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How Hercules cleans up the Augean stables: differentiated implementation of the EU Water Framework Directive

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ABSTRACT

Realising the goals of the European Union (EU) Water Framework Directive is difficult. The differentiation of water policies according to local conditions enjoys increasing attention and may be necessary to achieve good ecological status in all European waters. This paper seeks to explore to what extent and how local water quality determines the degree of coercion, i.e. the extent to which differentiated policies are voluntary or rather imposed upon policy addressees, of spatially differentiated water policies. It does so on the basis of seven cases in five EU Member States. For highly polluted waters, spatially differentiated policies tend either to make the use of authoritative policy instruments, i.e. coercion by way of formal regulation, or to rely on the threat to introduce such regulation. For preventing the deterioration of relatively 'clean' waters, voluntary instruments based on information and persuasion dominate, often supported by subsidies and/or the direct input of public resources. In relation to the spatial differentiation of water policies, issues of data demand, equality and legitimacy have to be taken into account.

Key words: EU Member States, Implementation, Policy instruments, Spatial differentiation, Water Framework Directive, Water policy

HIGHLIGHTS

- The paper explores the relationship between local water quality and policy instruments used for locally differentiated policies under the EU Water Framework Directive (WFD).
- In case of a long distance to the WFD targets, instruments with a high degree of coercion, e.g. formal regulation, prevail.
- If local quality is close to the WFD targets, lower degrees of coercion, e.g. information or subsidies, prevail.

INTRODUCTION

A wide variety of policies have been developed over the years to improve water quality, for instance by curbing emissions of pollutants at the source, by controlling the quality of ground or surface water more directly through

limit values for concentrations of specific substances in water, or through spatial planning, zoning or physical measures – or in fact by various combinations of such measures (see Gunningham & Sinclair, 2005; Carter, 2018).

Most of those policies have a generic character. They tend to set similar standards for categories of sources or water bodies across a whole country or even the European Union (EU). Equal standards guarantee, at least on paper, an equal level of environmental protection. In the EU as well as nationally, harmonised standards are important for avoiding distortions of conditions for trade and competition. Requiring equal steps from similar actors (firms and farmers) is likely to be socially, economically, politically and legally easier. In many cases, finally, equal standards can be more easily monitored and enforced.

However, geographical and ecological conditions vary, land and water are used differently in different locations and differences in economic and social conditions may lead to differences in the feasibility and costs of measures. Thus, taking account of local conditions makes it possible to optimise the environmental effect of measures at the lowest cost (Gunningham & Sinclair, 2005; Dalgaard *et al*., 2014; Jacobsen & Hansen, 2016; Odgaard *et al*., 2019). In this paper, we focus on policies explicitly aiming at the *spatial* differentiation of policies, i.e. differentiation across locations. Involving stakeholders in the design and implementation of locally specific measures allows for the mobilisation of local knowledge and potentially raises local engagement, support and legitimacy (Graversgaard *et al*., 2017). But there are also drawbacks. Effective differentiation requires large amounts of detailed data, for instance regarding local hydrology, ecological conditions, emissions, production processes and implementation costs (Thorsøe *et al*., 2017; Wiering *et al*., 2018). Ensuing inequalities need to be embedded legally and defended politically. Thus, there is a number of challenges that need to be resolved for differentiation to work, such as ensuring legitimacy and gaining stakeholders' support (Thorsøe *et al*., 2017).

The Water Framework Directive (WFD; Directive 2000/60/EC) provides the key point of reference for water quality policies in the EU. The Directive, adopted in 2000, provides a comprehensive framework for the management of surface and ground water in the EU. Crucial features are its focus on both ecological and chemical quality and the organisation of policies along river basins rather than traditional administrative borders. The WFD builds on a number of pre-existing EU directives, including the Nitrates Directive (ND; Directive 91/676/EC) (Wiering *et al*., 2020b). Member States are obliged to designate their water bodies as either 'artificial', 'heavily modified' or 'natural'. The latter are supposed to have reached 'good status' by 2027; for 'artificial' and 'heavily modified' water bodies, a 'good potential' suffices. Parameters for designating waters and for 'good status' resp. 'good potential', involving a wide range of ecological and chemical criteria, are largely set and monitored by the Member States themselves and subsequently assessed in an elaborate European review procedure (Voulvoulis *et al*., 2017).

The implementation of the WFD is notoriously problematic (Voulvoulis *et al*., 2017; European Commission, 2019; Wiering *et al*., 2020a). To improve implementation and approach the ambitious goals of the Directive, the idea of a spatial differentiation of water policies within the territory of the individual Member State enjoys increasing attention, particularly in countries where water problems are relatively high on the political agenda, such as Denmark, the Netherlands and Belgium (e.g. Vlaamse Landmaatschappij, 2015; Ministry of Environment and Food of Denmark/EPA, 2017; Boezeman *et al*., 2019; LBST, 2019).

However, as Thorsøe *et al*. (2017: 203) point out, it is 'difficult to clearly distinguish between differentiated and general regulation'. In fact, general rules may work out differently when applied in different contexts. In that case, however, variation cannot be seen as the outcome of a deliberate strategy to differentiate. In some cases, moreover, policies merely differentiate between *categories* of sources or recipients throughout a given, e.g. national or European, territory. One example is differentiated limit values for applying manure to the land according to crop types and soil types under the EU ND (Directive 91/676/EC, e.g. Keessen *et al*., 2011; Dalgaard *et al*., 2014). In other cases, policies are truly locally specific, for instance tailor-made programmes for specific areas

(Graversgaard *et al*., 2017; Boezeman *et al*., 2019). Furthermore, differentiation may take different legal forms, ranging from a firm legal basis to more open and voluntary approaches (e.g. Keessen *et al*., 2011; Anker, 2015). The latter aspect – the extent to which differentiated policies are voluntary or rather imposed upon policy addressees, referred to here as the degree of coercion – is at the heart of this paper.

As a first step towards better understanding the pros and cons of spatially differentiated water policies, this paper strives to identify typical patterns of such policies. Our aim is to explore to what extent and how local water quality, operationalised as the distance to the target of 'good ecological status' set by the WFD, determines the degree of coercion of spatially differentiated water policies. Acknowledging that other factors, ranging from the type of land use and the costs of measures to social, political and cultural conditions, also play a role in policy design, this paper exclusively focuses on the link between local water quality and the degree of coercion of spatially differentiated policies, or in other words, on the types of policy instruments selected for addressing the WFD's core concern. All instances of differentiation examined in this paper are aimed at achieving the goals contained in the Directive. This excludes national legislation setting norms for specific waters intended for, for instance, the extraction of drinking water.

