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EU Water Governance: Striking the Right Balance between Regulatory Flexibility and Enforcement?

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ABSTRACT. Considering the challenges and threats currently facing water management and the exacerbation of uncertainty by climate change, the need for flexible yet robust and legitimate environmental regulation is evident. The European Union took a novel approach toward sustainable water resource management with the passage of the EU Water Framework Directive in 2000. The Directive promotes sustainable water use through long-term protection of available water resources, progressively reduces discharges of hazardous substances in ground and surface waters, and mitigates the effects of floods and droughts. The lofty goal of achieving good status of all waters requires strong adaptive capacity, given the large amounts of uncertainty in water management. Striking the right balance between flexibility in local implementation and robust and enforceable standards is essential to promoting adaptive capacity in water governance, yet achieving these goals simultaneously poses unique difficulty. Applied resilience science reveals a conceptual framework for analyzing the adaptive capacity of governance structures that includes multiple overlapping levels of control or coordination, information flow horizontally and vertically, meaningful public participation, local capacity building, authority to respond to changed circumstances, and robust monitoring, system feedback, and enforcement. Analyzing the Directive through the lens of resilience science, we highlight key elements of modern European water management and their contribution to the resilience of the system and conclude that the potential lack of enforcement and adequate feedback of monitoring results does not promote managing for resilience. However, the scale-appropriate governance aspects of the EU approach promotes adaptive capacity by enabling vertical and horizontal information flow, building local capacity, and delegating control at multiple relevant scales.

Key Words: *adaptive governance; environmental law; European Union; resilience; Water Framework Directive*

INTRODUCTION

Conceptual framework

Resilience is the capacity of a system to absorb disturbance and maintain essentially the same structures and processes (Holling 1973). Human influence on ecosystem resilience can hardly be overestimated, and the concept of social-ecological resilience describes the capacity of linked social and ecological systems to absorb and adapt to change (Folke et al. 2004, Adger et al. 2005). Social-ecological resilience depends upon the interactions between processes and structures at multiple scales (Gunderson and Holling 2002). Thus, scale is a critical consideration in managing for resilience (Peterson et al. 1998), but the current conception of resilience does not provide a blueprint that can be used with regard to scale-specific conditions (Garmestani et al. 2009). Thus, couching environmental management within the context of a scale-dependent theory, panarchy theory, can help to develop sound environmental management (Benson and Garmestani 2011*a*).

Panarchy theory improves upon hierarchical models because, unlike top-down control envisioned in traditional hierarchies, connectivity between adaptive cycles in a panarchy provides feedback and resources from levels above or below. In a hierarchy, lower-level patterns and processes are dominated from above. To address environmental problems in complex systems, panarchy-based governance differs from hierarchical nesting in that conditions can trigger bottom-up, i.e., cross-scale cascading, system change (Garmestani et al. 2009). This nested governance model of social-ecological systems acknowledges their inherently dynamic nature. The EU Water Framework Directive's (WFD or Directive) nested approach to governance at multiple scales reflects the complexity of managing a dynamic system.

Adaptive governance incorporates formal institutions, informal networks, and individuals at multiple scales for collaborative environmental management (Folke et al. 2005). Adaptive governance shares management power and responsibilities and promotes collaborative, participatory processes (Green et al. 2013). Adaptive governance depends upon adaptive comanagement, and, in turn, adaptive comanagement relies upon social networks for success. Social networks are key because of their capacity to promote innovation, facilitate communication between entities, and foster the flexibility necessary for successful environmental management, which requires interplay between fluid ecological systems and rigid institutions (Folke et al. 2005, Green et al. 2012).

Multiple frameworks for evaluating the adaptive capacity of governance structures exist in the literature, and we have selected a modified version of Cosens (2010) as the basis of our evaluation. Cosens (2010) identifies five critical elements of adaptive governance:

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1. multiple overlapping levels of control with one level of control or strong coordination at the relevant social-ecological scale;
2. horizontal and vertical flow of information and coordination of decision-making;
3. meaningful public participation;
4. local capacity building; and
5. authority to respond to changes across a range of scenarios.

