

Coordination of water policies for quality and quantity: experiences from Nordic and Baltic countries

Rolf Larsson^{a,*}, Antti Belinskij^{b,c}, Bjørn Kløve^d, Diana Meilutyte-Lukauskiene^e, Elve Lode^f, Eva Skarbøvik^{f,g} and Vytautas Akstinas^e

^a Water Resources Engineering, Lund University, Box 118, Lund 22100, Sweden

^b Freshwater Centre, Finnish Environment Institute SYKE, Latokartanonkaari 11, FI-00790 Helsinki, Finland

^c Law School, University of Eastern Finland, Yliopistonkatu 2, FI-80100, Joensuu, Finland

^d Water, Energy and Environmental Engineering Research Unit, University of Oulu, PL 8000, FI-90014, Oulun yliopisto, Finland

^e Laboratory of Hydrology, Lithuanian Energy Institute, Breslaujos g. 3, LT-44403, Kaunas, Lithuania

^f Institute of Ecology, School of Natural Sciences and Health, Tallinn Univ., Uus Sadama 5, 10120, Tallinn, Estonia

^g Division of Environment and Natural Resources, Norwegian Institute of Bioeconomy Research (NIBIO), P.O. Box 115, 1431, Ås, Norway

*Corresponding author. E-mail: Rolf.Larsson@tvrl.lth.se

 RL, 0000-0002-6152-1761

ABSTRACT

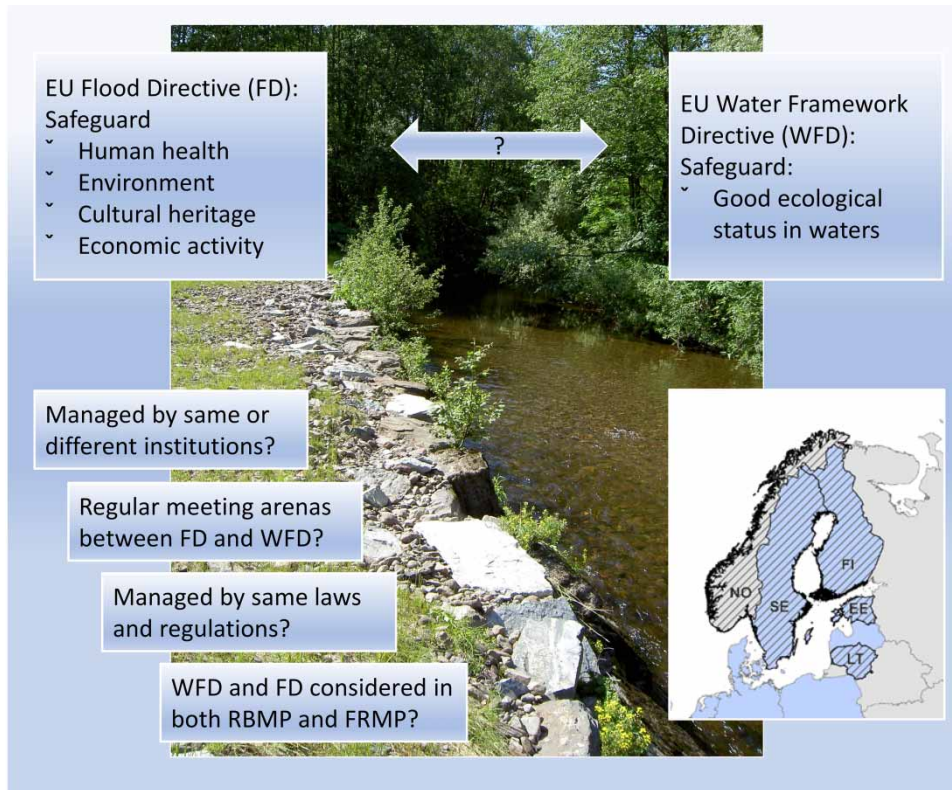
The European Union (EU) Water Framework Directive is of paramount importance for water management. According to the legal text, coordination with other directives like the Floods Directive is imperative and motivated by potential synergy effects. In this paper, the degree to which such coordination is achieved is evaluated for five Nordic and Baltic countries. The evaluation is based on legal documents, management plans, as well as on organizational structure in the five countries. The results show that the coordination between the Water Framework Directive and the Floods Directive (or flood management for Norway's case), have been successful for Estonia and Lithuania, whereas Norway, Finland, and especially Sweden need to improve more.

Key words: Baltic countries, coordination, Floods Directive, governance, legislation, management, Nordic countries, Water Framework Directive

HIGHLIGHTS

- In this paper, the coordination of work with two EU directives in Nordic and Baltic countries is studied.
- The potential for synergy effects is reached with varying success in the studied countries.
- National legislation and organization of work affect the rate of success with coordination.
- Our results confirm conclusions made by the European Commission.

GRAPHICAL ABSTRACT



INTRODUCTION

The European Union (EU) Water Framework Directive, WFD (EC 2000), is based on a holistic view of water and its management. Also, the Floods Directive, FD (EC 2007), has several statements about the importance of coordinating flood management with the water (quality) management done under the WFD umbrella. To fulfil these objectives, the two directives need to be linked and governed to some extent jointly. Although the directives and their goals are binding, they leave to the national authorities the choice of the form and methods for implementation. However, around 15–20 years after the adaptation of the Directives, it remains unclear whether the national public authorities have chosen the best forms and methods to successfully achieve the objectives set by both Directives.

There is a plethora of scientific publications dealing with water governance and implementations of the WFD and FD in Europe, ranging from great expectations to problems with implementation efforts (Voulvoulis *et al.* 2017). Several studies were made about the implementation of both the WFD (Liefverink *et al.* 2011; Maia 2017) and the FD (Douka 2020; Solomun *et al.* 2021). The main indicators that were used in such analyses were related to integration (Roy *et al.* 2011; Pires *et al.* 2017), adaptation (Blackmore *et al.* 2016; van Eerd *et al.* 2019), and social learning (Pahl-Wostl *et al.* 2013; Newig *et al.* 2014; Albrecht 2016; Challies *et al.* 2017). Some studies also targeted individual countries, like Greece (Mylopoulos & Kolokytha 2008; Kanakoudis *et al.* 2015), Spain (Moren-Abat & Rodriguez-Roldan 2012), Germany (Richter *et al.* 2013), Italy (Martinengo *et al.* 2020), and the Netherlands (Van Eerd *et al.* 2019).

The objectives of this paper are as follows:

- to evaluate how well the WFD and the FD (or flood management in the case of Norway) are coordinated in the selected countries;
- to relate the level of coordination in each country to the legal and organizational structures for implementing the two directives; and
- to compare the coordination of WFD and FD among the selected countries.

Theoretical framework

The WFD was ratified in the year 2000 (EC 2000) after many years of debate, cooperation, and preparation. Some examples of important principles adopted in the WFD are: (i) water management organized by natural boundaries, i.e., river basins; (ii) integration of water management with other major policy areas like energy and agriculture; (iii) the polluters pay principle; and (iv) public participation. Later, the FD was ratified in 2007 (EC 2007), motivated *inter alia* by some disastrous flood events in central Europe in the preceding years. The main goal of the WFD is to ensure good or high ecological status in all water bodies.

The main goal of the FD is to ‘reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity’ (https://ec.europa.eu/environment/water/flood_risk/). Hence, whereas the WFD focuses on the environment, the FD also includes other target groups.

The FD requires, especially, that the application of FD and WFD is coordinated. According to Article 9 of the FD, such a coordination must focus on opportunities for improving efficiency, information exchange and for achieving common synergies and benefits having regard to the environmental objectives of the WFD. Further on, the development and review of the Flood Risk Management Plans, FRMPs, must be carried out in coordination with, and may be integrated into, the reviews of the River Basin Management Plans, RBMPs, provided for in the WFD. Also, the active involvement of all interested parties under the FD has to be coordinated, as appropriate, with the active involvement of interested parties under the WFD. Since the FD came later than the WFD, there are no such requirements embedded for the institutions responsible for implementing the WFD. In 2022, the implementation of the FD should have reached a milestone, where the FD should be integrated into national water management plans and the corresponding measures were to be reflected in water-related legislation (e.g., COM 2021).

The differing target groups of the two directives (environment for the WFD; human health, environment, cultural heritage and economic activity for the FD) can represent a potential conflict. Whereas the WFD would often be best fulfilled by flood protection measures based on nature-based solutions (NBS), such as making room for the river, retaining water in the landscape by restoring peatlands, planting trees along riparian zones, etc. (World Bank 2017), the needs to reduce flood damage may, possible due to tradition, call for more engineered solutions like stone gabions and concrete enforcements of riverbanks (Kumar *et al.* 2020).

Both directives, WFD and FD, have mechanisms for reporting by countries to the European Commission (EC), as well as for evaluation by the Commission of the compliance by individual countries with the directives. As an example, see the general report and country-wise appendices (EC 2019a). Among other comments in the EC report there are critical notes about the level of coordination between the WFD and FD accomplished by the member states.

Efficient coordination between planning and implementation of actions taken within the areas of WFD and FD (or Flood management) are not only required by EU, but it is also clearly aligned with the principles of Integrated Water Resources Management, IWRM. In order to achieve such coordination, all aspects of water governance need to be utilized in a strategic way. The theoretical aspects and background for WFD and FD are described below.