More specifically, we focus on agricultural pollution from non-point sources: nutrients in animal manure and artificial fertiliser, and pesticides. Due to their dispersed nature, agricultural non-point sources are particularly difficult to address. If the WFD poses to policy-makers a set of Herculean labours, diffuse emissions from farms represent the task of cleaning King Augeas' stables.

The next section reviews the literature, concluding with an interpretative framework focusing on the rationale for differentiation and the types of instruments used for that purpose, emphasising their degree of coercion. This is followed by seven short case studies in five EU Member States exhibiting a wide variety of differentiation practices. Based on these cases, we will return to our question of the relationship between local water quality and the degree of coercion of spatially differentiated water policies.

THEORY

The idea of spatial differentiation of environmental policies has been on the agenda for many years. From the 1970s, studies have shown that spatially differentiated emission charges for air pollutants could achieve policy goals at lower operational costs (Tietenberg, 1978; Anderson *et al*., 1979), however, at the expense of higher transaction costs (Dixit, 1996; Xabadia *et al*., 2008).

Differentiating emission limits or effluent charges according to location is particularly difficult when it concerns non-point, diffuse sources. In those cases, problems are caused by many small polluters, such as farmers. Historically, diffuse pollution has been addressed through generic 'one size fits all' policy instruments (Kneese & Bower, 1968; Dalgaard *et al*., 2014). Over time, various authors have recommended a shift towards more differentiated policies (Helfand & House, 1995; Gunningham & Sinclair, 2005: 80; Dalgaard *et al*., 2014; Wardropper *et al*., 2015). However, these studies do not systematically address different forms of spatially differentiated water policies. At its most basic level, such a 'taxonomy' should involve the rationale behind introducing such policies and the different types of policy instruments they employ.

Rationale

General reasons for the spatial differentiation of water policies include the need to deal with different geographical circumstances or different functions attributed to waters, improving cost-effectiveness or increasing the involvement of local stakeholders by developing 'tailor-made' policies. In this context, it is relevant to mention that the WFD itself requires stakeholder involvement (Art. 14) and encourages Member States to select the most cost-effectiveness measures (Annex III). Such rationales have found their way into policy practice, for

instance in the form of differentiated protection goals and measures for waters designated for the extraction of drinking water, bathing waters or water flowing into nature areas, or differentiated manure application standards for different types of soil (Keessen *et al*., 2011; Dalgaard *et al*., 2014; Van Grinsven *et al*., 2016).

In this paper, which attempts to distinguish basic forms of spatially differentiated policies in relation to water pollution by diffuse agricultural sources, we limit ourselves to policies that are differentiated with the explicit aim to achieve the WFD goals of 'good ecological status', or even 'good ecological potential'. These goals are, generally speaking, still distant. Herculean efforts are required to clean up the mess of the proverbial Augean stables. Under those circumstances, differentiated policies are likely to consist primarily of measures to reduce the distance to the targets of good ecological status set by the WFD. But the WFD also requires that waters currently of good quality do not deteriorate. Specifically, designed measures can also be necessary in those cases. In the literature, numerous factors other than the wish to differentiate co-determine the choice of policy instruments (e.g. Eliadis *et al*., 2005). However, these will not be systematically addressed in this explorative paper. By selecting a comprehensive and diverse set of cases (see below), we intend to zoom in on the relationship between local water quality, understood as distance to the WFD target, and the degree of coercion of spatially differentiated policies.

In the following, we distinguish between 'far from target' and 'close to target' situations. We assume that a long distance to the WFD target will lead to other types of instruments than a short distance. Thus, we expect more coercive measures to be used in the former case. With modern technology at his disposal, Hercules would probably have used high pressure for cleaning up the stables. For maintenance, even Hercules would have picked a broom.

Policy instruments

The policy instrument literature is rife with typologies. They vary primarily in terminology and the number of subcategories. At the core of instrument typologies is the assumption that 'public policy almost always attempts to get people to do things they otherwise would not have done, or it enables them to do things they might not have done otherwise' (Schneider & Ingram, 1990: 510).

Hood's classical NATO typology includes four basic types of instruments, each defined by the type of governing resource applied to promote the desired behaviours or activities: nodality, authority, treasure and organisation (Hood, 1986). Nodality refers to information that government has and can disperse due to its central position in society. Authority refers to legal powers and therefore to mandatory measures such as command-and-control regulation. Treasure refers to economic means. Organisation refers to the organisational setup of the provision of public goods and services, e.g. government agencies or private providers.

However, Vedung (2007: 38) argues that 'organisation' is a strategic choice, not a policy instrument. He outlines a typology with just three categories, defined by their degree of coercion (Vedung, 2007: 34), i.e. the extent to which the desired behaviour is voluntary or imposed upon policy addressees: economic instruments, regulation and information – or carrots, sticks and sermons. These are similar to Hood's first three categories. In fact, these categories appear to make up the backbone of all instrument typologies (see, for instance, Carter, 2018; Howlett, 2019).

In this paper, we integrate Hood's NATO typology and Vedung's carrots, sticks and sermons. In the context of water policy, we argue that organisation may indeed be conceptualised as an instrument for achieving policy objectives, for instance when public authorities build and run sewage infrastructure or install hydromorphological measures in watercourses to ensure fish habitats (also referred to as 'direct provisioning', see Hood, 2007). At the same time, Vedung's conceptualisation of categories, as it is based on the degree of coercion, is more relevant to the purpose of this paper. The two typologies are compatible as government resources imply a certain degree of

coercion, with information resources as least coercive and authority-based instruments as most coercive. Also, organisational resources may to a certain extent steer behaviour, for instance by offering administrative capacity for certain purposes or facilitating behavioural choices by making available certain types of physical infrastructure such as sewage treatment facilities. As instruments, in practice, tend to be part of instrument *mixes* (Howlett, 2005; Pacheco-Vega, 2020), the degree of coercion provides us with an easy and effective tool to bring some order in such mixes. It should be noted, finally, that the degree of coercion may vary also *within* categories, e.g. nodality (information vs. propaganda), treasure (subsidy vs. tax) or regulation (regulation vs. self-regulation, rights vs. obligations) (Howlett, 2005; Margetts & Hood, 2016).