In addition, we add two critical elements:

6. monitoring and system feedback; and
7. enforcement.

We build upon Cosens (2010) because a key factor in adaptive governance is monitoring, which enables continuous learning and feedback. Assessing the physical characteristics, human impacts, and changes therein is a sound adaptive approach when done at the appropriate scale. Adaptive governance requires system feedback in real time and, as Cosens (2010) illustrates, authority and legitimacy to act on the basis of monitoring data.

Background on the EU Water Framework Directive

The European Union is neither a traditional international organization nor a federal state but a supranational organization made up of 27 member states with unique implications for its organization and integrated legal order (Jans et al. 2007). Environmental regulation is a field of shared competency between member states and the European Union, which means that the member states share sovereignty with the European Union over water law and policy. The European Union has the power to adopt binding legislation for all member states and the power to enter into international agreements, while the member states retain ultimate sovereignty because the European Union cannot act outside of the authority granted it by the member states.

Under the EU Treaty, the European Union regulates only what is absolutely necessary with respect to international issues, such as the creation of markets between member states and transboundary environmental protection. The choice to develop scaled-up environmental regulations via EU legislation rather than leaving water management to the discretion of member states is based on the subsidiarity and proportionality principles (Jans et al. 2007). These principles imply that the European Union may only take action if and insofar as the objectives of the proposed action cannot be sufficiently achieved at the nation scale, and therefore the issue is better dealt with at supranational scale. This legal order of acquis communautaire, the EU body of law, attempts to achieve regulatory harmony across member states through required adoption of EU rules and has been framed as a more passive form of reterritorialization than outright border redelineation (Johnson 2012).

As in other environmental policies, the preferred legal instrument in water policy is the directive. Directives must be implemented in the national legal orders of member states in a way that guarantees the objectives of the legislation are fully attained, while the choice of the means to realize them is to a large extent left to member states (Jans and Vedder 2008). With respect to panarchy, the directive rescales governance along hydrologic boundaries, i.e., watersheds. Rescaling results in a hybrid form of jurisdictional authority: supranational objectives, i.e., directives, carried out through state policies, i.e., state legislation. Consolidated decision making at the supranational level tends to de-emphasize national borders, as some have termed "postsovereign environmental governance," while instead focusing on natural boundaries (Karkkainen 2004). However, upon enactment member states are responsible for transposition of the directive in their own legal order and for its application and enforcement, thus empowering states to dictate the specifics of how to achieve the goals of the directive.

The European Commission supervises state efforts because the member states are accountable to the commission for compliance with EU regulatory obligations (Jans et al. 2007). The commission takes preventative action by, for example, establishing performance score boards and guidance documents and takes enforcement action by bringing member states before the European Court of Justice to face financial sanctions for noncompliance. Because of the inherent flexibility granted in directive implementation from state to state, oversight poses challenges, and enforcement lags (Rechtschaffen 2007). Weak or unambitious implementation may escape enforcement action because of the subjectivity inherent in the determination as opposed to enforcement actions for nontransposition of EU law into national law, which is objectively determined, i.e., law is either transposed or not. The burden of proof lies with the Commission, but the Commission has limited capacity for monitoring the application and implementation of EU law, relying mostly on complaints and national implementation reports (Gil Ibanez 1999). Consequently, there are considerable differences between member states in the extent to which they comply with EU environmental obligations (e.g., EC 2008).

The earliest EU water legislation only contained standards for water bodies used as drinking water sources. Only five years later, in 1980, EU water legislation expanded to include binding quality standards for the protection of drinking water, fisheries, shellfish beds, bathing waters, and groundwater. In addition, directives were created to reduce water pollution from municipal, industrial, and agricultural sources by setting emission, i.e., effluent, standards for discharges (Jans and Vedder 2008). This sector-specific approach was abandoned in 2000 in favor of an integrated, river basin-specific approach

that would be better able to deal with regional variation and uncertainty and changing environmental, economic, and societal need.

