Water Quality as Property: Industrial Water Pollution and Common Law in the Nineteenth Century United States[1]

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ABSTRACT

This article examines how riparian law governed the disposal of industrial wastes into watercourses in the United States in the nineteenth and early twentieth century. The article investigates how the introduction of the doctrine of reasonable use and the balancing test gradually weakened the protection of customary water uses and facilitated industrial waste disposal. The article also examines the counter-reaction to weak protection of customary water uses at the turn of the twentieth century, which tightened the rules regulating industrial waste disposal. The article argues that riparian law was an ineffective governance institution because it created disincentives for the enforcement of riparian rights. The article also argues that riparian law arranged participation in collective choices over the rules of water use according to ability and willingness to pay, which largely explains the change of riparian law in the nineteenth century. However, the courts also gave weight to prevailing social values, which initially affirmed developmental uses of water but later took a more critical view of the interests of big business in water use.

KEY WORDS

Water pollution, industrial wastes, riparian law, reasonable use, balancing test, United States

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1. INTRODUCTION

> In a world in which there are costs of rearranging the rights established by the legal system, the courts … are, in effect, making decisions on the economic problem and determining how resources are to be employed.[2]

Morton Horwitz and several other legal historians have argued that changes in common law reduced liability for accidental and intentional injuries and provided 'a capital subsidy' for the nascent industry in the nineteenth century United States. This argument is largely based on analysis of water law and it implies that common law changed so as to facilitate industrial use of environmental resources such as water. The capital subsidy argument has not remained uncontested. Some historians have denied that there was ever such a capital subsidy. Law and economics scholars have in turn argued that common law changed so as to improve economic efficiency or to maximise wealth. It is warranted, therefore, to ask how water law actually changed in the United States in the nineteenth and early twentieth century.[3]

My article examines legal responses to industrial waste disposal especially in the North-East and the Mid-West, where riparian law and nuisance law governed the use and quality of water before the establishment of statutory water pollution control programs in the early twentieth century. Riparian law established riparian landowners' rights to the use of water and protected them from interference, by diversion or pollution, for example. Law of private nuisances protected the enjoyment of residences and riparian land from the adverse effects of water use, such as strong odours. Finally, the law of public nuisances constrained water use to protect public health and public rights, such as navigation. I will focus on riparian law, because it was used to resolve most complaints about industrial discharges.[4]

My analysis is based on the governance approach, which has been used to examine the management of natural resources such as pastures, forests and fisheries under customary common property institutions. However, the approach can also be used to examine formal legal institutions, such as common law and statutory law, that govern the use and quality of environmental resources. Its analytical starting point is that resource use and its physical, social and institutional contexts generate resource use conflicts. These conflicts are resolved by establishing or modifying informal or formal governance institutions. All environmental governance institutions perform broadly similar functions. They define who is authorised to use a resource and provide for the exclusion of unauthorised users, establish rules regulating how authorised users can use the resource and provide for their enforcement, organise conflict resolution, and provide for collective choices over governance institutions. The way these governance functions are organised and the formulation of institu-

tional rules obviously influence the effectiveness and outcomes of environmental governance.[5]

I argue that the early courts construed water uses, and the water quality they depended on, as private property. When new water users appeared, their water uses became increasingly interdependent, and conflicts between them became frequent. The courts then gradually weakened the exclusivity and protection of water rights in line with the capital subsidy argument. However, there was also a counter-reaction to weak protection of water uses at the turn of the twentieth century. The usual explanations for these changes in water law are that they either improved social welfare or benefited a powerful interest group. However, neither explanation is completely satisfactory. Litigation was pursued for economic self-interest but the decisions of the courts also weighed in prevailing social values. The pursuit of economic self-interest in the courts by industrial water users and polluters resulted in the capital subsidy, but it was legitimised by the strong developmental ethos that characterised the mid-nineteenth century United States. Similarly, the pursuit of self-interest by new industrial and other water users who were injured by industrial discharges resulted in counter-reaction, but it also reflects lower abatement costs and the Progressive Era's popular beliefs according to which the interests of big business were not in harmony with those of the general public.[6]

Riparian law was a governance institution that translated interests and values into governance outcomes through a market filter. It gave credence to the interests of those who had both the greatest ability and willingness to pay, and who could thereby influence the development of the rules of water use. The experience with riparian law in the nineteenth- and early twentieth-century United States demonstrates that a governance regime based on market incentives is insensitive to interests that cannot be fully expressed in economic terms. First to succumb was the early republican idea of property as a basis of 'propriety' and political participation – riparian law transformed property into a mere instrument of wealth. Similarly, when pollution of water by human wastes became a problem in the late nineteenth century, riparian law (and common law in general) was unable to translate interests in public health into outcomes. To protect interests in public health, riparian law was enveloped by a new layer of statutory law that set the limits for the operation of market logic. Later, new layers of statutory law have been added to protect other diverse interests, such as those in recreation and ecosystem services.

In what follows, the second section reviews early water law and how the doctrine of reasonable use transformed it in the first third of the nineteenth century. The third section examines how the balancing test changed water law in the mid-nineteenth century. The fourth section investigates the counter-reaction to balancing which improved the protection of water quality at the turn of the twentieth century. The fifth section proposes an explanation for the change of riparian law as a governance institution in the nineteenth-century United

States. The conclusions assess riparian law as a governance institution and contrast it with other areas of past environmental governance in the United States and elsewhere.