Based on this, we get the following four types of policy instruments:

- *Nodality/information:* Information is defined as measures undertaken to obtain policy objectives through the transfer of knowledge and information and through advice, persuasion and moral appeals (Hood, 1986: 21; Vedung, 2007: 48). It represents the least coercive type of policy instrument, as it is voluntary whether to use the information and there is no direct price to pay for not doing so.
- *Authority/regulation:* Regulation, which mandates or prohibits behaviour through rules, is the most coercive type of policy instrument. It rests on the legal authority of government (Hood, 1986). It may include rules that prohibit certain actions, such as a ban on the use of particular pesticides, or rules that certain activities require permission such as environmental licences. Following Howlett *et al*. (2009: 121), we also categorise self-regulation, including voluntary agreements (VAs), as an authority instrument, arguing that such regulation is implicitly or explicitly permitted by government and under the threat of direct government intervention if self-regulation is not successful.
- *Treasure/economic instruments:* Economic instruments aim to influence behaviour through incentives or disincentives. While positive incentives, e.g. subsidies, aim to enable or encourage target groups to undertake activities, disincentives, e.g. taxes or cap-and-trade schemes, aim to discourage the use of scarce resources or encourage the reduction of harmful substances. For this reason, taxes may be seen as more coercive than subsidies. At the same time, taxes are less coercive than regulation, as target groups may opt to pay the taxes instead of changing behaviour.
- *Organisation*: Hood (1986) defines organisation as the physical and human resources that give government the ability to act directly on a public problem or to shape and modify the target group's behaviour.

Summing up

The above discussion provides us with the following scheme for characterising the rationales and forms of spatially differentiated water policies (Table 1).

METHODOLOGY

In view of our aim to develop a better understanding of characteristics and patterns of spatially differentiated water policies, we chose a qualitative multiple-case study approach. We aimed to maximise the variation of cases based on the key variables derived from our literature review. First, we selected five Northwestern European countries: Denmark, Belgium (Flanders), Germany (Lower Saxony), the Netherlands and Ireland. In all of these, differentiation in the context of the WFD has emerged as a policy discourse, but they differ in relation to the legal system in which differentiation has to be embedded. Moreover, the selected countries differ to the extent to which they accommodate highly intensive (e.g. the Netherlands and Denmark) or more extensive (e.g. Ireland) farming systems, potentially changing the need for differentiation. By selecting only Northwest European liberal democracies, moreover, we aim to limit the impact of contextual (e.g. climatic/ecological,

Table 1. | Summary of interpretative scheme.

Rationale for differentiation		**Distance-to-target**			
	Definition	Distance to WFD goal of 'good status'			
	Degree	• Far • Close			
Type of instrument (Hood, 1986; Vedung, 2007)		**Nodality**	**Authority**	**Treasure**	**Organisation**
	Resource	Information	Legal authority	Money	Physical/human resources
	Degree of coercion	Low	High	Medium	Varying
	Definition	• Knowledge • Advice • Persuasion • Negotiation	• Rules/regulation (incl. sanctions) • Prohibitions • Requirements	Incentives and disincentives	• Physical (infrastructure) • Human (employees)
	Examples	• Information campaigns • Eco-labelling • Advisory services • Social nudges • VAs	• Planning law with land-use regulation • Emission limits • Pesticide regulation • Licences – e.g. for large animal husbandry facilities	• Subsidies • Loans • Grants • Taxes • User charges	• Water treatment facilities • Hydromorphological measures implemented by public authorities

social, political and cultural) differences on our findings. In a second step, and related to our theoretical expectations, we selected specific cases within those countries which varied with regard to the object to be differentiated, i.e. cases that could be characterised as 'far from target' vs. 'close to target' before any differentiated policies were being taken. In view of the complex and context-specific procedure of assessing 'good ecological status', the distance-to-target can only be expressed in relative terms. All cases employ mixes of instruments and, thus, offer a variety of behavioural options to farmers. For the explorative purpose of this paper, we made sure to include cases with a relatively more coercive and a relatively less coercive character. Table 2 provides an overview of the seven cases.

The case descriptions are short and do not aim to give an extensive overview of water policies, WFD implementation and/or agri-environmental policies in the countries involved. Instead, they are focused on the specific examples of spatial policy differentiation selected for this study and on the variables (rationale and type of instruments) developed in the Theory section. The empirical research was based on a mix of methods, including document analysis and four to eight semi-structured interviews with key informants[1] per case, supported by

[1] The names and institutional affiliations of interviewees are not stated to ensure non-attributability.

Table 2. | Overview of case studies.

Country	Case	Rationale: distance-to-target	
		Far	Close
Flanders, Belgium (FL)	Stricter rules in focus areas	x	
Denmark (DK)	Spatially targeted regulation of nitrogen on farms	x	
Denmark (DK)	Constructed wetlands	x	
Lower Saxony, Germany (LS)	Focus water bodies and water alliances		x
Lower Saxony, Germany (LS)	Nitrate-sensitive areas	x	
Ireland (IE)	High-status waters		x
The Netherlands (NL)	Area-specific approach to greenhouse horticulture	x	

the analysis of specific academic literature (as far as available for the cases selected). Details on both the empirical data and the analysis can be found in the original reports on which this study is based (notably Wiering *et al.*, 2018; Boezeman *et al.*, 2019; see also the references below).

EMPIRICAL FINDINGS

Flanders (Belgium): focus areas

In 2015, specific areas in the Belgian region of Flanders were designated as focus areas (*focusgebieden*), where nitrate concentrations in surface water exceed the norm of 50 mg NO_3/l, or where the evolution of the nitrate concentration in the groundwater shows insufficient progress. The delineation of focus areas is revised annually by the Manure Bank, a part of the Flemish Land Agency, based on monitoring. The focus areas cover approximately 35% of the Flemish farmland (Vlaamse Landmaatschappij, 2015; Vlaamse Overheid, 2019).

Manure policy in Flanders relies largely on regulation and enforcement. For farms in focus areas, lower nitrate residue values[2], stricter rules for manure application and obligatory use of catch crops apply without any financial compensation. Furthermore, farms in the focus area are subjected to more intense control and enforcement procedures. They can be exempted from the stricter focus rules if they prove, at their own cost, that their activities do not contribute to the nitrate pollution of ground and surface water. Unfortunately, the focus area approach has so far failed to sufficiently reduce the distance-to-target; a reorientation and intensification of the focus area policy will be needed (Vlaamse Overheid, 2019).

Flemish farmers' organizations support the stricter approach for farms in problematic areas to avoid a uniform approach in which every farm in Flanders is put under stricter regulations. Another important precondition for the support of the farmers' organizations for the spatial differentiation is the legitimacy of the monitoring network, which is very dense and generates a wealth of trustworthy data (Wiering *et al.*, 2018).

Denmark: targeted regulation and constructed wetlands

In Denmark, policies aimed at reducing the impact of diffuse water pollution from agriculture have traditionally focused on reducing nitrogen pollution through generic regulation of the input of fertilisers and other nitrogen

[2] Nitrate residue is a measure for the amount of nitrate left in the soil after uptake by the crops, or in other words, for the nitrate surplus (Vlaamse Landmaatschappij, 2019). In that sense, it is a measure for the net emission of nitrate to the environment.

mitigation measures (Dalgaard *et al*., 2014; Graversgaard *et al*., 2018). Most of the policy instruments used were based on authority (general rules on sowing catch crops, reduced manure and fertiliser use) and applicable to all farmers in Denmark.