The concept of IWRM has been around for almost 50 years. The UN Conference on water in Mar del Plata in 1977 was a starting point. Next, the Dublin Principles were determined in the Dublin conference in 1992 (WMO 1992) and became a main framework for water resources management. Notwithstanding all problems with implementation, the IWRM ideology has kept well and alive. Therefore, it was not surprising that the WFD, when it was ratified in the year 2000, had a clear stamp of IWRM all over it. An important pillar of IWRM is the understanding of the important links between water quality and water quantity. A similar approach to the handling of flood problems, denoted Integrated Flood Management has been promoted by the World Meteorological Organisation, WMO, and the Global Water Partnership, GWP (WMO 2009).

The water sector is highly linked with and interdependent in relation to other major sectors like industry, agriculture, and energy. Water management therefore has to be organized in such a way as to be flexible and able to function at all levels of society. In order to define and include all aspects of water management, the concept of water governance is quite useful. This concept is defined by The Water Governance Facility, WGF, which is a collaboration between UNDP and GWP, in the following way: ‘Water governance refers to the political, social, economic and administrative systems in place that influence water’s use and management’ (WGF 2021).

Considering this definition in relation to the ambitions, objectives, and methods of the WFD and the FD, it is clear that Water Governance is an appropriate term to be used in connection with the two directives. There is an abundance of

scientific literature dealing with water governance, and how to improve the practical manifestations thereof. Some key concepts that are used are integration (Roy *et al.* 2011), adaptation, (Blackmore *et al.* 2016), and social learning (Pahl-Wostl *et al.* 2013).

The FD defines flood to mean ‘the temporary covering by water of land not normally covered by water’ (Article 2). There are several mechanisms which may lead to flooding, the most important ones being coastal flooding, fluvial flooding, snow and ice related flooding and pluvial flooding. The FD deals with all four of these types of floods plus flooding caused by high groundwater levels. It has been less clear as to which extent urban flooding caused by local extreme rainfall should be included in the implementation of the FD. However, over time also this type of flooding has become included.

The ultimate goal of the WFD is to ensure good status of aquatic ecosystems in the EU. The status of an aquatic ecosystem is determined by ecological status and chemical status. Furthermore, the ecological status is dependent on hydromorphological elements, namely hydrological regime, river continuity, and morphological conditions.

The preventive actions that may be taken in order to reduce flood risk in river systems will by necessity affect the hydromorphological elements of the WFD. This relation will also work in the opposite direction, i.e., actions taken under the WFD to improve the status of hydromorphology in a river basin will affect the hydrological processes and thereby the risk of flooding.

Examples of more indirect effects are measures to increase water retention in the landscape which aim to reduce the concentration of nutrients in rivers and lakes as well as to reduce transport of nutrients to coastal waters. Such water retention affects the hydrological regime, and thereby the risk of flooding. Finally, it should be mentioned that flooding in areas with human activities might lead to spreading of various pollutants in the aquatic ecosystems. Specific measures might benefit the environment or flood protection to smaller or larger degree. In some cases, this might lead to counterproductive effects, while sometimes one gets a win-win situation. For illustration, see Figure 1.

Traditional EU policy evaluation takes place against standard criteria and a well-defined methodology, whereby evaluations must assess effectiveness, efficiency, coherence, relevance, and EU-added value (EC SWD(2017) 350). In this paper, the criteria used for comparison of WFD and FD coordination in selected countries were based on a qualitative assessment of certain indicators, see Table 2 and the Methods section.

Cases/Countries in this paper

Five countries are included in this study, namely Norway, Sweden, Finland, Estonia, and Lithuania. The geographical location of these countries are shown on the map in Figure 2. The most basic country facts are presented in Table 1.

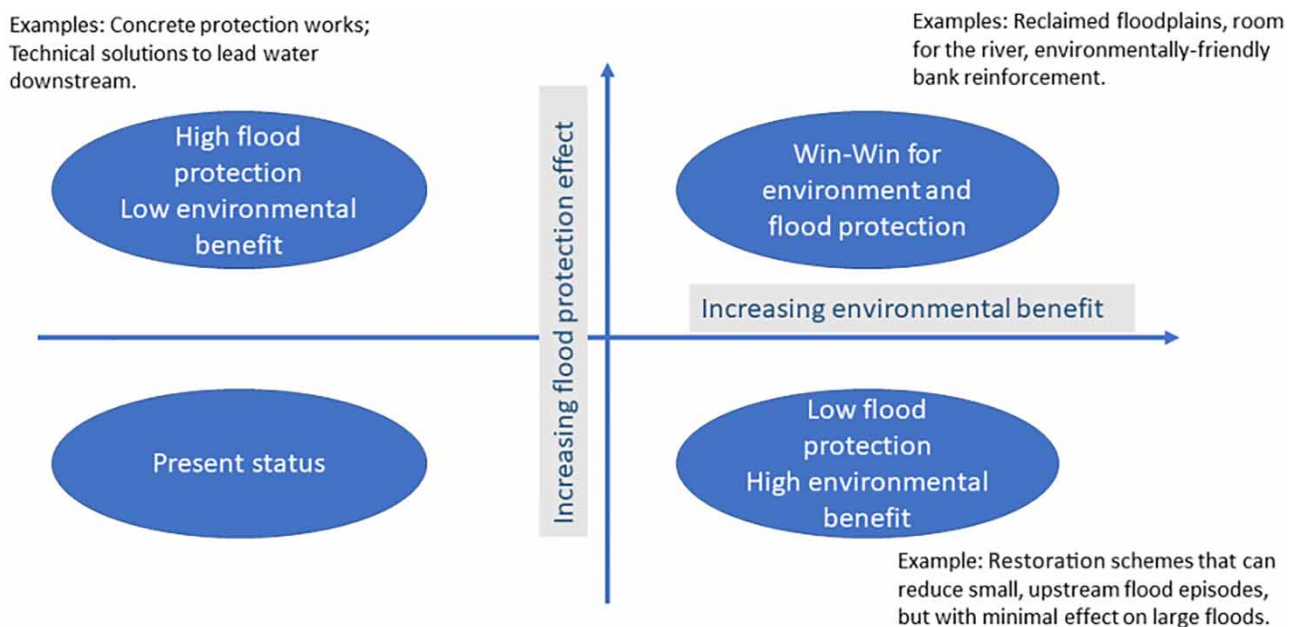


Figure 1 | Examples of measures which may benefit the environment (horizontal axis), flood protection (vertical axis), or both.



Figure 2 | Map of Europe showing the location of the countries included in this paper. Country abbreviations: NO, Norway; SE, Sweden; FI, Finland; EE, Estonia; LT, Lithuania.

The five countries share some characteristics, such as being small in population, and located in the north and north-east of Europe. They differ in topography, with Norway and Sweden sharing the Scandinavian mountain range with influence on both climate and hydrology, whereas Finland, Estonia, and Lithuania are comparatively flat, located in the eastern part of the Baltic Sea drainage basin. In relation to the present study, there are important political differences vis-à-vis the EU. Norway is not a member state and, while it has chosen to adopt the WFD, it has not adapted the FD. The other four countries

Table 1 | Basic information about the case countries in this paper

Country	Population (M)	Area (km ²)	Member EU (Yes/No and year)	WFD (Yes/No and year)	FD (Yes/No and year)
Sweden	10.4	450,000	Y (1995)	Y (2000)	Y (2007)
Norway	5.4	385,200	No	Y (2006)	N
Lithuania	2.8	65,300	Y (2004)	Y (2003)	Y (2009)
Estonia	1.3	45,000	Y (2004)	Y (2004)	Y (2009)
Finland	5.5	338,000	Y (1995)	Y (2000)	Y (2007)

are full members of the EU. However, Estonia and Lithuania did not join the EU until 2004, and therefore they also ratified the WFD and FD later than Sweden and Finland, see [Table 1](#).

The EU directives are binding for the member states, but they do not represent directly applicable laws. The directives have to be transposed into national laws and regulations. However, it is left to the individual states to design their own organizational, and administrative systems which will deal with matters related to the directives.

Below we will describe briefly how each country has implemented the two directives, WFD and FD. Thereafter we will point at the most important differences that we have found. In the case of Norway, since it has not adopted FD, we will describe its corresponding system for flood management. There are three steps required by the FD, namely (i) production of general flood maps, and selection of special risk areas; (ii) risk maps for the selected areas; and (iii) risk management plans for the risk areas.

Sweden

Water Framework Directive

The WFD was transposed into national law, through the Water Management Ordinance, and some amendments to the Environmental code. In the legal documents, it is prescribed that Sweden is divided into five, main Water Districts, plus some small international districts. Each of the five districts is managed by a Water Authority, under the Ministry of Environment (MOE). The Water Authorities are national authorities in their own right, but each one of them is placed at a Country Administration Board (CAB).

Other national authorities with clear responsibilities with regards to WFD are the Swedish Agency for Marine and Water Management, and the Geological Survey of Sweden, which are responsible for coordinating the work with the WFD, developing guidance, and reporting to the EC. It should be pointed out that, since water quality is strongly linked with land use, planning activities are extremely important for achieving improvements with regards to the WFD goals. In Sweden, the 290 municipalities have a very strong legal standing with regards to planning via the Planning and Building Act and are therefore very important actors in the implementation of the WFD:

Floods Directive

The FD was transposed, via the Flood Ordinance, and the Ordinance with Instructions for The Swedish Civil Contingencies Agency (*MSB*), which also issued legal instructions for the County Administration Boards CABs. The three steps required by the FD are organized in the following way in Sweden: (i) production of general flood maps, and selection of special risk areas, is managed by MSB; (ii) risk maps for the selected areas are produced by MSB in cooperation with the relevant CABs; (iii) risk management plans are produced by the CABs associated with the risk areas. MSB is an authority under the Ministry of Justice.

