

## Watershed protection to secure ecosystem services

*The New York city watershed governance arrangement*

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**ABSTRACT** In 1997, New York City and a group of smaller municipalities in the Catskills region of New York came to agree upon a novel and complex means of protecting water quality in the City's upstate reservoirs. The Memorandum of Agreement they authored tied previously uncooperating governments to a new shared goal: preserve the ecological integrity of the Catskill and Delaware watersheds so that the City could avoid chemically filtering its municipal water. The agreement represents a policy experiment in reaction to a stark choice. The U.S. Environmental Protection Agency's 1986 Surface Water Treatment Rule mandated that the City either filter its surface water supply or maintain a watershed control program to ensure the long-term protection of water quality in its source watersheds. The City decided to pursue a watershed control program in lieu of the more expensive filtration. The choice has led to a governing arrangement that has theoretical implications for how to simultaneously secure ecosystem services, promote rural livelihoods, and produce the critical public good of potable water to millions of people. The policy solution displays how cooperative institutions may provide low-cost and low-tech solutions to environmental dilemmas to protect ecosystem services. However, over time, governing entities have faced challenges that raise questions about the durability of the arrangement. This case study explores those challenges to better elucidate the possibilities and pitfalls of watershed governance to secure ecosystem services.

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### LEARNING OUTCOMES

- Explain several legal and practical challenges of intergovernmental cooperation in the United States
- Define some key ecosystem services produced by protected watersheds
- Identify major costs and benefits to different interest groups, political entities and populations of securing ecosystem services to produce public goods
- Identify and describe economic, political, and cooperative challenges to payment for ecosystem services governance arrangements

### CLASSROOM TESTED? NO

### INTRODUCTION

Providing clean, potable water to citizens is one of the more intensive and complicated services many governments

undertake, and for millions of people worldwide, provision is still inadequate. In the United States, municipal water quality is tightly regulated at the federal level to ensure public health. However, there are still failures by governments in the United States (such as recently in Flint, Michigan) to provide potable municipal water to citizens.

There are various solutions to improving and maintaining water quality, but they primarily focus on one of two strategies: prevent pollution from entering water sources and/or remove contaminants from water before delivering it to consumers. There are costs and benefits to each approach. To allow unfettered pollution would benefit polluters but place a high cost on municipal providers (who pass costs to consumers) who would have to remove pollutants before consumption. To prevent all pollution from entering surface water would place a high cost on polluters to change their behaviors, but would benefit water consumers who could forego costly filtration altogether.

Usually, pollution is allowed, but regulated at low levels to reduce the cost of filtration when sourcing water for consumption. In other words, the competing interests share costs.

Water quality and provision problems are complicated by the fact that surface water flows toward the sea in watersheds (naturally bounded drainage basins) that cross political boundaries and contain a multitude of land uses. This leads to upstream-downstream dilemmas in which upstream users harm water quality and/or quantity for downstream users. Additionally, the quality of water depends in large part on the health and structure of the ecosystem in which it occurs. Forested landscapes stabilize soil, filter surface water through leaf litter, soil and sand, add and subtract chemicals and remove pathogens [1]. Additionally, vegetated landscapes and stream corridors absorb higher storm flows of surface water and prevent erosion. A forested landscape does what a chemical filtration plant would, but at no direct cost. In watersheds, when upstream areas are polluted or degraded in ways that diminish the service of clean water produced by the ecosystem, downstream users will bear the costs of filtering water before use.

Understanding how watershed protection may secure ecosystem services therefore opens a new option for governments wishing to protect water quality for human consumption. Rather than altogether preventing pollution from entering water or removing pollution downstream, it is possible to conserve forests in upstream areas of watersheds to serve as water filtration landscapes. Such an approach has the potential to turn a commonly considered zero-sum pollution game into a mutually beneficial cooperative effort. In addition, landscape conservation to secure ecosystem services is more than just an economic calculation regarding provision of a public good—it has been demonstrated to lead to cascades of social, economic, and environmental benefits to human well-being [2]. How a policy instrument designed for this purpose works (or not) is of theoretical and practical importance.

This case study examines the efforts of a group of governments and interest groups in New York, United States, to secure ecosystem services that produce municipal water for millions of consumers in the nation's largest city. The results may be interesting to scholars and students who wish to explore ways to achieve the complementary goals of ecosystem protection, maintaining rural economies and livelihoods, conserving and using natural resources, and intergovernmental cooperation.