In 2012, it was concluded that further reductions were needed in order to reach the ecological goals laid down in the WFD and the EU ND, among others. For this purpose, the generic regulation of nitrogen should be supplemented and for some areas replaced by more spatially differentiated regulation (Natur- og Landbrugskommissionen, 2012). Two distinct policies that form part of this approach will now be discussed.

Spatially targeted regulation of nitrogen on farms

It took until 2018 before the first spatially targeted regulation was agreed upon. It focused on reducing the nitrogen discharge from agricultural sources to coastal areas (MFM, 2018). The regulation was implemented in 2019 but will be revised for later years due to uncertainty about the predicted nitrogen reductions (MFM, 2019).

Spatial differentiation is based on data regarding the nitrogen retention of the soil. Farmers in catchments draining to vulnerable coastal waters (about 70% of the Danish farmland) must put additional effort into reducing nitrogen leaching. The main measures that farmers can use are catch crops for which they receive compensation of DKK 529 per ha (2019 levels). Other possible measures include set-aside, burning of the fibre fraction of animal manure and voluntary nitrogen norm reduction[3].

The regulatory model is a mix of voluntary and mandatory elements. Farmers may choose between different measures at the *individual* level, with all measures being financially compensated. However, the required nitrogen reduction is mandatory at the *collective* level. If the programme does not deliver the desired results, mandatory regulation will follow.

Constructed wetlands

Another part of the new spatially targeted approach to nitrogen reduction in Denmark consists of the so-called collective measures. These are implemented collectively at the catchment level. One of those measures is the construction of mini-wetlands acting as nitrogen sinks.

Similar to the spatially targeted regulation, the instruments in the constructed wetlands programme have a voluntary character for individual farmers. Land-owners involved are eligible to apply for the constructed wetlands and there is no obligation to do so. Financial compensation serves as an incentive. Also here, the threat of a more mandatory approach looms in the background if nitrogen reduction objectives are not realised.

In contrast with targeted regulation, the constructed wetlands programme also uses nodality and organisation: 29 catchment officers have been given the task to find farmers and suitable areas for the implementation of the collective measures. They do so through knowledge, advice and persuasion. A new organisation around the catchment officers was commissioned by the Ministry of Food and Environment and is run by the farmers' advisory services (SEGES).

Lower Saxony (Germany): focus water bodies and nitrate-sensitive areas

In the German *Land* of Lower Saxony, spatially differentiated programmes and requirements exist for the so-called focus water bodies, i.e. water bodies characterised by promising potential for improvement, and for nitrate-sensitive areas, i.e. areas characterised by poor groundwater quality.

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[3] It must be noted, however, that the regulation does not take into account the *effect* of the differentiated measures. It is, for instance, calculated with the same effect of catch crops (kg nitrogen from the rootzone) throughout the country, even if there may be considerable variation in the discharge from the rootzone between, e.g. more clayey vs. sandy soils.

Focus water bodies and water alliances

Focus water bodies (*Schwerpunktgewässer*) in Lower Saxony were selected on the basis of the following criteria: (1) they are assessed to have moderate status or potential and are only 1° away from a good status or potential and (2) they show promising biological repopulation potential according to a biological assessment. The focus water bodies are, in other words, 'close to target'; their successful management is intended to show 'lighthouse examples'. They cover approximately ha and receive preferred funding (Interviews Lower Saxony, 2018; NLWKN, 2018).

To improve the water quality in these areas, water alliances were set up to develop and implement targeted measures. Water alliances take the form of cooperation agreements between the implementing agency of the *Länder* ministry (the *Niedersächsische Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz*, NLWKN) and the local water maintenance boards (*Unterhaltungsverbände)*. The NLWKN identified the focus water bodies and developed a number of management measures. If a maintenance board decides to cooperate with the NLWKN in these areas, it may choose from these measures and can develop them further to fit the area-specific context (Interviews Lower Saxony, 2018). For the actual planning and implementation, a so-called care-taker (*Kümmerer*) is appointed. This is someone from the local maintenance board, whose main task is to work on the implementation of the WFD by identifying synergies, co-creating innovative solutions and developing projects in close collaboration with local authorities, relevant interests groups and individual farmers. In 2018, there were 11 care-takers and the ministry aimed to increase the number to 24 (Interviews Lower Saxony, 2018). Most of the projects currently implemented focus on the improvement of hydromorphology (Interviews Lower Saxony, 2018), which fits the definition of organisation policy instruments.

Nitrate-sensitive areas

In contrast to the focus water bodies, nitrate-sensitive areas are 'far from target' areas, where the groundwater status is bad due to nitrate pollution. Altogether, they cover around 39% of the farmland in Lower Saxony (Niedersächsische Staatskanzlei, 2019).

A driver for setting up these areas was the EU's infringement procedure opened against Germany in 2016 for insufficient compliance with the ND. Following this procedure, a new Fertiliser Ordinance was established at the federal level. It offers to the *Länder* the possibility to identify nitrate-sensitive areas. In Lower Saxony, the implementing agency NLWKN was responsible for identifying and delineating those areas (Interviews Lower Saxony, 2018). In November 2019, the ministry imposed restrictions on farming activities in the designated nitrate-sensitive areas. These restrictions comprise three process standards: mandatory analysis of farm fertiliser (*Wirtschaftsdünger*) in order to calculate the exact nutrient concentration and to improve the precision of fertiliser usage, processing of fertiliser into the soil within 1 h and increasing fertiliser storage to 7 months (Niedersächsische Staatskanzlei, 2019). Whether these coercive measures are sufficient or need to be tightened remains to be seen.

Ireland: high-status waters

While most Member States in Europe have their hands full addressing the areas with the highest pollution and diffuse pollution risks, Ireland still has a considerable number of waters with a high ecological status and pays particular attention to preserving those. The argumentation for the special protection of high-status water in Ireland reflects a mix of functionality and vulnerability. On the one hand, it is stated that high-status water bodies provide 'important ecosystem services and public goods, including clean drinking water …, peaceful and scenic surroundings, and amenity value and the economic income associated with that' (Ní Chatháin *et al.*, 2012: 36). On the other hand, vulnerability is stressed: 'The assimilation capacity for nutrients of oligotrophic water bodies

is very low, and many are close to or have exceeded their capacity for catchment intensification of land use and development' (Ní Chatháin *et al.*, 2012: 36). A further rationale for this priority is that Ireland wants to be a European forerunner in the protection and restoration of high-status waters (EPA Catchments Unit, 2019).