The WFD marked a new beginning by prescribing river basin management, expanding the scope of water protection to all water bodies, promoting sustainable use of water, tentatively linking water management with other policies (Van Rijswick 2003, Keessen et al. 2010*a*), allowing for regional and multilevel goal setting, improving public participation, introducing ecological standards, and facilitating adaptation to climate change (Termeer et al. 2011). Article 4 of the Directive sets the environmental objectives with separate goals and standards for surface waters and groundwater. Surface waters must achieve good chemical and ecological status by 2015; groundwater should at that time be in a good chemical and quantitative status. Chemical goals are set at the EU level for the most hazardous substances and at the national level for less hazardous substances. Ecological goals are established at the sub-basin level.

The Directive is characterized by its cyclical planning process, based on a programmatic approach to protect and improve the status of river basins. The results of the assessment of the physical status and human impacts on a water system are part of the river basin management plans that have to be reviewed and updated every six years. Further, a program of measures must be established to tackle the causes of not achieving good status of waters. This program of measures is based on a combined approach for point and diffuse sources and combines environmental quality standards with effluent control measures. It integrates the mandatory measures from other EU water legislation, such as discharge controls based on best available technologies, effluent limit values, and in the case of diffuse impacts, best environmental management practices. Member states may expand their program of measures by adding voluntary measures like education, market-based instruments, covenants, and various other practical measures, e.g., desalination.

DISCUSSION

Multiple overlapping levels of control with one level of control or strong coordination at the scale of the social-ecological system

The decentralized nature of directive implementation allows member states flexibility in developing scale-specific water management policy, and scale-specific solutions are crucial to adaptive governance (Green et al. 2013). The Directive provides flexibility for developing water policy at the appropriate level, because geophysical circumstances differ per region (Keessen et al. 2010*b*). The most innovative aspect of the WFD is its river basin approach whereby water management is oriented based on hydrologic, not political, boundaries (Moss 2012). This central organizing principle guides the development of all goals and standards. The WFD mandates that the appropriate social-ecological system is the river basin in Articles 3 and 13. Likewise, strong coordination at the river basin scale is obligatory. The structure of overlapping levels of control vary by member state, as each state implements the WFD through different institutions, but all river basins are governed, at the highest level, by the European Union. Below that, a member state may create a new state-wide water management agency, or revise an existing one, to coordinate or oversee the work of river basin districts, as is the case in England and Wales (White and Howe 2003). Within established river basin districts, management at the sub-basin scale may be more appropriate and such schemes are within the scope of the WFD.

Horizontal and vertical information transfer and coordination of decision making

The institutional design of EU water management and governance takes an integrated river basin management approach. By removing jurisdictional barriers, integrated river basin management emphasizes coordination across borders, and if fully implemented, strong horizontal and vertical information flow. Member states must identify river basins and assign them to individual river basin districts (Article 3). Each member state must ensure appropriate administrative arrangements, which include the identification of appropriate competent authorities, both on the national and the international level because many river basins are transboundary. EU water management therefore depends on cooperation and shared responsibilities for the attainment of its goals by way of shared goal setting, planning, and risk assessment.

As in other EU policies, member states have discretion in assigning the competent authorities because they implement EU law through their own national legal order, i.e., procedural autonomy, and in making use of their own civil servants, i.e., institutional autonomy. The Directive term “appropriate” nominally limits that discretion to mean that the identification of competent authorities and administrative arrangements should result in effective river basin management throughout the whole river basin. In its first report on the implementation of the Directive, the European Commission concluded that most administrative arrangements appear ostensibly capable of ensuring proper implementation of the Directive. However, commission findings concerning the coordination arrangements between different authorities within the member states were inconclusive (EC 2007). Coordination at the international scale seems lacking as well; the Commission reported that despite international coordination mechanisms in place in many international river basin districts, only a few member states reported using them to coordinate their monitoring programs, indicating weak horizontal information flow (EC 2009*a*).

Meaningful public participation

Another institutional element of EU water management is strong focus on public participation (EC 2002), which is supposed to improve decision making and legitimacy (Arnstein 1969, Alexander 2002, Walker et al. 2002). Article 14 obliges member states to inform and consult the public when defining goals, making plans, and adopting measures (Van Rijswick 2011). This requires transparency and a clear explanation of the proposed measures (EC 2007). Similar disclosure and participation requirements apply to the results of risk assessment and the proposed measures for dealing with flooding risk as follows from the directive on the management of flood risks.