## DATA AND METHODS

To assess the efficacy of a governance arrangement in New York for securing the watershed produced ecosystem service of potable water, this paper uses a historical, time-series case study methodology, relying on the collection of a variety of data. The study explores a basic theoretical proposition in a particular context—that watershed governance to secure ecosystem services is robust if it maintains proper institutional means (i.e. rules) of cooperation. In keeping with proper design of a case to examine *how* and *why* this may work given political, social, and environmental change over time, the case is mainly descriptive of events and the reactions to events as a means of opening up questions about the underlying theoretical proposition [3]. As such, the case provides a detailed description of historical antecedents to a moment of political cooperation to govern a watershed and a description of events since then that have challenged the core rationale of intergovernmental cooperation to govern a watershed so as to secure ecosystem services.

The analysis draws a broad variety of data. Legislative and regulatory documents provide an historical context and rationale for policy action; contractual agreements, policy documents, and archived meeting minutes provide a means of tracing intergovernmental cooperation (and changes to it) over time; and surveys and formal interviews of governance actors (bureaucrats, legislators, community leaders, activists, citizens) provide evidence of how governance actors perceive their work and the challenges and opportunities of watershed governance.

Rather than draw strong causal conclusions, the case is used as a means of opening up questions about how to govern watershed landscapes to secure ecosystem services.

## CASE EXAMINATION

*Legal context: state and federal water quality protection*

New York City grew to its current size and economy in part due to its securing of low-cost and high-quality municipal water supplies. To promote growth, in 1799, the New York State Legislature passed 4 L. & A. 733, “Act supplying the City of New York with pure and wholesome water.” Following cholera outbreaks and poor well water quality in lower Manhattan, a key revision in 1834 (1834, chapter 256) tasked the City Water Commission to seek water sources in other jurisdictions to develop and transport to the City [4]. The City bought properties and flooded

reservoirs in Westchester and Putnam Counties in the Croton watershed north of the City, which served as the water supply until the early twentieth century.

In 1905, the State Legislature passed The City Water Supply Act (Law 1905 c. 724), which tasked the new State Water Supply Commission to expand the New York City water supply system. Citing City water quality as a State public health concern, the law gave the City the power of eminent domain in other jurisdictions to flood reservoirs and build aqueducts. The City sought large, well-forested upland watersheds as sources to ensure lasting system capacity and water quality. In the subsequent decades, dams and aqueducts were constructed throughout the combined Catskill and Delaware watersheds and those watersheds now supply 90% of the City's water by volume, untreated by chemical filtration. Meanwhile, surface waters throughout the United States were being threatened by industrial, residential, and agricultural pollution.

Public and political will to regulate surface waters in the United States culminated in the Clean Water Act amendments of 1972 (P.L. 107-303) and the Safe Drinking Water Act of 1974 (P.L. 93-523), which gave broad authority to the U.S. Environmental Protection Agency (EPA) to regulate pollutant discharges into surface waters and to set national standards for contaminants in drinking water. In response to cases of surface contamination of municipal water sources, the Safe Drinking Water Act was amended in 1986 to include the Surface Water Treatment Rule (P.L. 99-339). This rule mandated the U.S. EPA to promulgate rules requiring municipalities using surface waters to chemically filter the water unless they can “maintain a watershed control program which minimizes the potential for *Giardia lamblia* cysts and viruses in the source water” [5].

To protect water quality, the Surface Water Treatment Rule provides a choice to municipalities in the United States: they may either construct and operate chemical filtration facilities to remove pollutants from water at its intake from a source, or maintain the ecosystem functions in the watersheds that naturally prevent *Giardia lamblia* cysts and viruses from proliferating at the source. If a municipality chooses to filter the water at intake, they produce clean water and have little incentive to prevent pollution of water sources. However, if a municipality chooses to manage its source watersheds, they preserve the ability of ecosystems to produce clean water, and have major incentives to prevent pollution of entire landscapes. In addition, ecosystem services tend to be bundled, and that protection

of watersheds to produce potable water may include various attendant services, such as improved hunting, forest recreation, tourism, carbon sequestration, and soil phosphorous retention, among others [6].