Norway

Water Framework Directive

Norway is not a member of the EU, but the country transposed the WDF in December 2006 through the regulation 'Framework for the water management'. Four laws constitute the legal basis for the regulation: The Law on Pollution, the Law on Biodiversity, the Water Resources Act, and the Plan and Building Act. The latter is of importance because the WFD plans must be authorized through the same system as other management plans.

The WFD is managed by the Ministry of Climate and Environment, which leads a so-called Group of Ministries on the WFD. This consists of eight ministries, of which the Ministry of Petroleum and Energy deals with hydropower, floods, and flood and erosion protection. Similarly, on the next national management level, there is a group of altogether 13 directorates and the County Governors, which is led by the Norwegian Environment Agency. The group is responsible for ensuring cooperation between the directorates and that all water regions receive the same type and level of guidance and information. There is also a National Reference Group with representatives from different sector organizations and non-governmental organizations (NGOs), with a mandate to advise the Group of Directorates on the implementation of the WFD. On the regional level, Norway is divided into nine River Basin Districts (RBDs) led by the County Municipalities. Finally, on the local level, there are 105 River Basin Sub-districts. At this level, also the municipalities play a strong role, as they are important for the Programmes of measures (PoMs) and local land use planning.

Flood management

Norway has not implemented the EU Floods Directive. The main document describing flood management in Norway is a White Paper (*Stortingsmelding 15 2011–2012*). This states that the main laws that regulate responsibilities and measures related to floods, are the Water Resources Act (2000); the Plan and Building Act (2008); the Act on Civil Protection (2010); The Act on Insurance against Nature Damage (1989) and the Act on Nature Damage (1994). Hence, flood management is governed by several of the same laws as the WFD, but both management areas also have laws that are not governing the other.

The White Paper further states that the Ministry of Petroleum and Energy has the national management responsibility for floods and landslides, with the Norwegian Water Resources and Energy Directorate as operative authority. Nevertheless, it is stated that all national authorities have an independent responsibility to prevent and manage floods and landslides within their sector. The Ministry of Climate and Environment; Ministry of Municipalities and Regions; and the Directorate for Building Quality are planning authorities, whereas the Directorate for Civil Protection and Emergency has a responsibility to ensure a holistic and coordinated preparedness. Several agencies are also involved, including the Meteorological Institute. On a regional level, the County Municipality is responsible for coordinating the work on civil security and preparedness; and has the responsibility to oversee the municipalities' preparedness for floods.

Estonia

Water Framework Directive

The WFD was transposed legally through the national Water Act in 2009. But designation of the WFD districts (i.e., three main basins and eight sub-basins) was legislated in 2004. The Koiva-Gauja River district is the only international district. The MOE is responsible for implementing the requirements of the WFD in Estonia. Hereby the preparation and implementation of water management plans is organized by the Water Department of the MOE.

Other organizations with clear responsibilities for the WFD implementation in Estonia are: Environmental Board, Environment Agency and Environmental Inspectorate; all agencies operating under the MOE. Other responsible organizations, outside the MOE, are the Consumer Protection and Technical Regulatory Authority, Health Board, Transport administration, Agriculture and Food Board. In order to expand the list of organizations aware of WFD (also FD) policy developments in Estonia, the Government formed a Water Management Committee in 2009, consisting of representatives of expert groups and research institutions, whose main task is to monitor the results of WFD policy integration in everyday life.

Floods Directive

Transposition of the FD into Estonian Water Act took place in 2009 and the latest amendment took place in 2019. Between 2009 and 2019 the following activities took place: (1) flood risk assessment, (2) estimation of the flood hazard and creation of flood risk maps, and (3) creation of FRMPs. As a result, 16 *densely populated* areas were declared as low probability (at least once per 1,000 years) flood risk areas in Estonia.

Pursuant to § 112 of the Water Act, the Ministry of the Environment organizes the preparation of the FD management plan in cooperation with the Ministry of Rural Affairs, the Ministry of Finance, the Ministry of the Interior and other relevant ministries. The Ministry of the Environment involves the local government units.

Pursuant to § 114 of the Water Act, the Ministry of the Environment and the Ministry of the Interior, in cooperation with other ministries and local municipalities, organize the implementation of a flood risk management plan. Flood preparedness is guaranteed by the Rescue Act and the Emergency Situations Act in accordance with the procedure provided by law in accordance with the emergency response plans and the management plan.

A key implementer (party responsible for implementation) has been designated for each measure of the PoM. Additional activities or those to be involved have been identified for certain activities, as appropriate institutions. All this is described in detail in Annex 3 and 4 of the FD management plan. Here the responsibility of 45 flood risk mitigating measures is listed for 30 different responsible organizations, whereas responsibility for instance of 'Reducing the risk or impact of floods through technical activities' is shared between 12 local municipalities or relevant companies.

Lithuania

Water Framework Directive

In Lithuania, the main legal instrument for water policies and preparedness for WFD is the Law on Water 1997, last amended 2019. The first steps for transposition of WFD were as follows: (1) Law concerning the establishment of RBDs and the designation of the authority responsible for their administration to achieve water protection objectives; (2) Law regarding the establishment of Dauguva, Lielupė, Nemunas and Venta RBD coordination councils and the adoption of their statutes; and (3) Law regarding the personal composition of Dauguva, Lielupė, Nemunas and Venta RBD coordination councils. The WFD was implemented legally, by the MOE and Environment Protection Agency (EPA) under the MOE.

Lithuania is divided into four main Water Districts (Nemuno, Dauguvos, Ventos, and Lielupes). The Nemunas River Basin Management Plan (RBMP) was adopted by the Government in 2010. In 2010, the Lielupe, Venta, and Dauguva RBMPs were approved by Government as well. The first revision of RBMPs was adopted as an integral part of the Water Sector Development Programme for 2017–2023. The second revision of RBMPs (2022–2027) is now ongoing.

Floods Directive

In Lithuania, the first step of flood management was the transposition of the FD into national legislation. The main stages were as follows: (1) *the preliminary flood risk assessment* 2009. The responsible institution for the preparation of mentioned document was the MOE. The preliminary flood risk assessment was implemented in 2012 by the mentioned Ministry; (2) *Flood hazard maps and flood risk maps*. Such maps were formally endorsed by the Minister of Environment in 2014. The maps contain information on floods hazard and risk for the main river valleys within Lithuanian territory; and (3) *FRMPs*. The MOE announced in 2014 the ongoing preparation of FRMPs. The institutions, taking part in this process, were the MOE, the Environmental Protection Agency and the Lithuanian Hydrometeorological Service. The amended version of the project was announced by the MOE and Environmental Protection Agency in 2015. The final versions of the FRMPs were published on 26 May 2017.

Finland

Water Framework Directive

The WFD is transposed into Finnish law mainly through the Act on the Organisation of River Basin Management and the Marine Strategy (RBMA). According to the Decree on RBDs, Finland is divided into seven RBDs of which two are international districts (Belinskij *et al.* 2018).

The Ministry of the Environment and the Ministry of Agriculture and Forestry guide and monitor the enforcement of the RBMA within their respective spheres of operation. Under the ministries the Centres for Economic Development, Transport and the Environment (ETE-Centres), which are state authorities, manage the duties under the act in their areas of operation (RBMA sec. 4). In each RBD, the ETE-Centres must prepare a RBMP and a programme of measures (PoM) (sec. 5). The Government approves the RBMPs (sec. 17). As a general rule, state and municipal authorities must give due consideration in their activities to the RBMPs (sec. 28).

According to the RBMA, the purpose is that river basin management takes into account flood risk management (sec. 1). The PoMs must include summary of measures presented in the FRMPs under the Flood Risk Management Act (FRMA) and an account of their impacts on the environmental targets of river basin management (sec. 12).

Floods Directive

Concerning the FD's transposition into Finnish law, the FRMA is the central piece of legislation. The Ministry of Agriculture and Forestry guides and monitors the implementation of FRMA together with the Ministry of the Interior, Ministry of Transport and Communications and Ministry of the Environment (sec. 3). The Ministry of the Agriculture and Forestry approves the FRMPs for river basins and coastal areas (sec. 18).

The ETE-Centres prepare flood hazard and flood risk maps and proposals for FRMPs for river basins and coastal areas (FRMA sec. 4). A municipality must designate significant stormwater and meltwater flood risk areas and prepares flood hazard maps and flood risk maps for these areas. The municipality prepares and approves a flood risk management plan for an area designated as a significant flood risk area due to stormwater or meltwater flood (sec. 19).

One of the purposes of the FRMA is to coordinate flood risk management and other management of river basins (sec. 1). The preparation and revision of flood hazard and flood risk maps and FRMPs for river basins and coastal areas must be coordinated with RBMPs and in particular with the environmental objectives of PoMs. Participation and communication referred to in FRMA and RBMA must also be coordinated with each other as necessary (sec. 12). In addition, a river basin management district constitutes a flood risk management unit (sec. 28).

