	Description	Partners	Areas covered
	inundation and drought	NGO	constructions in the area; energy efficiency measures; Informing the public regarding energy efficiency measures, flood prone areas and flood protection through considering floods in land use decisions
	Outcome: Sensitivity map of the study area – reachable for all stakeholders; A Good Practices Handbook available for all stakeholders and the general public		
7. Flood Hazard Maps Serbia	Technical Assistance for the Preparation of Floods Risk Maps and Flood Hazard Maps in Serbia	Supported by the IPA Pre-Accession Assistance by the EU Partners: EPTISA SEE	Support Serbia in Fulfilling obligations for implementation of FD; Harmonization of requirement, data, and methods Data Collection and Management; Production of high resolution digital flood hazard and flood risk maps. Incorporation of all input data in the Water Management Information System
	(Expected) Outcome: high resolution digital flood hazard and flood risk maps; Integration of hazard maps and risk maps and of other input data of the project in the Serbian Water Management Information System (WMIS)		