Several major US cities have chosen to control their watersheds and protect the ecosystem services that produce clean water at the source. Famous examples include San Francisco, Seattle, and Portland (Oregon). These cities are common in their watersheds are in established wilderness areas (owned by the city or managed by a federal agency). In other words, ecosystem services in the watershed are preserved by removing or excluding humans, and thus human pollution, from the ecosystem and ultimately the water source. In the densely populated east, Boston and New York City also control their watersheds and avoid filtration, but they must do so in cooperation with the other municipalities and counties that their watersheds span. Their watersheds are not wilderness; on the contrary, they are heavily populated.

Following the promulgation of the Surface Water Treatment Rule, New York City faced a choice: construct a chemical filtration facility<sup>1</sup> and forego efforts to “control” the watershed, or devise a lower-cost cooperative arrangement with Catskill municipalities and counties to divert pollution from the reservoirs naturally. The City chose to attempt a “watershed control” effort, but again faced another choice: whether to use its power of eminent domain and established legal authority to take properties and control behaviors of landowners in the watersheds, or to devise a new cooperative arrangement with watershed municipalities to share authority and responsibility for watershed protection. Fearing the prospect of a command-and-control strategy by the City, watershed municipalities organized to assert their rights to self-governance and formed the Coalition of Watershed Towns to challenge the City. Fearing the prospect of organized resistance to City control of the watershed, the City chose to forego its power of eminent domain and pursue a negotiated and collaborative strategy for watershed protection.

The City wanted to keep the watersheds as wild as possible, and improve the ability of the ecosystem to naturally filter surface water. Watershed counties and municipalities wanted to maintain the natural landscape as well, but also protect their autonomy and ability to grow economically.

1. Cost estimates of between US\$2.74 billion and US\$6 billion [7].

To consolidate these visions, both sides would need to agree on a means of shaping development in the watershed and compensating watershed residents and municipalities for the behavioral and infrastructural changes needed to protect water quality for the long term. Any legal agreement would likely be a very complex payment for ecosystem services scheme involving a broad and heterogeneous set of interests.

*Legal context: a new agreement for watershed governance*

Between 1993 and 1997, the City and watershed municipalities negotiated a Memorandum of Agreement (MOA) to serve as a constitutional document guiding shared governance of the Catskill, Delaware, and to a lesser extent the East-of-Hudson Croton watersheds.<sup>2</sup> The MOA created several decision-making forums populated by elected representatives of watershed communities, appointed representatives of the City, State Department of Environmental Conservation, and governor-appointed representatives of environmental advocacy groups. The Catskill Watershed Corporation was founded and is governed by such a group, to develop programs and allocate City funds for a variety of public and private uses. A key provision of the MOA requires the City to fund several watershed programs and infrastructure projects, some of which produce major public benefits to watershed communities (wastewater treatment facilities, septic systems, economic development projects, road and bridge repair, stormwater management, farm consultation, and flood recovery to name a few). In return, watershed municipalities must abide by regulations on development and economic activities that have potential to harm water quality. The City also continues to purchase and manage property in the watershed and retire it to wilderness.

The MOA also provides a means for representatives of various and competing interests to monitor each others' behaviors via prescribed information sharing and to sanction each other for shirking their duties or not abiding by the document. Like any constitution, the MOA is designed to bring previously uncooperative governments together to follow a new set of rules meant to produce group benefits.

2. See Figure 1 for a map of the watersheds in relation to the City. The larger dark area to the north comprises the Catskill and Delaware watersheds, the unfiltered source of 90% of the City's water, and the primary target for hydrologic ecosystem service protection. The Catskill and Delaware watersheds comprise parts of five counties.

Predictably, as is natural in such cooperative arrangements, conflicts persist and challenge the durability of the governance experiment.

*The memorandum in practice: challenges and opportunities*

The MOA was designed as rule institution to direct the means by which the City would fund ecosystem service protecting programs and compensate upstate municipalities to forego industrial and commercial development that may harm water quality. Since the MOA was signed in 1997, the City has funded numerous infrastructural projects to reduce the risk of agricultural runoff, human sewage and stormwater runoff from contaminating Catskill reservoirs. The City has also continued to purchase and manage streambank corridor properties to serve as buffers against runoff pollution and alleviate flooding risks. City municipal water quality has remained high. The Catskill Watershed Corporation continues to function as a collective choice venue for directing City funds to watershed projects and as a venue in which representatives of the City, State, watershed communities, and environmental groups can resolve conflicts [9].