The European Commission is not the sole enforcer of compliance; private citizens can also bring cases before the national courts of member states. National legal systems must guarantee that citizens enjoy the full protection offered by EU law. In particular, when a directive offers rights to citizens, these rights have to be implemented in binding legislation, and citizens must be assured of their right to bring cases before national courts (Jans et al. 2007). This approach grants EU law at least the same footing as national law (the principle of equivalence) and in some circumstance even higher (the principle of effectiveness), and it makes EU law more powerful and effective than international law (Hey and Van Rijswick 2011). However, some fear that the shift to a programmatic, more flexible approach in European water policy will negatively impact the effectiveness of private enforcement (Krämer 2008). Further, the Janecek decision, a case regarding a harmed private citizen's right to have an air quality action plan drawn up, illustrates the risk that citizens who are directly concerned by threatened noncompliance with environmental quality objectives cannot enforce the timely achievement of these objectives. Instead, private action can only ensure that states draw up plans with measures capable of achieving the objectives, taking into account the factual circumstances and the various opposing interests (C-237/07 Dieter Janecek [2008] ECR I-6221). The combination of competent authorities and administrative arrangements per river basin district and strong demand for disclosure and public participation are positive institutional elements of the Directive. They enable dealing with the specific and changing circumstances within river basins and with changing societal needs, thus increasing the adaptive capacity of the system.

Authority to respond to changes across a range of scenarios

Ecological objectives implement the Directive's ecological goal that all surface waters attain at least a good ecological status by 2015. The benchmark against which this is to be tested is the best status achievable, the high status, defined as the biological, chemical, and morphological conditions associated with no or very low human pressure (Howarth 2006). Reference conditions must be set at the sub-basin level on the basis of expert ecological advice, as ecological objectives depend on local circumstances. Assessment of the quality of a particular water body is based on the extent of deviation from the reference status. Good status is achieved if only a slight deviation from high status, undisturbed or pristine conditions, is present. However, ecologists have criticized the benchmark against which the attainment of good ecological status is tested for being unrealistic (e.g., Paganelli et al. 2011).

Although admirable in themselves, ecological objectives should also be attainable to make a difference from a social-ecological resilience perspective (Moss 2008). Expert opinion on what constitutes the high ecological status of a particular water body are futile if the implementation measures to achieve this ideal status ignore local human impacts (Bijker et al. 2009, Dieperink et al. 2012). A particular water body may be used for purposes such as transport or cooling that result in modifications that cannot be easily reversed. From a societal point of view it may not be feasible or financially possible to abandon these uses (EC 2003). Perhaps the only achievable improvement is a limitation of their impact in the longer term. Likewise, authority to respond to changed circumstances may not be legitimate if the objectives toward which the state is acting are unattainable or ill-defined. Not surprisingly, many member states had severe problems implementing and administering ecological standards (Keessen et al. 2010*b*).

Further, in water management one has to deal with many uncertainties, and solutions to deal with them must be found at the European, national, regional, and local level (Dessai and Hulme 2007, Cosens 2010, Raadgever et. al 2010). Although the Directive does not explicitly mention adaptation to climate change, its flexibility allows the use of WFD tools to facilitate adaptation to any environmental disturbance, including climate change (EC 2009*b*). Later water directives and strategies explicitly include taking measures to adapt to climate change.

Local capacity building

Because member states implement the WFD as appropriate, the WFD does not mandate explicit actions to building local capacity. However, the European Commission has taken steps to build capacity at the country and river basin scale through exercises such as intercalibration and stakeholder workshops or "fitness checks." To enable states in implementing and administering ecological standards, the Directive prescribed an intercalibration exercise to harmonize the understanding of good ecological status and facilitate the establishment of ecological objectives and their achievement. Member states were placed into 14 intercalibration groups that share ecologically similar rivers, lakes, and coastal/transitional waters, e.g., northern lakes, Mediterranean rivers, and can thus compare monitoring results. This resulted in harmonized

variables and values attached to these variables. The intercalibration exercise classified water bodies in groups with an ecological high, good, moderate, and low status to enable comparison with analogous bodies (EC 2007).