METHODS

The main objective of this paper is to evaluate how well the two directives WFD and FD (or for Norway, the WFD and the national flood management) are coordinated in the five selected countries. As described in the Introduction, see for example, [Figure 1](#), measures taken with the purpose of reducing flood risk under FD may have negative, positive, or neutral effects on the aquatic environment, thereby being of importance for WFD goals. The same logic can be used to explain why measures taken under WFD can be important for FD. However, it is very difficult to systematically collect information about measures at a detailed level. Instead, we have chosen to analyse the measures and their coordination across the directives as they are presented in the PoMs. In order to do the analysis, we have sampled the body of RBMPs that are published for the 2nd cycle of WFD, i.e., 2015–2021. The Directive is implemented through 6-year recurring cycles, the first of which covers the period 2009–2015. The third cycle, which succeeds the cycle which has been used for this study, covers 2022–2027. With regards to FD we have sampled the body of FRMPs that are published for the 1st cycle of WD, i.e., 2015–2021. In order to evaluate the coordination between measures for the WFD and FD, we have especially analysed the sections of the RBMPs that contain the PoMs. For Norway, where the FD is not implemented, national plans for flood management have been analysed. As criteria for how well the coordination between the two Directives works in the studied countries, we have checked to which degree the objectives of both WFD and FD are considered in the RBMPs and the FRMPs, see [Table 2](#), Questions 10 and 11.

As a supplementary way of evaluating coordination, we have used the analysis made by the EC in their report ([EC 2019a](#)), with country-wise comments on the strengths and weaknesses of both RBMPs and FRMPs.

After having analysed the coordination of measures between the WFD and the FD, another objective is to find explanatory factors, to the level of coordination, in the legal and organizational set-ups in the individual countries. Those factors have been extracted from the documents describing the transposition of the directives, i.e., primarily the legal documents themselves, but also the Managements Plans, various official documents, and other sources.

In order to perform an analysis of the level of coordination between the WFD and the FD/flood management, we developed a set of criteria, see [Table 2](#). The questions concerned whether the WFD and the FD/flood management are managed by the same or different national and regional/local units, and if managed by different institutions, if regular meetings have been established. Moreover, we compared to which degree the laws and regulations governing each directive/management system are overlapping or not. The explanatory factors are found in the Questions 1–9 in [Table 2](#).

For a semi-quantitative evaluation of the level of coordination in the studied countries, the coordination has been designated as poor, average, or good. Those values are assigned based on the following criteria: poor coordination when synergy effects (positive or negative effects) are not mentioned at all in the plans; average coordination when synergy effects (positive or negative effects) are mentioned in a general way without specifying clearly how this has been taken into account; good coordination when synergy effects (positive or negative effects) are specified clearly and this has been taken into account when planning the actions.

As a further qualitative evaluation, short descriptions were compiled for WFD and FD action plans, measures, and coordination.

Table 2 | Indicators of level of coordination between WFD and FD (or flood management system (FMS) of Norway) in the case countries

Q no	Question	Yes	No
1	Is it the same <i>ministry</i> which is (the main) responsible for implementation of both WFD and FD?	EE LT	NO SE FI
2	Is it the same <i>directorate/authority</i> which is (the main) responsible for implementation of both WFD and FD?	FI EE LT	NO SE
3	Is there a 'group of ministries' which cooperate on the implementation of the <i>WFD</i> ?	NO FI	SE EE LT
4	Is there a 'group of ministries' which cooperate on the implementation of the <i>FD</i> ?	NO FIEE	SE LT
5	If yes to both Q3 and Q4: Is it the same group?		NO FI
6	Is there a 'group of directorates/authorities' which cooperate on the implementation of the <i>WFD</i> ?	NO SE FI EE LT	
7	Is there a 'group of directorates/authorities' which cooperate on the implementation of the <i>FD</i> ?	NO EE LT FI	SE
8	If yes to both Q6 and Q7: Is it the same group?	EE LT	NO
9	Are the WFD and the FD linked to the same <i>laws</i> ?	EE	NO SE FI LT
10	Do FRMPs take into account the WFD water bodies or water district improvement plans?	NO FIEE LT	SE
11	Are the objectives of both WFD and FD considered in RBMPs and FRMPs? ^a	FIEE LT	SE

NO, Norway; SE, Sweden; FI, Finland; EE, Estonia; LT, Lithuania.

^aFor Norway, this question is not relevant.

RESULTS AND DISCUSSION

This section contains country-wise evaluation of coordination between WFD and FD. Based on those evaluations, a comparison between the countries is given. A condensed version of the evaluations, with indicators of level of coordination is shown in [Table 2](#).

WFD PoMs

Sweden

We have sampled and studied two out of five WFD RBMPs, S. Baltic ([Water Authority South Baltic Sea 2016](#)) and Bothnian Sea ([Water Authority Bothnian Bay 2016](#)). The district Bothnian Sea is coded as SE2 by EU while South Baltic is coded SE4. The RBMP is a voluminous document, with around 500 pages over five sections plus appendices, but here we focus on the section called PoM, which is dedicated to the measures to be taken in the (then) coming 6-year period, 2015–2021.

In the PoM, it is stated that it is directed towards authorities, which in turn are supposed to make demands on other actors like industries, etc. It is the organizations in the latter category which will implement the actual, physical measures, for example, through water and environmental permits. The measures describe and motivate what authorities and municipalities need to do in order to decrease the gap between now-state and goals according to the Environmental Quality Norms (EQN). However, although many of the measures are clearly related to flood risks and/or flood prevention, there is virtually no mentioning whatsoever of flooding or the FD. One example of such an action is directed towards the Swedish National Board of Housing, Building and Planning and concerns guiding and guidelines regarding physical planning directed at CABs and municipalities.

In some of the other sections of the Management Plan, apart from the PoM, the necessity and advantages of coordinating WFD measures with FD measures is stated. Especially so with respect to the expected effects of climate change. However, these recommendations give a rather superficial impression, since they are so concentrated to a few chapters in the plans and do not permeate throughout the RBMP.

In conclusion, the sample RBMPs show quite poor indications of serious attempts at coordinating the work under the WFD with the FD activities in Sweden. This tentative result is corroborated by the EC evaluation report for Sweden ([EC 2019b](#)).

Norway

There are presently nine RBDs in Norway, but for the period 2016–2021 there were 13, with corresponding PoM. All PoMs include sections on floods and flood protections, as they were obliged to do, but the text is often quite general, and sometimes even similar in the different plans (e.g., [Glomma RBD 2015](#); [Vest-Viken RBD 2015](#)). The problem with stormwater management, especially in urban areas, is treated more in-depth, and some of the plans mention conflicts of interest between flood protection and biodiversity or fishery. Several sectors are listed as interested parties in the flood protection works, as for example, shown in the RBMP for [Trøndelag RBD \(2015\)](#) where issues related to water supply, sewerage, agriculture, urban stormwater management, flood and land slide risk, and hydropower are briefly discussed.

The plans for 2022–2027 are not yet finalized, but are out on hearing. A search through the plan that includes the largest river in Norway, River Glomma, reveals that floods and flood protection works are treated in more detail than in the old plans. Apparently, more information on registered pressures from flood protection is now available, including old and less environmentally friendly protection works (e.g., lowering water levels in lakes, concrete or stone gabions along river banks).

Estonia

There are three RBDs of WFD in Estonia: Eastern Estonia, Western Estonia and the transboundary Koiva RBD. The status of all water bodies of these RBDs has been assessed and developments described in the RBMPs accordingly. The PoM is an integral part of the RBMPs. Based on the WFD recommendations the measures in Estonia are divided into: *main measures*, *planned additional measures*, and *additional measures*. The *main measures* are measures designed to implement existing policies and legislation. The *planned additional measures* are those agreed and assigned to other policies (national, international) but not related to the EU policies. The *additional measures* are measures that need to be taken to maintain or improve the status of a body of water if the *main measures* and the *planned additional measures* prove insufficient to maintain or achieve at least *good* status. Although WFD-related activities follow policy of action integration, the PoMs are differentiated into action plans for *surface water* and *groundwater bodies* in corresponding RBMPs. Thus the *Surface Water Action Programme* includes measures to reduce the impact of point loads and measures to reduce the impact of diffuse pollution. This programme also includes measures to reduce the impact of changes in water flow or hydromorphological anomalies, additional studies and measures to prevent an increase in additional loads.

Since in Estonia, a preliminary flood risk assessment was carried out in 2011, the chapter related to the flood risk is presenting the summary of flood risk assessments, the flood risk area maps and conclusions, relevant FRMPs for flood risks in transboundary areas of different RBDs, and flood risk prevention measures. As a result, the flood risk management plan consisting of 12 blocks of measures, 24 actions and 118 activities. According to the objectives, the measures developed are divided into the following three: preventive, avoidance and preparedness measures.

Lithuania

For the implementation of WFD, four RBMPs were prepared, i.e., Nemunas RBD, Venta RBD, Lielupė RBD, and Dauguva RBD. The RBMPs were developed according to the elements provided in Annex VII of the WFD. In the RBD Management Plans and in the PoMs, the preparedness for floods and the elimination of flood consequences are stated. Plans include control measures as follows: preparation and approval of the preliminary flood risk assessment reports; consideration and approval of the preliminary flood risk assessment reports and any amendments (every 6 years); preparation and revision of the flood hazard and flood risk maps; and preparation of the FRMPs.