Protecting high-status water bodies entails avoiding source pollution and accidental releases of pollutants as well as monitoring and control even of low- and medium-intensity activities such as one-off housing, forestry or wind farm development. It is stressed that high-status water protection should be well integrated with land-use planning and mapping systems at different administrative levels (White *et al.*, 2014). In addition to existing generic measures, Ireland started the Blue Dot Catchments Programme. Local authorities appoint a Blue Dot Co-ordinator who manages the activities, develops a communications and engagement plan and gives recommendations for the management and integrated planning of high-status sites. Stakeholders cooperate within the Local Authorities Water Programme (LAWPRO) with Catchment Assessment Teams to identify risks to water quality in the Blue Dot catchments. The programme draws on national and EU (e.g. LIFE) subsidies (EPA Catchments Unit, 2019) and consists mostly of research and planning mechanisms as well as awareness building, with great emphasis on exchange of information, monitoring activities and taking 'early corrective action' to eliminate risks to water quality (Department of Housing, Planning and Local Government, 2019: 104–106).

The Netherlands: greenhouse horticulture

Greenhouse regions in the Netherlands struggle to meet water quality targets for both pesticides and nutrients under the WFD (Tiktak *et al.*, 2019). Regional water boards have limited competencies for setting differentiated regulatory standards but have more discretion to provide subsidies, enforcement, physical infrastructure and communication (Boezeman *et al.*, 2019). A series of regional negotiated agreements was concluded with the greenhouse sector in Westland/Oostland, the country's key greenhouse area.

The 'area-specific approach' is the centrepiece of this regional arrangement (Van Peperstraten, 2018). It combines sticks and sermons and costs the competent water authority Delfland an additional 900,000 euros annually for monitoring and personnel (Stijger, 2020). The approach does not specify stricter standards but rather intensifies monitoring. As per the closed polder system, the area is mapped and the enforcement agencies cooperate. The results are shared with all entrepreneurs in the area. Individual greenhouses get a year to resolve leakages or illegal emissions. During this period, public and private actors communicate actively and organise advisory sessions and learning groups, and entrepreneurs get support in applying for subsidies to take measures. Although costly, evaluations of the approach underscore its effectiveness for diminishing both nutrient and pesticide concentrations (Boezeman *et al.*, 2019; Delfland, 2019).

The local greenhouse sector supports this approach for two reasons. First, the sector has a high stake in making sure that an effective package of pesticides remains on the market. Farmers are aware that the *national* regulator may ban specific substances when water problems remain unresolved. Second, the sector supports intensive surveillance with the argument of a 'level playing field' for all greenhouses involved. Those who live by the rules should not have a competitive disadvantage to those cutting corners. For that reason, the regional sector organisation also advocates this approach to become common practice in other greenhouse areas.

COMPARATIVE ANALYSIS

This section will start by comparing the findings of the case studies against the interpretative scheme developed in the Theory section. In a second step, we explore the wider implications of the findings, focusing on the issues of compliance, data demand and equality.

Table 3. | Summary of findings.

	Rationale		Type OF instrument (Hood, 1986; Vedung, 2007)			
	Distance-to-target					
Case	Far	Close	Nodality	Authority	Treasure	Organisation
BE (Flanders) focus areas	x			Regulation and enforcement		Monitoring, enhanced enforcement
DK targeted nitrogen	x			Shadow of authority	Compensation	Monitoring
DK constructed wetlands	x		Knowledge transfer, advice	Shadow of authority	Compensation	Catchment officers, monitoring
DE focus water bodies		x	Awareness building, knowledge transfer, advice		Preferred funding	Public care-taker, hydromorphological measures by public authorities, etc.
DE nitrate-sensitive areas	x			Regulation		
IE high-status waters		x	Awareness building, knowledge transfer, advice		Subsidies	Research, monitoring, communication services
NL horticulture	x		Knowledge transfer, advice	Shadow of authority		Monitoring, enhanced enforcement

Comparative findings

Table 3 summarises the findings of the case studies presented in the previous section.

Table 3 clearly shows that the use of *authority* is limited to instances that are far from the WFD target. The cases of the Flemish focus areas and the nitrate-sensitive areas in Lower Saxony, in particular, rely on strongly coercive instruments. Here, formal regulation was established in specific regions in order to attain the water quality required by the WFD. In Flanders, this was backed up by enhanced enforcement.

The Danish targeted regulation and constructed wetlands programmes and the Dutch greenhouse horticulture case are far from the WFD target too, but here the use of authority is more indirect. These programmes are in principle voluntary: farmers are initially free to decide if and to what extent they want to participate and which measures they want to take. However, if the programme turns out to be insufficiently effective, the government made explicitly clear that it will turn to a more coercive approach based on formal regulation. As farmers are aware of this risk and are likely to take it into account when deciding on their 'voluntary' course of action, this may be referred to as the 'shadow of hierarchy' (Scharpf, 1994; see also Howlett *et al.*, 2009: 121) – or in our terminology: the 'shadow of authority'.

In the two cases in our sample that are close to the WFD target – the Lower-Saxon focus waters and the Irish high-status waters – authority is as good as absent. Both approaches rely primarily on *nodality*. Stakeholders are stimulated to take measures through different combinations of awareness building, knowledge transfer, individual advice and persuasion, supported by sometimes extensive use of subsidies (treasure), e.g. in the Irish case, and public resources (organisation). In the Danish constructed wetlands and the Dutch horticulture cases, elements

of nodality (knowledge transfer, advice and persuasion) are used to keep the 'shadow of authority' at safe distance.

Treasure, usually in the form of national subsidies or EU regional funding, plays a role mostly to support differentiation with a voluntary element, i.e. programmes that primarily build on nodality such as the Irish efforts to protect high-status waters, or combine an initially voluntary approach with the 'shadow of authority'. The latter is the case in the Danish targeted regulation and constructed wetlands programmes, where compensation is intended as an incentive to help farmers avoiding regulation in a later stage.

Organisation, i.e. the input of public resources into the policy, is important in almost all cases, regardless if they primarily rely on nodality or authority. First, this entails research and monitoring, aimed at selecting and delineating the areas to be assigned for differentiation. Good and reliable data are highly important for motivating and justifying area designation vis-à-vis stakeholders. Monitoring is also needed to keep the track of the programme's effectiveness and, where applicable, to render credibility to the 'shadow of authority'. Second, organisation may take the form of enhanced enforcement[4]. In the Dutch horticulture case, enhanced enforcement is in fact an essential part of the package, as it adds to maintaining a 'level playing field' for all farmers in the region. Third, public authorities may invest in communication, dissemination and advice. They do so for instance in the 'close to target' cases in Lower Saxony and Ireland, but also in relation to the Danish constructed wetlands. This suggests that communicative efforts can also be relevant under the 'shadow of authority'. Finally, public authorities may engage in the 'direct provisioning' of goods and services (Hood, 2007), such as the hydromorphological measures taken by the government in the Lower-Saxon focus waters.