Local social and economic aspects are not taken into account in the process of setting ecological objectives, but member states can subsequently justify not meeting the ecological objectives under one of the WFD exemptions, such as force majeure or new sustainable development, resulting in either deadline extension or relaxed objectives. The flexibility of the WFD ensures that the ambitious ecological aims can be made compatible with human impacts by allowing member states to justify failing to obtain good ecological status (EC 2009*c*). These exemptions must be included in the river basin management plan and are subject to disclosure and public participation obligations. This ensures that locals and interest groups have input and can provide decision makers with local knowledge. Moreover, the European Commission may only accept an exemption in situations that fit the conditions of the four explicit exemptions of the WFD: postponement of the deadline for meeting the objectives, lowering the objectives, force majeure, and new sustainable developments. A proportionality test and an assessment of costs and benefits are among the conditions for the invocation of an exemption (Brouwer et al. 2005). Exemptions are a mechanism of last resort whereby all affordable and practically feasible measures must be taken before invocation is justified.

Monitoring and system feedback

Proper reaction to disturbance is especially challenging if the causes and ecological or societal effects are uncertain. Therefore, Article 5 of the Directive requires member states to assess the physical characteristics, impacts of human activities on surface waters and groundwater, and of the economics of water use for each river basin district or for the portion of an international river basin district falling within its territory (Brouwer et al. 2005). As such, analysis of the physical condition of river basins and the impact of human activities is combined with an obligation to establish programs for the monitoring of water status to establish a coherent and comprehensive overview of the qualitative and quantitative water status within each river basin district.

As detailed in Annex VI, the monitoring program must not only cover chemical and ecological quality elements but also the volume and level or rate of flow to the extent relevant for the ecological and chemical status of surface water. For groundwater, such programs must monitor the chemical and quantitative status, i.e., recharge and abstraction rates, to protect this valuable resource from overexploitation. For protected areas, the monitoring programs are supplemented by specifications following the legislation on the basis of which they acquired their protective status. This means that for a protected natural area, e.g., a forest or a swamp, specific water objectives follow from the nature conservation objectives established by the nature management plan for the area.

The monitoring data are used to update the river basin management plans in a six-year planning cycle. In addition, Article 11 (5) provides that monitoring and additional data must be used to evaluate whether the objectives for the current planning period will be achieved. If data reveal that the objectives for the current planning period will not be timely met, the causes of the possible failure must be investigated and intermediate revision of measures may be required. The relevant permits must be examined and reviewed as appropriate, the monitoring programs must be reviewed and adjusted as appropriate, and additional measures may be necessary to achieve the objectives. Additional measures may include the establishment of stricter environmental quality standards. To enable commission supervision, the monitoring data must be reported to the Commission three years after the publication of each river basin management plan or update (Article 11 and 15 (3)). Interim reports describe progress in the implementation of the planned program of measures. The Commission uses the national reports to analyze the status of WFD implementation for the whole European Union.

If monitoring results midway through the planning period show that goals and standards will not be timely achieved, plans and programs must be revised. However, it is unknown to what extent this actually happens. The first generation of plans and programs date from 2009 and expire in 2015. In the meantime, new plans and programs have to be drafted to cover the next planning period that lasts from 2015 until 2021. This six-year planning cycle nominally facilitates learning and enables adaptive water management. Unfortunately, it also enables the member states to postpone the realization of the goals and objectives at least until the third planning cycle has ended in 2027 because the WFD allows states to invoke the exemption of extension of time limits until then (Keessen et al. 2008, Howarth 2009). It is not fully clear to what extent plans and programs of measures may or must be changed during the planning period. It appears, as mentioned above, from the text of the Directive that changes must be made if monitoring reveals that the goals as set out in the plan will not be met without additional measures. However, member states may in these circumstances also be entitled to invoke an exemption.