FRMPs for the Nemunas, Lielupė, Venta, and Dauguva RBDs contain the following information: the conclusions of the flood risk assessment for the RBDs in a summary map form, where areas covered by the flood risk management plan were indicated; flood hazard and flood risk maps, and the conclusions that can be made from these maps; a description of the flood risk management objectives; a list of priority measures, based on a cost–benefit analysis, to help achieve the objectives of flood risk management, including ongoing flood protection measures, related measures under European Community legislation and other related measures.

The PoM includes all groups of measures as indicated in Annex VI of the WFD. All major information is also provided according to sub-basins. Agricultural pollution is one of the most important pressures and great attention is devoted to this source of pollution. Public participation during the development of the RBMPs was extensive, for example, with active involvement of relevant stakeholders.

For the period 2022–2027, the MOE in cooperation with the Environmental Protection Agency are planning to prepare the revised version of RBMPs. Under the improvements, interactive maps of point source pollution, rivers affected by straightening, barriers for fish migration and impact of hydropower plants on river stretches are created in order to propose better measures for the improvements of the ecological status of surface water bodies. Measures for restoration of rivers continuity are also proposed.

Finland

Finland has seven RBMP, each including one or more PoMs. In the following, the RBMPs of Kymi River and Gulf of Finland district (FI1) Vuoksi district (FI2) for the management cycle 2016–2021 are analysed from the point of view of their coordination with flood risk management.

FI1 includes six high flood risk areas. FI2 includes no such areas but has 13 other flood risk areas and underscores that local flood risks must be taken into account in water management. According to the plan, climate change will decrease spring floods and increase winter floods and summer floods in population centres and small rivers. Floods may negatively affect, for example, the quality of groundwaters.

Remarkably, FI1 and FI2 aim to reconcile the river basin management and flood risk management measures. They include the assessment on the impacts of water management measures to flood risk management. Also, FI1 and FI2 describe the flood risk management measures in the district and the assessment of their overall compatibility with the objectives of river basin management. In the Vuoksi district, flood risks are also assessed in the Finnish–Russian transboundary cooperation.

Concerning river basin management measures, FI1 and FI2 propose that the regulation of lakes should be developed to manage flood risks. In general, both plans aim to improve water retention capacity in the district. Also, FI1 and FI2 state that flood sensitive fields require measures to prevent nutrient loads in winter.

The EC has provided some positive feedback but also identified challenges concerning the coordination of the objectives of WFD and FD in RBMPs in Finland. The Commission states that the objectives of the FD have been considered in the RBMPs and some win–win measures such as natural water retention measures were included in the plans. However, the RBMPs and FRMPs have not been integrated in the Finnish system (EC 2019c).

FD action plans, measures

Sweden

We have sampled and studied six out of 18 FRMPs (e.g., [Västra Götaland County Administrative Board 2015](#)). There are large variations in the scope and style of these plans. With regards to coordination there is a general text, which is common for most of the plans, with a description of the WFD and the potential synergies between measures of the two directives. However, when it comes to the PoM, it is only one of the plans which gives concrete examples of how the synergies can be realized.

Another problem with the FRMPs, which affect the possibilities for coordinating FD with WFD, is the weak legal standing of the FRMPs and the CABs which are responsible for producing the plans. The CABs have no means to enforce the implementation of the measures in relation to the other authorities which are targeted in the plans. In one of the FRMPs it is even claimed that the CAB itself is not legally bound by the plan.

Norway

Although Norway has not implemented the FD, the country has flood risk plans on a national level, developed by NVE. In a new plan for mapping flood risks for the period 2021–2025 ([Eikenæs et al. 2020](#)), NVE lists three focus areas: (i) develop flood risk maps, (ii) collect and present data on floods, and (iii) develop guidance documents for mapping of flood risks. The latter is linked to a goal to increasingly call for tenders and let others (e.g., consultants) develop the flood risk maps after priorities set by NVE.

Based on the main document on national flood management ([Stortingsmelding 15 2011–2012](#)), municipalities can apply to NVE for funding of the following types of flood measures: (1) surveying, planning and implementation of physical measures to reduce the risk of flooding on existing buildings; (2) tear down and/or move buildings with high flood risk where other measures will be unproportionally expensive; (3) other risk-reducing measures, including monitoring and notification; and (4) planning and implementing environmental measures to reduce the damage of former, less environmental-friendly flood protection works. In addition, both municipalities and the county municipalities can apply for funding to develop management plans for handling risks of floods and landslides.

Estonia

Estonian flood management strategy is divided into three groups: prevention, avoidance and preparedness. The aim of preventive measures is to prevent the emergence of new flood risk areas and to reduce the risk of flooding in designated flood risk areas. Flood prevention measures are divided into two parts: flood prevention and flood protection and control. Flood prevention is the technical lowering and reduction of water levels, such as dredging. Flood protection and control is the reduction of the impact of floods through various technical measures, taking into account the flow and water level of the floods that occur. The purpose of flood avoidance measures is to ensure flood prevention, i.e., artificial reduction of flood risk areas and thus reduction of the impact of floods on human health, the natural environment, cultural heritage and economic activity. It includes also flood protection and control, i.e., flood mitigation through technical measures in buildings and sites to protect human health, the environment, cultural heritage and economic activity. The purpose of flood preparedness measures is to ensure flood preparedness, including public awareness of the action to be taken in the event of a flood, the existence and operation of the necessary protection mechanisms and the elimination of the consequences of floods.

All the flood risk measures set out in corresponding RBD action plans are designed to meet the relevant objectives of the flood risk management plan: to prevent the emergence of new flood risk areas, to prevent and reduce floods in key risk areas, to ensure flood preparedness and to address the consequences of floods. At the same time all measures are divided into the four main driving levels: *administrative*, *construction*, *research* and *consultancy* measures. Some of the activities of the measure may be both *construction* and *research* at the same time.

In Estonia, the principles of the FD have been integrated into the Water Act and Regulation No. 121. The FRMPs have been prepared and updated in parallel *with water management plans* and their PoMs. The parallel preparation of documents makes it possible to harmonize the planning of measures affecting water bodies and to avoid or mitigate possible conflict situations arising from different objectives.

Lithuania

The flood risk assessment set out in the Government resolution on floods (which outlines the main guidelines for the implementation of the aims set out in the Flood Directive) reflects the principles set out in the Articles 4 and 5 of the Flood Directive. The resolution also provides for the indication of the flood risk areas.

The stages of implementation of the flood directive in Lithuania were as follows:

- *The preliminary flood risk assessment*; this document describes the river basins, characterizes previous floods, and their negative effects, indicates the territories which have high risks of floods, and also considers the possible negative effects of future floods.
- *Flood hazard maps and flood risk maps*; the maps contain information on floods hazard and risk for the main river valleys within Lithuanian territory. The hazard was divided into two sources of origin, i.e., snowmelt and heavy rainfall driven floods (based on discharge) for 10, 1, and 0.1% of probability, and ice jam floods based on the water level (from 1 up to 8 m). The risk was evaluated for the social, economic and resident's sectors, as well as the combined risk of all previously mentioned factors was estimated. Also, measures for flood risk management were proposed.
- FRMPs; first part of the plan describes the RBDs located in Lithuania, the second part includes the flood risk and flood hazard maps and the territories that were affected by floods. This plan also considers the effect of climate change on the occurrence of floods.

Five types of flood risk management measures are proposed for the implementation of the tasks of flood risk management: (1) precautionary measures to prevent an increase of flood risks, (2) engineering flood protection measures (reconstruction of old infrastructure or building new one), (3) non-structural flood protection measures in order to reduce the existing flood risks and natural runoff regulation in the river basins, (4) flood preparedness measures related to flood forecasting, early warning about upcoming flood, and public information, and (5) recovery measures after a floods.

Finland

In Finland, multi-criteria decision analysis is utilized in the assessment of FRMPs. One of the factors in the assessment is river basin management objectives. The assessment has affected the selection and prioritization of flood risk management measures (see [Verta & Marttunen 2010](#); [Rytkönen & Marttunen 2013](#); [Söderholm et al. 2018](#)).

In the following, the coordination of flood risk management measures and river basin management objectives is discussed in more detail. For the purpose, two FRMPs in the Kymi River and Gulf of Finland district are analysed: (1) Hamina and Kotka coastal area FRMP (FI3) and (2) Kymi River watercourse FRMP (FI4).

Both FI3 and FI4 aim to reconcile the flood risk management measures and the objectives of river basin management. Also, flood risk management planning schedule was coordinated with the river basin management planning. According to the FRMPs, flood risk management measures support the environmental objectives of the RBMPs at their best. However, flow and water level regulation, dredging and flood banks may also have negative impact on water quality.

FI3 and FI4 include a specific assessment of the impact of the planned flood risk management measures on the achievement of water management objectives. The plans use a five-level scale (very positive, positive, neutral, negative, very negative) for the purpose. Accordingly, only a very few flood risk management measures have negative impact on the water management objectives. In general, the flood management measures in FI3 do not affect their achievement. Most of the planned flood risk management measures are neutral and some are positive in this regard. Also, most of the measures in FI4 are neutral and some are positive in relation to the achievement of river basin management objectives.