Although this analysis is based on a limited number of cases and although it goes without saying that a large variety of other factors co-determine the choice of policy instruments, we may tentatively conclude that local water quality matters in selecting more or less coercive forms of spatially differentiated water policies. Or more precisely: that more impositional instruments are used for 'cleaning up' local situations that are far from the WFD target of good ecological status and more voluntary ones for protecting water that are close to that target.

Wider implications

Although in some of the policies discussed in this paper the influence of 'Brussels' may seem remote, they all relate directly to the WFD. Differentiation in all 'far from target' cases is explicitly aimed at achieving the status required by the WFD, often linked to the limits for nitrate set by the ND. Without differentiated policies, the goals of the two directives would not be in reach. In Lower Saxony, moreover, the pressure was increased by an infringement procedure under the ND. But also in the 'close to target' cases, as in Lower Saxony, it was stressed that the focus water bodies should be seen as 'lighthouse examples', demonstrating successes in the implementation of the WFD (Interviews Lower Saxony, 2018; Wiering *et al.*, 2018). In the Irish programmes, reference is made to 'protecting, and where required, restoring high ecological status' in the sense of the WFD (Interviews Ireland, 2018; Wiering *et al.*, 2018; Department of Housing, Planning and Local Government, 2019).

The formulation of spatially differentiated responses to the general requirements set by the WFD makes it very difficult to compare local measures and to see if they are compliant with those requirements at all. It also makes it hard to see if they perhaps go further than what is required by the EU. Over-compliance, or 'goldplating',

[4] Although enforcement is in principle 'part of the regulatory system' (Vedung, 2007: 36), the Dutch area-specific approach for greenhouse horticulture, for instance, entails a considerable *extra* investment in the organisational capacity for enforcement on the part of the government (see The Netherlands: greenhouse horticulture section, above). Here, the borders between authority and organisation arguably get unclear.

could – at least theoretically – be imagined in the two 'close to target' cases in particular. Studies focusing on other EU directives also suggest that differences in local/regional implementation may blur the boundaries between 'correct', 'incorrect' and 'overcorrect' implementation (e.g. Thomann, 2015; Hupe & Hill, 2016; Bondarouk & Liefferink, 2017).

Apart from EU compliance, the question of data demand and the question of inequality and possible distortion of conditions of competition need to be addressed. The two may actually be related.

First, the design and motivation of differentiated policies requires a great deal of data, regarding both emissions and environmental quality. And more fine-grained forms of differentiation require more fine-grained data. This may be one of the reasons why differentiated measures tend to be accompanied by research and enhanced monitoring efforts, as observed above. In this sense, new monitoring techniques and big data analysis may in the longer term improve the odds of differentiated policies.

Second, the spatial differentiation of policies almost inevitably leads to inequalities. If farmers in one region face more demanding requirements than farmers in another region, this may give rise to a competitive disadvantage. Not surprisingly, Dutch horticulture farmers in the Westland/Oostland region press for taking a similar approach in other greenhouse areas. Particularly in the absence of financial (or other forms of) compensation, inequalities may become a serious barrier to differentiation. An earlier case in Denmark and the Flemish focus areas provide two contrasting examples in this regard.

An attempt made in Denmark in the early 2010s to introduce differentiated requirements for the establishment of buffer zones was challenged by farmers with reference to inequality, distortion of competitive conditions, violation of property rights *and* insufficiency of the scientific data underpinning the policy – here the issues of inequality and data demand meet. The ensuing court case was won by the farmers and eventually led to the withdrawal of the policy in 2015 (Thorsøe *et al*., 2017). If the current, initially voluntary programmes for targeted nitrogen reduction and constructed wetlands in Denmark prove to be unsuccessful, they may turn into mandatory programmes without compensation. Looming in the background is the risk of a 'data trap', where data are increasingly called into question, leading to demands for more detailed data, which are again called into question, and so on (Interviews Denmark, 2018; Wiering *et al*., 2018).

In Flanders, in contrast, the stricter requirements to farmers in focus areas went largely unchallenged. Farmers' organisations allegedly perceived the inequalities connected to the focus areas as the 'lesser evil' compared to stricter requirements across the board. In addition to this, the broad acceptance of the focus areas can be related to the circumstance that farmers and farmers' organisations have so far seen the underlying data, produced by a long-standing and relatively dense monitoring network, as reliable and trustworthy (Interviews Flanders, 2018; Wiering *et al.*, 2018).

CONCLUSION

This paper has explored to what extent and how local water quality, understood as distance to the WFD target, determines the degree of coercion of spatially differentiated water policies. For this purpose, we have focused on the differentiation of policies related to diffuse agricultural pollution and aimed at achieving the goals of the WFD. Empirically, we have focused on seven cases from five Northwest European EU Member States.

Detailed comparative findings have been discussed in the previous section. Taking one step back, two observations stand out. First, the need to achieve the goals of the WFD appears to provoke spatially differentiated policy solutions. In some places, in view of the seriousness of the problems, extra efforts are required to comply with the ambitious goals of the WFD. In other places, specific measures are set in place to comply with the Directive's requirement demand to 'keep clean waters clean'. At the most basic level, this is of course due to the fact that ecological and socio-economic circumstances, among others, are not similar across or

even within Member States. Thus – and somewhat paradoxically – achieving *harmonised* goals, as set in framework directives such as the WFD, urges for *different* policy efforts in different places. Paraphrasing Risse *et al.* (2001), this leads to Europeanisation not only with national but also with regional and local colours. As mentioned, this considerably complicates the task of assessing if local implementation is in fact compliant with the initial EU requirements – or over-compliant, for that matter.

Second, turning to the typical characteristics of spatially differentiated water policies in terms of our interpretative framework, we see two distinct patterns. On the one hand, instances, where a long distance to the WFD targets is to be bridged, tend to go together either with the use of authoritative instruments directly, i.e. coercion by way of formal regulation, or with the 'shadow of authority', i.e. the threat to come up with regulation if less coercive instruments turn out not to work. In 'close to target' cases, on the other hand, information and persuasion (nodality) is key. Subsidies (treasure) and the direct input of public resources or 'direct provisioning' by the state (organisation) come in support. In this sense, our expectation of Hercules using high pressure for cleaning up the Augean stables in the first place and turning to the broom for subsequent maintenance is confirmed.

Having said this, a large research agenda remains. Although seven cases in five countries have been covered, empirical evidence remains confined to the specific problem of diffuse agricultural pollution in the context of the WFD. A much wider sample would be needed to identify patterns with more certainty. The focus on rationale and type of instruments could be a start for a more encompassing analysis using for instance Qualitative Comparative Analysis (QCA) or quantitative methods. More variables could be taken into account, notably a further refinement of the 'rationale' dimension or variables relating to the policy and implementation process. Finally, and perhaps most importantly, the wider implications of policy differentiation relating to data demand, equality and legitimacy deserve much more attention in future research.