Although every social-ecological system differs in the time scale required for effective learning, it is unlikely that updates on a six-year cycle are appropriate for many, if any, river basins (Green and Garmestani 2012). The Directive provides for a general obligation to act in that member states must prevent further deterioration and enhance protection and improvement of the aquatic environment through the establishment of river basin management plans. However, these are only general

terms, and Article 4 allows for inaction through the invocation of exemptions. These exemptions, which may also be invoked when intermediate monitoring results suggest taking additional measures, can entrench institutional inertia against taking intermediate adaptation measures. Without robust enforcement or incentive to adapt, member states may be unlikely to change course in response to monitoring data.

Enforcement

Serving flexibility and regional differentiation is positive, but at the same time, the legal system must have "teeth" at the scale of the European Commission if the Directive is to improve river basin management and be effective in the end. For chemical objectives, the key is to set enforceable standards, i.e., thresholds, for the most hazardous substances at the supranational scale but allow for novelty and innovation in the manner in which member states meet those standards. This raises the question of how enforcement of standards not set at EU level can be made equally effective. The available oversight mechanisms of monitoring and reporting of compliance with chemical standards are expected to achieve compliance with chemical standards set by member states. That leaves the question whether the same approach is effective with novel ecological standards that are set by member states.

The extent of the enforceability of ecological objectives remains controversial. When the Commission proposed the Directive, the Council fought with the European Parliament about the legal status of these objectives (Kaika 2003). Debates concerned whether the good status obligations were obligations of best effort or obligations of result. An obligation of best effort is less far reaching than an obligation of result, especially in cases where the result of good surface water status is not achieved. If a member state put forth its best effort but still did not achieve good status, their legal obligation would still be met under the best effort obligation. By contrast, under a results obligation, a member state could put forth a best effort but still fail to meet its obligation if that best effort did not result in good status. Despite a change in formulation, from "in order to achieve" to "with the aim of achieving," the Court of Justice will have the final say in the qualification of the good status obligations. Because the 2015 deadline for compliance with the WFD goals is fast approaching, one can take cue from a case in which Luxembourg was condemned for not timely and correctly having transposed WFD goals into binding national law (ECJ case C-32/05, Commission vs Luxembourg [2006], ECR I-11323). This condemnation suggests that the WFD ecological obligations qualify as obligations of result, which would bode well for water quality (Van Kempen, *in press*).

In case of transboundary disputes, riparian states can ask the European Commission to mediate. However, the Commission does not have binding dispute settlement powers because of the absence of a legal basis in the Directive for commission arbitration (Keessen et al. 2008). Consequently, disputes have to be solved amicably or through infringement proceedings brought before the European Court of Justice. Although EU member states can take each other to court over disputes if they suspect an infringement of EU law, in practice they rarely make use of this power. They may not seek arbitration instead because the European Court of Justice has established in its case law that international arbitration is not allowed over disputes involving the interpretation or application of EU law (Keessen et al 2008, Hey and Van Rijswick 2011). Thus, the attainability of the WFD goals also relies on the willingness of the Commission to bring proceedings before the European Court of Justice against states that do not comply with their obligations.

Synthesis

Meeting the WFD objectives on time is unlikely; the first commission report on the implementation of the Directive revealed that the percentage of water bodies actually meeting all objectives is very low, in some member states as dismally low as 1% (EC 2007). Most water bodies are at risk for not complying before 2015. Many high risk water bodies are located in densely populated areas and regions of intensive, often unsustainable, water use (EC 2007). Another factor is whether a member state had made the necessary investments to comply with previous EU water law, which addressed pollution by domestic waste water discharges, nutrients from agriculture, and industrial discharges (EC 2007). Currently, the most significant and widespread pressures are diffuse pollution, physical degradation of water ecosystems, and, particularly in Southern Europe, overexploitation of water (EC 2007).

Striking the right balance between flexibility and enforceability is particularly important for transboundary European rivers like the Danube, Meuse, and Rhine, where member states are collectively responsible for attaining goals. However, because of the EU legal system, each member state is only liable for meeting the chemical and ecological objectives in its own part of the river basin. Under the Directive, member states are only obliged to discuss their river basin management plans and programs of measures in international river basin committee meetings and to attempt to coordinate overarching management plans and programs of measures. The available instruments to realize this cooperation are traditional international treaties between riparian states, which do not offer a proper legal system to enforce shared responsibilities (Van Rijswick et al. 2010, Hey and Van Rijswick 2011, Green and Perrings 2014). Administrative cooperation between the various authorities and states involved therefore only proceeds on a weak legal or voluntary basis.