The flood management measures have six categories in the FRMPs: (1) flood risk reduction, (2) flood protection, (3) flood preparedness, (4) flood action, (5) recovery measures after flood, and (6) the monitoring of the implementation of the plan. The flood risk reduction measures may be partly same as the river basin management measures. In FI4, one of the reduction measures is exactly the same as a river basin management measure in FI1 and FI2: development of the regulation of lakes to manage flood risks.

The Commission states in its feedback to the FRMPs that there is a strong evidence that the environmental objectives of the WFD have been considered in the plans. It refers to the separate section in the FRMPs where the effects of the planned measures to the environmental objectives of the WFD have been assessed. The Commission provides positive feedback also on the coordination with the WFD in more general. It states that all FRMPs include a similar procedure of coordination with the RBMP. Also, the same authority is responsible for the preparation of both plans and the consultation processes of the plans have been coordinated. At the same time, the FRMPs and RBMPs have not been integrated and, for example, planning of win-win measures or sustainable drainage systems, such as wetlands, is not evident in the FRMPs (EC 2019d).

Coordination WFD/FD

Sweden

Based on the selected RBMPs and FRMPs there is clearly an awareness of the beneficial effects of coordinating the measures taken within the two directives. However, there is very little evidence of such coordination actually taking place. This conclusion is also drawn by the EC in their report (EC 2019b). While the EC report concludes that not much coordination can be found in the measures put forward in the management plans, there is no proposed explanations as to why there is a lack of such coordination. The probable cause of non-compliance with the demand for coordination is to be found in the structure and organization of the Swedish implementation of the WFD and the FD. The most important weaknesses in the structure are as follows: (1) The responsibility for implementing the WFD and the FD are handled by two separate national authorities. The WFD is handled not only by five Water Authorities, but some parts are also in the hands of the Swedish Agency for Marine and Water Management, and the Geological Survey of Sweden. The FD, on the other hand is the responsibility of the Swedish Civil Contingencies Agency, together with those County Administration Boards, which contain the appointed flood risk areas. (2) While the River Basin perspective is clearly part of the work with the WFD, there is hardly any traces of that in the FD plans. Instead, the RMPs focus on geographically restricted areas, with little consideration of the upstream/downstream connections. (3) The actual implementation of measures in the two directives is very indirect. The Water Authorities have no power to enforce any concrete measures. Instead, the governance is supposed to be accomplished by setting the Environmental Quality Standards, and giving instructions to national authorities, CABs and municipalities, which in their turn are supposed to make key actors, like industries and agriculture, implement concrete measures.

Norway

As Norway has not implemented the FD, the EU has not evaluated the country's coordination of the two directives. This lack of evidence makes the assessment of Norway's success, or lack of such, to coordinate the WFD with flood management more challenging. Nevertheless, some general reflections can be done based on the institutions and laws involved, as outlined in the Methodology section.

The Environment Agency is the main responsible for the implementation of the WFD, and the Norwegian Water Resources and Energy Directorate, NVE, is a member of the WFD Group of Directorates, with a strong role in hydromorphological issues. Regarding flood management, the operative implementation institution is NVE. Perhaps interestingly, the Environment Agency is not mentioned in the White paper, which is the main document governing flood management in Norway (Stortingsmelding 15 2011–2012). However, the Ministry of Climate and Environment is one of three ministries listed as important in the White paper, and it can be assumed that the Environment Agency therefore is implicitly involved. The White paper states that flood measures with a positive impact on both flood and environment should be evaluated in the work with the WFD RBMPs. It also states that less environmentally friendly flood measures can be considered removed or improved.

FRMPs according to the FD have of course not been prepared in Norway, but flood risk maps have for a long time been a key instrument for NVE's work with flood preparedness (cf. Eikenæs *et al.* 2020). However, we have not found that flood protection prioritizes areas of pollution risks, such as landfills or polluted sediments or soils: the main priority remains the protection of lives, buildings, and infrastructure.

NVE has funding opportunities for flood mitigation measures that municipalities, developers or other interested parties can apply to. In NVE, either the central level (main office) or one of the five regional units are handling the applications. The NVE regional units are not, as in the WFD, divided according to RBDs, but rather to five parts of the country (east, south, west, middle, and north). The flood mitigation plans must go on a hearing, so that all interested parties can give their views, including environmental interests. NVE has currently issued a guidance on mitigating measures against floods (NVE 2021). The guidance is divided into four parts, Planning; Design; Implementation; and Management, operation, and maintenance. It is clearly stated that flood mitigation measures can also be seen as impacts on the water environment, and that all plans of mitigation measures should be out on hearing, the hearing procedures varies according to the severeness of the impacts of the measure, but all relevant parties can give their views. Also, there is progress in the legal system, as it was recently stated in the Norwegian legislation for 'Climate and energy planning and climate adaption' (Lovdata 2021), that NBS must be considered in municipal and regional planning.

In summary, Norway seems to have a good connection between preparedness and measures against flooding and WFD-related concerns, although managed by different units. However, the formalized cooperation seen in the WFD, where a group of ministries and directorates have regular meetings, is not reflected in the flood management. In the latter, NVE is the main institution implementing all issues related to floods. NVE has a unit responsible for environmental issues in catchments, and also employees with dedicated responsibility for the WFD-related tasks, and the environmental issues of flood protection are much more in focus now than they were in earlier years.

Whereas the WFD has its 6-years' rotation of RBMPs, the flood management does not have the same system. Some river valleys have regional plans with flood protection measures (e.g., Oppland FK 2018), but far from all regions or river basins have such plans. It appears that it is voluntary to produce such plans, but funding for the development can be provided by NVE.

Estonia

Based on the Commission report (EC 2019e) there are two comments related to the implementation of the WFD: (1) to develop specific and measurable FRMP objectives and describe the process for setting objectives and (2) to provide more detailed information on how much the implementation of measures would cost in each UoMs (Units of Management) and about their timetables. Estonia should provide also indicators of progress and describe in the FRMPs the methodology used for cost-benefit analysis and present corresponding results. There were no any specific comments related to FD integration with the WFD in Estonia. However, integration of FD into the WFD in Estonia is based on the FD main strategy stipulated under the paragraph (17). In all Estonian RBMPs the flood risks were summarized as following: (1) results of the initial assessment, (2) maps and conclusions of the flood risk areas and sections influenced by the flood risk area, and (3) flood risk management objectives for risk areas. Based on reported activity for the FRMPs and corresponding Commission comments, the coordination effectiveness for Estonia can be considered good.

Lithuania

In Lithuania, the main responsible authority for implementation of both WFD and FD is the MOE. Additionally, the Environmental Protection Agency takes part as implementer with responsibility for technical tasks, communication, dissemination,

public procurements, etc. Regional authorities such as municipalities participate only during the final steps (in the final deliberations) as target users of taken decisions or providers of necessary data. Therefore, legally the regional authorities cannot be indicated as implementers of either of the two directives.

According to the Commission Report (EC 2019f) some strengths and areas for improvement of implementation of these directives were indicated. Regarding the objectives of FRMPs, it was stated that the objectives are specific and measurable. They are quantitative to achieve targets (e.g., no new buildings that are not flood proof shall be constructed in the medium probability flood zone) and are coordinated at the national level across all UoMs. Measures from the FRMPs and the RBMPs were integrated into the Water Sector Development Programme 2017–2023. The Programme *‘aims to provide a systematic approach to water protection issues and ensure more effective use of available resources’*. Thus, the implementation of the FD and WFD measures was regarded as well coordinated. However, the Programme includes only limited text from each plan. Moreover, the FRMP provided no specific references to any measures that are common with the WFD. According to the Commission Report (EC 2019f), the expectation was that the coordination between the RBMP and FRMP plans should be further strengthened.

Finland

The WFD and FD objectives are relatively well coordinated in Finland. As the Commission has stated in its feedback presented above, the objectives of both directives have been considered in the RBMPs and FRMPs. The multi-criteria decision analysis utilized in the FRMPs and also in the RBMPs to a certain extent is a main strength in this coordination.

Also, the authorities responsible for the river basin management and flood risk management are largely the same. While the Ministry of the Environment has the main responsibility in the management of the environmental objectives of the WFD, the Ministry of Agriculture and Forestry has a role in guiding and monitoring both flood risk management planning and river basin management planning. Moreover, the ETE-Centres are responsible for the preparation of both RBMPs and FRMPs.

The coordination also includes some challenges. First, the Commission has pointed out that RBMPs and FRMPs are not integrated. However, it is doubtful whether this is a real challenge since the main parts of the FRMPs are described in the RBMPs. Second, one can state that the coordination of water management measures could be stronger. Especially, the FRMPs could actively seek to find flood risk management measures that supported the environmental objective of the WFD.

Comparison between countries

The relative success in coordinating the work with WFD and FD is found in the country-by-country descriptions above, and in a condensed form in Table 2. As is obvious from the descriptions of the PoMs, for WFD in the RBMPs and for the FD in the FRMP in the respective countries, there are large variations in the degree of coordination between the measures related to the two directives (and for Norway the WFD and its system for flood management).

The two Baltic countries, Estonia and Lithuania, stand out positively, in comparison with the other three countries, by having succeeded well in taking advantage of the opportunities for synergy effects in the work with the two directives. Such synergies can ensure more environmental-friendly flood protection, ensuring more NBS that will also benefit aquatic ecology. In Estonia the FRMPs are part of the RBMPs, thus making coordination between the two directives very efficient. This is confirmed by the lack of comments about coordination in the Commission report to the EU Parliament. However, Nones *et al.* (2017) evaluated the implementation of both directives in this country, and was concerned by the lack of inclusion of issues such as hydromorphology and sediments.