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DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

REFERENCES

Anderson Jr., R. J., Read, R. O. & Seskin, E. R. (1979). *An Analysis of Alternative Policies for Attaining and Maintaining a Short Term NO_2 Standard.* MATHTECH, Princeton.

Anker, H. T. (2015). Agricultural nitrate pollution: regulatory approaches in the EU and Denmark. *Nordic Environmental Law Journal 2*, 7–23.

Boezeman, D., Liefferink, D. & Wiering, M. (2019). De governance van de Kaderrichtlijn Water, regionale verschillen en sturingsopties. *Water Governance 2*, 72–81.

Bondarouk, E. & Liefferink, D. (2017). Diversity in sub-national EU implementation: the application of the EU Ambient Air Quality Directive in 13 municipalities in the Netherlands. *Journal of Environmental Policy and Planning 19*(6), 733–753.

Carter, N. (2018). *The Politics of the Environment: Ideas, Activism, Policy*, 3rd ed. Cambridge University Press, Cambridge.

Dalgaard, T., Hansen, B., Hasler, B., Hertel, O., Hutchings, N. J., Jacobsen, B. H., Jensen, L. S., Kronvang, B., Olesen, J. E., Schjørring, J. K., Kristensen, I. S., Graversgaard, M., Termansen, M. & Vejre, H. (2014). Policies for agricultural nitrogen

management – trends, challenges and prospects for improved efficiency in Denmark. *Environmental Research Letters 9*(11), 115002.

Delfland (2019). *Waterkwaliteitsrapportage 2018*. Delfland, Delft.

Department of Housing, Planning and Local Government (2019). *River Basin Management Plan for Ireland 2018–2021*. Department of Housing, Planning and Local Government, Dublin.

Dixit, A. K. (1996). *The Making of Economic Policy: A Transaction Cost Politics Perspective*. MIT Press, Cambridge, MA.

Eliadis, P., Hill, M. M. & Howlett, M. (2005). *Designing Government: From Instruments to Governance*. McGill-Queen's University Press, Montreal.

EPA Catchments Unit (2019). *The Blue Dot Catchment Programme*. Available at: https://www.catchments.ie/the-blue-dot-catchments-programme/ (accessed 23 April 2020).

European Commission (2019). *Report from the European Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC)*. European Commission, Brussels, COM(2019)85final.

Graversgaard, M., Jacobsen, B. H., Kjeldsen, C. & Dalgaard, T. (2017). Stakeholder engagement and knowledge co-creation in water planning: can public participation increase cost-effectiveness? *Water 9*, 191.

Graversgaard, M., Hedelin, B., Smith, L., Gertz, F., Højberg, A. L., Langford, J., Martinez, G., Mostert, E., Ptak, E., Peterson, H., Stelljes, N., Van den Brink, C. & Refsgaard, J. C. (2018). Opportunities and barriers for water co-governance – a critical analysis of seven cases of diffuse water pollution from agriculture in Europe, Australia and North America. *Sustainability 10*, 1634.

Gunningham, N. & Sinclair, D. (2005). Policy instrument choice and diffuse source pollution. *Journal of Environmental Law 17*(1), 51–81.

Helfand, G. E. & House, B. W. (1995). Regulating nonpoint source pollution under heterogeneous conditions. *American Journal of Agricultural Economy 77*, 1024–1032.

Hood, C. (1986). *The Tools of Government*. Macmillan, London.

Hood, C. (2007). Intellectual obsolescence and intellectual makeovers: reflections on the tools of government after two decades. *Governance 20*(1), 127–144.

Howlett, M. (2005). What is a policy instrument? Policy tools, policy mixes and policy implementation styles. In: *Designing Government: From Instruments to Governance*. Eliadis, P., Hill, M. M. & Howlett, M. (eds). McGill-Queen's University Press, Montreal, pp. 31–50.

Howlett, M. (2019). *Designing Public Policies. Principles and Instruments*. Routledge, London.

Howlett, M., Ramesh, M. & Perl, A. (2009). *Studying Public Policy. Policy Cycles and Policy Subsystems*. Oxford University Press, Oxford.

Hupe, P. L. & Hill, M. J. (2016). 'And the rest is implementation.' Comparing approaches to what happens in policy processes beyond *Great Expectations*. *Public Policy and Administration 31*(2), 103–121.

Interviews Denmark, February, (2018). Interviews Flanders, February–March, 2018.

Interviews Ireland, March, (2018). Interviews Lower Saxony, February–March, 2018.

Jacobsen, B. H. & Hansen, A. L. (2016). Economic gains from targeted measures related to non-point pollution in agriculture based on detailed nitrate reduction maps. *Science of the Total Environment 556*, 264–275.

Keessen, A. M., Runhaar, H. A. C., Schoumans, O. F., Van Rijswick, H. F. M. W., Driessen, P. P. J., Oenema, O. & Zwart, K. B. (2011). The need for flexibility and differentiation in the protection of vulnerable areas in EU environmental law: the implementation of the Nitrates Directive in the Netherlands. *Journal for European Environmental and Planning Law 8*(2), 141–164.

Kneese, A. V. & Bower, B. T. (1968). *Managing Water Quality: Economics, Technology, Institutions*. Johns Hopkins Press for Resources for the Future, Baltimore, MD.

LBST (2019). *Tilskud til Målrettet kvælstofregulering (Subsidy for Targeted Nitrogen Regulation)*. Ministry of Environment and Food of Denmark/Agri-Fish Agency, Copenhagen.

Margetts, H. & Hood, C. (2016). Tools approaches. In: *Contemporary Approaches to Public Policy*. Zittoun, P. & Peters, B. G. (eds). Palgrave/MacMillan, London, pp. 133–154.

MFM (2018). *Aftale om målrettet regulering – et nyt paradigme for miljøreguleringen af Dansk landbrug (Agreement on Targeted Regulation – A New Paradigm for Environmental Regulation of Danish Agriculture)*. Available at: https://mfvm.dk/fileadmin/user_upload/MFVM/Aftaletekst_om_maalrettet_regulering.docx.pdf (accessed 3 March 2020).

MFM (2019). *Aftale om kvælstofindsats (Agreement on Nitrogen Input)*. Available at: https://www.regeringen.dk/publikationer-og-aftaletekster/aftale-om-kvaelstofindsatsen-i-2020/ (accessed 3 March 2020).

Ministry of Environment and Food of Denmark/EPA (2017). *Overview of the Danish Regulation of Nutrients in Agriculture and the Danish Nitrates Action Programme*. Ministry of Environment and Food of Denmark, Copenhagen.

Natur- og Landbrugskommissionen (2012). *Natur og landbrug – en ny start (Nature and Agriculture – A New Start)*. Available at: https://openarchive.cbs.dk/bitstream/handle/10398/8851/Oestrup_2.pdf?sequence = 1 (accessed 3 March 2020).