Despite obvious successes in protecting water quality and preserving ecosystem services in the watersheds, challenges remain. Of note, major storm events (e.g., Tropical Storms Irene and Lee in 2011 and Hurricane Sandy in 2012) caused major damage to watershed towns located in floodplains. Flooding in the Catskills caused by Hurricane Sandy produced a level of turbidity (suspended solids) in the terminal reservoir that exceeded legal limits set by the EPA [10]. This prompted an EPA requirement that the City plan to better control turbidity in the event of major storms. A City-sponsored Flood Buyout Program was authored and, after considerable debate, signed off by the Catskill Watershed Corporation. The Program expanded the authority of the City to purchase properties in towns situated in floodplains, which watershed municipalities feared might gradually threaten the existence of whole communities if the City purchases enough properties to fragment commercial and residential town centers. This raises a contentious issue in the watersheds: towns tend to be situated along rivers and streams, but flood models show those areas are important to manage as undeveloped stream buffers.

Less dramatic, a natural attrition of leadership is occurring at various levels of government. City and State agencies



**FIGURE 1.** New York City water supply system (reprinted with permission) [8].

and watershed municipalities have a turnover of leadership and personnel over time, and many of those who were part of the initial crafting and administration of the MOA are now retiring. In interviews and a 2014 survey, several representatives of the EPA, State agencies, the City, and watershed municipalities expressed concern that new leadership does not have the experience of creating consensus as they had, and thus may be less favorable to or unpracticed in intergovernmental cooperation. Additionally, interviewees and survey recipients expressed that such cooperation fosters trust over time, and when leadership is replaced, that social capital must be rebuilt [9].

This leadership turnover may be exacerbated by the perception of several County, Town, and Village representatives who expressed a concern that the expansion of land acquisition by the City in response to flooding

risks is privileging City interests over watershed community concerns. On the other hand, representatives of the City, State, and environmental nonprofits emphasized that decision-making be made according to sound science, and were concerned that economic interests by watershed communities may threaten that.

Finally, following requirements by the EPA that the City strengthen its flooding precautions, and the response by the City to pursue a Flood Buyout Program, watershed community representatives are increasingly skeptical that federal rules are fair to their interests. Regarding the rule instrument the EPA uses to direct the City, the Filtration Avoidance Determination, representatives of watershed municipalities were significantly less likely to view the rules as “fair,” compared to representatives of City, State, or nonprofit agencies [9].

## CONCLUSION

The New York City watershed governance arrangement has been lauded as a means of protecting ecosystem services in order to produce and deliver potable water to more than 10 million people at a very low cost. However, the case illustrates that to do so, a delicate conflict of values and interests must be managed. In addition, governance of the watershed is pursued under a complex set of intergovernmental relationships and authorities, emblematic of some of the core issues of the federal governance system itself in which governments are nested hierarchically and yet retain some autonomy. Finally, the case illustrates the importance of two complementary elements of durable resource governance: strong institutional constraints and leadership by policy entrepreneurs. The work of bureaucrats and elected representatives in the 1990s led to the creation of the MOA, a formal rule institution to guide behavior of governing actors into the future.

Currently, governance actors in New York face a variety of dilemmas. New flooding risks have highlighted the conflict between “science based” decision-making (to manage streambanks) and protecting economic interests of existing communities in floodplains. At an important and sensitive time for such planning, leadership is turning over, and new representatives and bureaucrats who do not have a shared history of building cooperation and managing conflict must forge social capital, collaborative practice and trust. Some representatives of Catskill communities still feel that their interests are unfairly represented by the rules in place, while representatives of environmental nonprofits, the City, and the State worry that water quality management may be sacrificed to the economic interests of Catskill municipalities.

## CASE STUDY QUESTIONS

1. What costs and problems did various actors (the City, State, EPA, watershed municipalities, environmental groups) avoid by creating the New York City watershed governance arrangement? What costs and problems do various groups face because of it?
2. How do/should governance actors protect economic interests of different groups,

governments, and individuals while preserving the watershed ecosystem?

3. How can governance actors manage the turnover of leadership? Does turnover by nature threaten such big generational environmental policies?
4. Governance actors have identified severe storms and flooding events as a major future concern. How should they think about the flexibility of their governance arrangement in light of that?
5. What other long-term problems do you foresee for those trying to maintain an equitable, functional, ecological service protecting governance arrangement in New York?

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## COMPETING INTERESTS

The authors have declared that no competing interests exist.

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