In Lithuania, like in Estonia, the FRMPs are included in the RBMPs, making the coordination highly efficient. For Lithuania, the coordination between the directives is commended in the Commission report. However, although an investigation by Mikša *et al.* (2021) concluded that Lithuanian authorities comply with the requirement of the correct and timely transposition of the FD in national law, they had in most cases only fulfilled the minimum requirements. Hence, there may be some discord as to how faithfully the directives are implemented.

At the other end of the spectrum, Sweden has succeeded less well with coordinating the measures taken according to the WFD with the measures taken within the framework of the FD. The RBMPs are totally separate from the FRMPs and the opportunities for coordination are not utilized well. This relative lack of coordination is also stated clearly in the Commission report. Moreover, Priest *et al.* (2016) analysed Swedish legislative and policy issues related to the implementation of the FD and found that existing traditions had in some cases overridden the objectives to harmonize flood risk management. Despite some shortcomings, however, the FD had led to a positively stimulated discussion on flood risk management planning.

Hammer *et al.* (2011) revealed that the lack of financial support from the national level was perceived as challenging by the municipalities, possibly hampering the successful implementation on the local level.

Norway and Finland makes up the middle group with some steps towards good coordination between the measures according to WFD and the FD. Also in these two countries, the RBMPs and FRMPs are developed separately. In Norway, since the FD has not been ratified, the planning cycle of the WFD is not mirrored in the system for flood management. However, there are efforts to promote flood measures which have a beneficial effect on the environment, and as noted by Nielsen *et al.* (2013), Norway's institutional implementation of the WFD adheres to catchment and ecosystem-based principles.

In Finland, while the RBMPs do take interaction between aquatic ecology and flooding into account, the FRMPs are less prone to consider effects on the environment.

There are clear formulations in the directives that coordination should be an important aspect of the implementation since large gains will follow. Why is it then that the variation in the outcome is so clear between the five case countries? There could be various factors which influence this variation, but probably the most important explanation is to be found in the way that the individual countries have chosen to implement the directives. There are important differences both in the legal systems and the organizational structures. These differences are highlighted in Table 2.

From Table 2 one can see that Sweden and Norway stand out in that, both at ministry level and at directorate/authority level, WFD and FD (for Norway its system for flood management replaces the FD) are implemented through separate organizations. In the three other countries, the two directives are managed in a more unified way. In both Estonia and Lithuania, the same government ministry is in charge of both WFD and FD, while in Finland the same regional authorities are in charge. These regional authorities in Finland are named the Centres for Economic Development, Transport and the Environment (ETE-Centres).

Another factor of importance is the use of overarching legal systems and water management plans. In Estonia both the WFD and the FD are covered in the national Water Act. In Lithuania, measures planned within the framework of the WFD and measures in the FD are integrated in the Water Sector Development Plan. In Norway, Sweden, and Finland the picture is more divided.

CONCLUSIONS

Based on thorough analyses of the RBMPs (WFD) and the FRMPs (FD) as well as the legal systems and the organizational systems in place in the five countries it has been possible to draw some conclusions in response to the objectives of the paper. It should be reiterated here that the criteria used to evaluate the rate of success of coordinating the work with the two directives are reflected by Questions 10 and 11 in Table 2. Similarly, the explanatory factors for such rate of success are reflected by Questions 1–9 in Table 2.

Coordination between the two directives is handled very well by Estonia and Lithuania, with the positive consequence of having strong synergy effects between the PoMs. Such synergies can, for example, be flood protection works that ensure a healthy water environment and at the same time protect humans, cultural heritage, buildings and infrastructure from devastating flood damage. For Finland and Norway, the coordination is managed fairly well with some evident synergy effects. In Sweden, there is less coordination of the measures and there are opportunities for improvement.

For example, it is recently stated in the Norwegian legislation for 'Climate and energy planning and climate adaption' (Lovdata 2021), that NBS should be considered municipal and regional planning.

The relative success of coordination between the directives are clearly reflected in the way the WFD and the FD have been implemented in the countries. In both Estonia and Lithuania, the directives are managed under the same ministry. In Estonia both directives are also regulated under the same law. For Norway, Sweden and Finland, the two directives are managed by separate ministries and separate national authorities/directorates. In Norway there is more clear structures for cooperation between the various directorates involved than in Sweden. Finland has regional authorities (ETE-Centres) which are responsible for work with both directives.

It should be pointed out again that this paper is based on the cycle 2016–2021 (WFD), and that new plans for the next cycle are near ratification.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

ACKNOWLEDGEMENTS

Antti Belinskij received financial support from the BlueAdapt project funded by the Strategic Research Council of Finland.

REFERENCES

- Albrecht, J. 2016 Legal framework and criteria for effectively coordinating public participation under the floods directive and water framework directive: European requirements and German transposition. *Environmental Science & Policy* **55** (2), 368–375. <https://doi.org/10.1016/j.envsci.2015.07.019>.
- Belinskij, A., Aroviita, J., Kauppila, J., Kymenvaara, S., Leino, L., Mäenpää, M., Raitanen, E. & Soininen, N. 2018 *Vesienhoidon ympäristötavoitteista poikkeaminen – perusteet ja menettely (Exemptions to the Environmental Objectives in River Basin Management – Grounds and Procedure)*. Publications of the Government's analysis, assessment and research activities 42/2018. Available from: <https://julkaisut.valtioneuvosto.fi/handle/10024/160921>.
- Blackmore, C., van Bommel, S., de Bruin, A., de Vries, J. R., Westberg, L., Powell, N., Foster, N., Collins, K., Roggero, P. P. & Seddaiu, G. 2016 Learning for transformation of water governance (CADWAGO) project. *Water* **8**, 510. <https://doi.org/10.3390/w8110510>.
- Challies, E., Newig, J., Kochskämper, E. & Jager, W. 2017 Governance change and governance learning in Europe: stakeholder participation in environmental policy implementation. *Policy and Society* **36** (2), 288–303. <https://doi.org/10.1080/14494035.2017.1320854>.
- COM 2021 970 final. REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on the implementation of the Water Framework Directive (2000/60/EC), the Environmental Quality Standards Directive (2008/105/EC amended by Directive 2013/39/EU) and the Floods Directive (2007/60/EC). Implementation of planned Programmes of Measures New Priority Substances Preliminary Flood Risk Assessments and Areas of Potential Significant Flood Risk. Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0970>.
- Douka, A. 2020 Adaptation measures to climate change within the European FD (2007/60/EC). *Environmental Sciences Proceedings* **2** (1), 38. <https://doi.org/10.3390/environsciproc2020002038>.
- EC European Commission 2000 *Water Framework Directive 2000/60/EC*.
- EC European Commission 2007 *Floods Directive 2007/60/EC*.
- EC European Commission 2019a *Implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) Second River Basin Management Plans First Flood Risk Management Plans*, COM(2019)95.
- EC European Commission 2019b *Commission Staff Working Document: Second River Basins Management Plans – Member State: Sweden*, SWD(2019) 57 final.
- EC European Commission 2019c *Commission Staff Working Document: Second River Basins Management Plans – Member State: Finland*, SWD(2019) 46 final.
- EC European Commission 2019d *Commission Staff Working Document: First Flood Risk Management Plans – Member State: Finland*. SWD (2019) 70 final.
- EC European Commission 2019e *Commission Staff Working Document: First Flood Risk Management Plans – Member State: Estonia*. SWD (2019) 40 final.
- EC European Commission 2019f *Commission Staff Working Document: First Flood Risk Management Plans – Member State: Lithuania*. SWD (2019) 248 final.
- EC, SWD 2017 350. COMMISSION STAFF WORKING DOCUMENT Better Regulation Guidelines. Available from: https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en.
- Eikenæs, O., Bakkan, M., Berg, H. & Roald, C. M. 2020 *Plan for flomfarekartlegging, 2021–2025*. (Plan for flood risk mapping) NVE Rapport nr. 33/2020. Available from: https://publikasjoner.nve.no/rapport/2020/rapport2020_33.pdf.
- Glomma RBD 2015 *Regionalt tiltaksprogram etter vannforskriften 2016–2021, (Regional Programme of Measures Based on the WFD; in Norwegian)*. Glomma River Basin District Authority, p. 83. Available from: <https://www.vannportalen.no/plansyklus/planperioden-2016–2021/regionale-tiltaksprogram-2016–2021/>.
- Hammer, M., Balfors, B., Mörtberg, U., Petersson, M. & Quin, A. 2011 Governance of water resources in the phase of change: a case study of the implementation of the EU Water Framework Directive in Sweden. *Ambio* **40**, 210–220. doi:10.1007/s13280-010-0132-2.
- Kanakoudis, V., Tsitsifli, S. & Azariadi, T. 2015 Overview of the river basin management plans developed in Greece under the context of the Water Framework Directive 2000/60/EC focusing on the economic analysis. *Water Resources Management* **29**, 3149–3174. <http://dx.doi.org/10.1007/s11269-015-0988-9>.
- Kumar, P., Debele, S. E., Sahani, J., Aragão, L., Barisani, F., Basu, B., Bucchignani, E., Charizopoulos, N., Di Sabatino, S., Domeneghetti, A., Edo, A. S., Finér, L., Gallotti, G., Juch, S., Leo, L. S., Loupis, M., Mickovski, S. B., Panga, D., Pavlova, I., Pilla, F., Prats, A. L., Renaud, F. G., Rutzinger, M., Basu, A. S., Shah, M. A. R., Soini, K., Stefanopoulou, M., Toth, E., Ukonmaanaho, L., Vranic, S. & Zieher, T. 2020 Towards an operationalisation of nature-based solutions for natural hazards. *Science of The Total Environment* **731**, 138855. <https://doi.org/10.1016/j.scitotenv.2020.138855>.