Ní Chatháin, B., Moorkens, E. & Irvine, K. (2012). *Management Strategies for the Protection of High Status Water Bodies*. STRIVE Report 2010-W-DS-3. Environmental Protection Agency.

Niedersächsische Staatskanzlei (2019). *Gebietskulissen der nitrat- und phosphatsensiblen Gebiete in Niedersachsen stehen fest (Regional Settings of the Nitrate and Phosphate Sensitive Areas in Lower Saxony Have Been Established)*. Available at: https://www.stk.niedersachsen.de/startseite/presseinformationen/gebietskulissen-der-nitrat-und-phosphatsensiblen-gebiete-in-niedersachsen-stehen-fest-182749.html (accessed 15 January 2020).

NLWKN (2018). *Gewässerallianz Niedersachsen (Water Alliance Lower Saxony)*. Available at: https://www.nlwkn.niedersachsen.de/wasserwirtschaft/flussgebietsmanagement_egwrrl/oberflaechengewaesser/ergaenzende_massnahmen/gewaesserallianz-niedersachsen-132369.html (accessed 10 January 2018).

Odgaard, M. V., Olesen, J. E., Graversgaard, M., Børgesen, C. D., Svenning, J. C. & Dalgaard, T. (2019). Targeted set-aside: benefits from reduced nitrogen loading in Danish aquatic environments. *Journal of Environmental Management 247*, 633–643.

Pacheco-Vega, R. (2020). Environmental regulation, governance, and policy instruments, 20 years after the stick, carrot, and sermon typology. *Journal of Environmental Policy & Planning 22*(5), 620–635.

Risse, T., Cowles, M. G. & Caporaso, J. (2001). Europeanization and domestic change: introduction. In: *Transforming Europe: Europeanization and Domestic Change*. Cowles, M. G., Caporaso, J. & Risse, T. (eds). Cornell University Press, Ithaca, pp. 1–20.

Scharpf, F. W. (1994). Games real actors could play: positive and negative coordination in embedded negotiations. *Journal of Theoretical Politics 6*, 27–53.

Schneider, A. & Ingram, H. (1990). Behavioral assumptions of policy tools. *The Journal of Politics 52*(2), 510–529.

Stijger, H. (2020). *Hoogheemraad Delfland neemt afscheid (Delfland Water Board Chief Officer Bids Farewell)*. Available at: https://www.nieuweoogst.nl/nieuws/2019/05/03/hoogheemraad-delfland-neemt-afscheid (accessed 23 April 2020).

Thomann, E. (2015). Customizing Europe: transposition as bottom-up implementation. *Journal of European Public Policy 22*(10), 1368–1387.

Thorsøe, M. H., Graversgaard, M. & Noe, E. (2017). The challenge of legitimizing spatially differentiated regulation: experiences from the implementation of the Danish Buffer zone act. *Land Use Policy 62*, 202–212.

Tietenberg, T. H. (1978). Spatially differentiated air pollutant emissions charges: an economic and legal analysis. *Land Economics 54*(3), 265–277.

Tiktak, A., Bleeker, A., Boezeman, D., van Dam, J., Franken, R., Kruitwagen, S. & Den Uyl, R. D. (2019). *A Closer Look at Integrated Pest Management*. Netherlands Environmental Assessment Agency, The Hague.

Van Grinsven, H. J., Tiktak, A. & Rougoor, C. W. (2016). Evaluation of the Dutch implementation of the Nitrates Directive, the water framework directive and the national emission ceilings directive. *NJAS – Wageningen Journal of Life Sciences 78*, 69–84.

Van Peperstraten, J. (2018). Emissieloze kas in zicht (Emission-free greenhouse in sight). *Het Waterschap 12* (10), 24–25.

Vedung, E. (2007). Policy instruments: typologies and theories. In: *Carrots Sticks and Sermons. Policy Instruments and Their Evaluation*, 4th edn. Bemelmans-Videc, M.-L., Rist, R. C. & Vedung, E. (eds). Transaction Publishers, New Brunswick, pp. 21–58.

Vlaamse Landmaatschappij (2015). *Actieprogramma ter uitvoering van de Nitraatrichtlijn 2015–2018 (Action Programme for the Implementation of the Nitrates Directive 2015–2018)*. Available at: https://www.vlm.be/nl/SiteCollectionDocuments/Mestbank/Algemeen/Definitief_Actieprogramma_2015–2018_NL.pdf (accessed 22 January 2018).

Vlaamse Landmaatschappij (2019). *Fiche Nitraatresidu (Nitrate Residu Sheet)*. Available at: https://www.vlm.be/nl/SiteCollectionDocuments/Mestbank/Algemeen/Info%20op%20Mestbankloket/Nitraatresidu/Fiche_Nitraatresidu.pdf (accessed 17 February 2020).

Vlaamse Overheid (2019). *6de Actieprogramma in uitvoering van de Nitraatrichtlijn 2019–2022 (6th Action Programme for the Implementation of the Nitrates Directive 2019–2022)*. Available at: https://www.vlm.be/nl/SiteCollectionDocuments/Mestbank/Algemeen/6de-actieprogramma-Vlaanderen.pdf (accessed 17 February 2020).

Voulvoulis, N., Arpon, K. D. & Giakoumis, T. (2017). The EU Water Framework Directive: from great expectations to problems with implementation. *Science of the Total Environment 575*, 358–366.

Wardropper, C. B., Chang, C. & Rissman, A. R. (2015). Fragmented water quality governance: constraints to spatial targeting for nutrient reduction in a Midwestern USA watershed. *Landscape and Urban Planning 137*, 64–75.

White, B., Moorkens, E., Irvine, K., Glasgow, G. & Chuanigh, E. N. (2014). Management strategies for the protection of high status water bodies under the Water Framework Directive. *Biology and Environment: Proceedings of the Royal Irish Academy 114*(3), 129–142.

Wiering, M., Liefferink, D., Kaufmann, M. & Kurstjens, N. (2018). *Final Report. The Implementation of the Water Framework Directive*. Radboud University, Institute for Management Research.

Wiering, M., Boezeman, D. & Crabbé, A. (2020a). The water framework directive and agricultural diffuse pollution: fighting a running battle? *Water 12*(5), 1447.

Wiering, M., Liefferink, D., Boezeman, D., Kaufmann, M., Crabbé, A. & Kurstjens, N. (2020b). The wicked problem the Water Framework Directive cannot solve. *Water 12*(5), 1240.

Xabadia, A., Goetz, R. U. & Zilberman, D. (2008). The gains from differentiated policies to control stock pollution when producers are heterogeneous. *American Journal of Agricultural Economics 90*(4), 1059–1073.

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