A trend toward regional water authorities is emerging, following the traditions of France, Spain, Flanders, and the Netherlands, although these water authorities differ in task,

legal status, and competencies (Van Rijswick et al. 2010). Thus, the practical elaboration of these institutional elements may differ considerably between member states, restricting cooperative transboundary management of river basins (Van Rijswick et al. 2010), thus limiting the effectiveness of multilevel governance. Furthermore, the interests of all actors, private or public, may be contradictory. Common goals and necessary measures may prove difficult to define and to realize when so many opposing interests are at stake.

The flexibility of the Directive permits so much policy discretion to member states that implementation can differ considerably from member state to member state (Keessen et al. 2008). Interviews with civil servants involved in the implementation and questionnaires completed by legal experts from various member states revealed that member states adopt different approaches (Keessen et al. 2010*b*). Such discretion creates the risk that unambitious national practices inspired by an unambitious interpretation of the vague wording of the Directive will lead to a lack of practical effectiveness (Moss 2008, Howarth 2009, Keessen et al. 2010*b*). In transboundary river basins, this may lead to conflict should an ambitious state's efforts be weakened by an unambitious riparian neighbor state and affect the overall result (Odom and Wolf 2011). In particular, attainment of ecological aims may be imperiled because achieving those goals often requires transboundary cooperation. For instance, the objective of facilitating fish migration between headwater streams and marine waters requires measures like fish ladders to be established on the whole river basin otherwise the measures are useless.

CONCLUSION

We have analyzed the Water Framework Directive from the perspective of resilience science. The Directive provides an interesting venue for the exploration and application of resilience principles, especially panarchy and adaptive governance. Although the Directive was not specifically crafted with principles from resilience thinking, it is important to assess the potential effectiveness of the Directive in light of the realities associated with managing social-ecological systems. The WFD provides a sound example of multiple overlapping levels of control with one level of strong coordination at the relevant social-ecological scale; by shifting from state-centered governance to management at the environmentally appropriate scale, i.e., river basins, the Directive challenges conventional notions of political geography. Collectively determining the proper environmental objectives at the supranational scale then handing off design and implementation to local institutions could serve as a sound model for scale appropriate environmental management. This structure also facilitates horizontal and vertical information flow, especially in transboundary basins, and empowers states with the authority to respond to changing scenarios. The degree to which states empower citizens through meaningful public participation and building local capacity is largely dependent on the implementation at the state scale, and thus difficult to evaluate at the supranational scale, even though the Directive encourages public participation.

However, inadequate implementation and enforcement provides an opening whereby unambitious member states and local entities may exploit the Directive's inherent flexibility and fail to meet the objectives of the Directive. Likewise, the Directive's six-year monitoring and revision structure is inadequate for continuous learning and adaptation. Even if member states conduct vigorous monitoring, the monitoring results are useless without an iterative adaptation mechanism. Managing for resilience requires system feedback in real time, not every six years, or longer if exemptions are invoked, and thus this aspect of the Directive is in need of reform. In particular, the potential reliance on exemptions, which may be invoked when intermediate monitoring results suggest taking additional measures, can entrench institutional inertia against taking adaptation measures. Without robust enforcement or incentive to adapt, member states may be unlikely to change course in response to monitoring data.

Balancing the need for regulatory flexibility to achieve environmental objectives with enough certainty and enforcement to ensure performance plagues the application of resilience principles in many circumstances (Benson and Garmestani 2011*b*). In this case, it seems the European Union has failed to strike the right balance by granting too much weight to flexibility without the necessary counterweight to monitoring feedback and enforcement to ensure achievement of good status objectives. Thus, to manage for resilience, the Directive requires reform in its feedback and enforcement regimes.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/issues/responses.php/5357

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