- Liefferink, D., Wiering, M. & Uitenboogaart, Y. 2011 *The EU water framework directive: a multi-dimensional analysis of implementation and domestic impact*. *Land Use Policy* **28** (4), 712–722. <https://doi.org/10.1016/j.landusepol.2010.12.006>.
- Lovdata 2021 Klima og energiplanlegging og klimatilpasning (Climate and energy planning and climate adaptation; in Norwegian). Available from: https://lovdata.no/dokument/SF/forskrift/2018-09-28-1469/KAPITTEL_4_3#KAPITTEL_4_3.
- Maia, R. 2017 *The WFD implementation in the European member states*. *Water Resources Management* **31**, 3043–3060. <https://doi.org/10.1007/s11269-017-1723-5>.
- Martinengo, M., Ziantoni, A., Lazzer, F., Rosatti, G. & Rigon, R. 2020 A practitioners' view on the application of water and flood directives in Italy. 10.31219/osf.io/5yj6w. Available from: <https://osf.io/5yj6w>.
- Mikša, K., Kalinauskas, M., Inácio, M. & Pereira, P. 2021 *Implementation of the European union floods directive – requirements and national transposition and practical application: Lithuanian case-study*. *Land Use Policy* **100**, 104924. <https://doi.org/10.1016/j.landusepol.2020.104924>.
- Moren-Abat, M. & Rodriguez-Roldan, A. 2012 *The challenges of implementing the Water Framework Directive in Spain*. *International Journal of Water Resources Development* **28**, 13–18. <http://dx.doi.org/10.1080/07900627.2012.640606>.
- Mylopoulos, Y. A. & Kolokytha, E. G. 2008 *Integrated water management in shared water resources: the EU water framework directive implementation in Greece*. *Physics and Chemistry of the Earth* **33**, 347–353. <http://dx.doi.org/10.1016/j.pce.2008.02.031>.
- Newig, J., Challies, E., Jager, N. & Kochskämper, E. 2014 *What role for public participation in implementing the EU floods directive? A comparison with the water framework directive, early evidence from Germany and a research agenda*. *Environmental Policy and Governance*. <https://doi.org/10.1002/eet.1650>.
- Nielsen, H. Ø., Fredriksen, P., Saarikoski, H., Rytönen, A.-M. & Pedersen, A. B. 2013 *How different institutional arrangements promote integrated river basin management: evidence from the Baltic Sea Region*. *Land Use Policy* **30**, 437–445. <https://doi.org/10.1016/j.landusepol.2012.04.011>.
- Nones, M., Gerstgraser, C. & Wharton, G. 2017 *Consideration of hydromorphology and sediment in the implementation of the EU water framework and floods directives: a comparative analysis of selected EU member states*. *Water and Environment Journal* **31** (3), 324–329. <https://doi.org/10.1111/wej.12247>.
- NVE 2021 *Sikring mot flom og erosjon (in Norwegian)*. Available from: <https://www.nve.no/sikring-mot-flom-og-erosjon/> [2022-07-14].
- Oppland FK. 2018 *Lågenplanen. Regional plan for Gudbrandsdalslågen med sidevassdrag- Tiltak for å redusere flom- og skredskader*. Oppland Fylkeskommune, p. 85. (in Norwegian). Available from: https://innlandetfylke.no/_f/p1/ib8fff23e-54a2-48f9-80a5-932b0efba4df/regional-plan-for-gudbrandsdalslagen-med-sidevassdrag.pdf.
- Pahl-Wostl, C., Becker, G., Knieper, C. & Sendzimir, J. 2013 *How multi-level societal learning processes facilitate transformative change*. *Ecology and Society* **18** (4), 58. <https://doi.org/10.5751/ES-05779-180458>.
- Pires, A., Morato, J., Peixoto, H., Botero, V., Zuluaga, L. & Figueroa, A. 2017 *Sustainability assessment of indicators for integrated water resources management*. *Science of the Total Environment* **578**, 139–147. <https://doi.org/10.1016/j.scitotenv.2016.10.217>.
- Priest, S. J., Suykens, C., Van Rijswijk, H. F. M. W., Schellenberger, T., Goytia, S., Kundzewicz, Z. W., van Doorn-Hoekveld, W. J., Beyers, J.-C. & Homewood, S. 2016 *The European Union approach to flood risk management and improving societal resilience: lessons from the implementation of the Floods Directive in six European countries*. *Ecology and Society* **21** (4), 50.
- Richter, S., Völker, J., Borchardt, D. & Mohaupt, V. 2013 *The water framework directive as an approach for integrated water resources management: results from the experiences in Germany on implementation, and future perspectives*. *Environmental Earth Sciences* **69**, 719–728. <http://dx.doi.org/10.1007/s12665-013-2399-7>.
- Roy, D., Barr, J. & Venema, H. D. 2011 *Ecosystem approaches in integrated water resources management (IWRM). A Review of transboundary river basins*. United Nations Environment Programme and the International Institute for Sustainable Development. Retrieved from <https://www.unepdhi.org/wp-content/uploads/sites/2/2020/06/Ecosystem-Approaches-in-Integrated-Water-Resources-Management.pdf>.
- Rytönen, A.-M. & Marttunen, M. 2013 *Monitavoitearviointi tulvariskien hallinnan suunnittelun tukena (Multicriteria decision analysis to support flood-risk management planning)*. *Vesitalous* **5/2013**, 8–12.
- Söderholm, K., Pihlajamäki, M., Dubrovin, T., Veijalainen, N., Vehviläinen, B. & Marttunen, M. 2018 *Collaborative planning in adaptive flood risk management under climate change*. *Water Resources Management* **32**, 1383–1397. <https://doi.org/10.1007/s11269-017-1875-3>.
- Solomon, M. K., Ferreira, C. S. S., Zupanc, V., Ristic, R., Drobnjak, A. & Kalantari, Z. 2021 *Flood legislation and land policy framework of EU and non-EU countries in Southern Europe*. *WIREs Water* **9** (1), e1566. <https://doi.org/10.1002/wat2.1566>.
- Stortingsmelding 15 2011–2012 *Hvordan leve med farene – om flom og skred*. (White Paper, in Norwegian). Available from: <https://www.regjeringen.no/no/dokumenter/meld-st-15-20112012/id676526/>.
- Trøndelag RBD 2015 *Regionalt tiltaksprogram etter vannforskriften 2016–2021, (Regional Programme of Measures for Trøndelag River Basin Management District; in Norwegian)*. Trøndelag River Basin District Authority. p. 65. Available from: <https://www.vannportalen.no/plansyklus/planperioden-2016–2021/regionale-tiltaksprogram-2016–2021/>.
- Van Eerd, M. C. J., Wiering, M. A. & Dieperink, C. 2019 *Policy discretion, adaptation pressure and reloading implementation experiences in EU water governance: the case of the Netherlands*. *Water Alternatives* **12** (3), 886–906.
- Västra Götaland County Administrative Board 2015 *Risk Management Plan for Flooding in Göteborg, Report 2015:55 (in Swedish)*.
- Verta, O.-M. & Marttunen, M. 2010 *Multi-Criteria Decision Analysis (MCDA) in the evaluation of the flood risk management alternatives – the Kokemäenjoki River Basin case*. CIS Working Group F Thematic Workshop, Ghent, 25-26 October 2010. 8 pp.

- Vest-Viken RBD 2015 *Regionalt tiltaksprogram for vannregion Vest-Viken, 2016–2021, (Regional Programme of Measures for Vest-Viken River Basin Management District; in Norwegian)*. Vest-Viken River Basin District Authority, p. 79. Available from: <https://www.vannportalen.no/plansyklus/planperioden-2016–2021/regionale-tiltaksprogram-2016–2021/>.
- Voulvoulis, N., Arpon, K. D. & Giakoumis, T. 2017 *The EU Framework Directive: from great expectations to problem with implementation. Science of the Total Environment* **575**, 358–266. <https://doi.org/10.1016/j.scitotenv.2016.09.228>.
- Water Authority Bothnian Bay 2016 *Water Management Plan 2016-2021 D-nr 537-9060-15 (in Swedish)*.
- Water Authority South Baltic Sea 2016 *Water Management Plan 2016-2021 D-nr 537-9357-16 (in Swedish)*.
- WGF Water Governance Facility 2021. Available from: <https://www.watergovernance.org/water-governance/> (accessed 1 November 2021).
- WMO 1992 International conference on water and the environment: development issues for the 21st century, 26–31 January 1992, Dublin, Ireland. In: *the Dublin Statement and Report of the Conference*.
- WMO 2009 *Integrated Flood Management – Concept Paper, Report WMO-No. 1047*.
- World Bank 2017 *Implementing nature based flood protection*. In: *Principles and Implementation Guidance*. <https://doi.org/10.1596/28837>.

First received 17 February 2022; accepted in revised form 19 July 2022. Available online 19 August 2022