2. FROM EARLY RIPARIAN LAW TO THE DOCTRINE OF REASONABLE USE

At the beginning of the nineteenth century, little statutory law existed on water use beyond the Mill Acts which modified the liability of users of water power in many states. Riparian law provided a unified framework for governing the use and quality of water east of the Mississippi. The United States had inherited its riparian law from England, where it had developed on Roman law foundations. It was still common for the courts to cite English precedents at the turn of the nineteenth century, although they recognised that water use in industrialised England was more intensive and that its water law reflected this. As the same law governed all uses of water resources, I will first discuss riparian law in the more general context of water use. I will then move on to how riparian law governed the disposal of industrial wastes.

Riparian law entitled an exclusive group to use water of a stream – the riparians whose land abutted to it. As riparians, tanneries and mills therefore had a right to use water for power generation, production and waste disposal. However, common law also set limits to water use. Early English property law included the maxim, *sic utere tuo ut non alienum laedas*, which denied a right to such use of property which interfered with the use of property by others. The same rule of non-interference was established by the English concept of 'natural flow', according to which riparians had a right to receive water in its accustomed (and thus natural) quantity and quality. In the early nineteenth century, customary water uses included the use of water for domestic and agricultural purposes, for watering livestock, and for power generation in small, traditional mills. An interference with these customary uses, by altering the quantity or quality of water, was a legally recognised injury and entitled the injured riparian to compensation. In effect, these water uses were treated as private property. Absolute rights like these could be maintained before water use intensified and water use conflicts became frequent.[7]

Water law changed several times in the nineteenth century as a response to new water use conflicts. Early conflicts over industrial water use usually included a mill owner and an upstream riparian whose land was flooded by the mill dam. The upstream riparian could initiate a case at law for damages to restore the pecuniary value of his property or a case in equity for an injunction to restore the enjoyment of his property. The court could resolve a conflict in three ways. A denial of relief endorsed the defendant's right to his water use. When early courts found for plaintiffs, they clearly favoured damages although the award of

injunction was also available. The award of damages affirmed and priced the plaintiff's right and completed the implicit transaction initiated by the defendant. Injunction affirmed the plaintiff's right and enabled him to price and trade it at his will. The plaintiff could obviously refuse to trade at any price because two uniquely situated individuals cannot constitute a functioning market: mitigation of market power requires a seller, an alternative seller, a buyer, an alternative buyer, and a judge. For this reason, Mill Acts relieved mills from liability for flooding upstream land or allowed them to do so by paying compensation. Yet bargaining and exchange were expected to take and usually took place after the granting of an injunction.[8]

The early nineteenth century witnessed a change in water use conflicts both in the United Kingdom and in the United States. The use of water for industrial purposes intensified and the number and scale of mills, milldams, and millponds increased. As a result, new types of water use conflicts emerged. First, upper mills' wheels were inundated more frequently by lower mills' dams. More importantly, larger mills now exposed a number of downstream riparians to the adverse effects of their water use. Industrial water pollution enters the picture here. Industrial wastes had customarily been thrown into watercourses but the practice became problematic when the mills became large and numerous.[9]

FIGURE 1. Old , traditional saw mill from Winnipiseogee Lake, Connecticut. The print was published in *American Scenery* in 1839. Original with the author.

FIGURE 2. A saw mill at the Hudson River. The print was published in *Pictoresque America* around 1882. Original with the author.

Tanneries and water-powered mills were the earliest industrial polluters. Mines became significant water polluters in the mid-nineteenth century. Finally, pulp and paper mills, packaging houses and other new, large-scale industrial establishments emerged as big water polluters in the late nineteenth century. The discharges of early industrial establishments were often solids such as sawdust which settled on the riverbeds, obstructed navigation, contributed to flooding, destroyed fisheries, and interfered with the use of water for power generation and other industrial purposes. Some industrial discharges contained organic matter, which decomposed in water, depleted oxygen and killed aquatic life, spoiled water supplies, and created strong odours that interfered with the use of riparian properties. Finally, sometimes acidic and toxic discharges from mines and mills spoiled water supplies, corroded equipment and machinery, and destroyed fisheries.[10]

FIGURE 3. By the late 19th century, industrial water use had attained a large scale and new polluters such as pulp and paper mills had appeared. The photograph depicts Corinth Paper Mills on the Hudson River. Photo courtesy of the Collection of Brookside Museum, Saratoga County Historical Society.

Industrial discharges thus created conflicts between industrial polluters and downstream riparian farmers or industrial water users. These conflicts resulted in litigation, which intensified from the early nineteenth century until about the First World War. However, the locus of water pollution policy moved away at the turn of the twentieth century from the courts to legislatures and the new departments of public health that had been created in many states by this time. The reason was that common law could not protect public health from sewage discharges, which had become by this time the foremost water pollutant. The interests of fishermen were also injured by industrial waste disposal but little was done about it. Although the question why fisheries were not protected is interesting, it will not be examined here.[11]

The idea of water uses as private property worked less satisfactorily with the new water use conflicts that involved a number of injured downstream riparians. As Coase argues in the quote at the beginning of this article, the court's decision could well determine the final use of water resources. If the polluter's right to discharge wastes were endorsed, the downstream riparians could only stop him by offering to buy his right. Because of the costs of collective action and incentives to ride free (to let the others pay the polluter and to enjoy the benefits of improved water quality without contributing to the costs of making it

available), this was unlikely to happen. If the downstream riparians were entitled to their water use, industrial establishments could continue to operate only by buying or compensating for the rights of downstream riparians. If an injunction were issued, any one of the downstream riparians could hold out. As the strict protection of customary water uses was the precedent informing the courts' consideration, the implication was that new uses of water are not possible if the law is not changed. Yet in the East water flow could be used for power generation in successive mills, unlike in the arid West, where water use mainly for irrigation diminished the amount of water available for downstream users.[12]

Law indeed changed in the early nineteenth century so as to accommodate more intensive use of water. The new rule that was to regulate water use was established in *Tyler* v. *Wilkinson* (1827), a federal case involving several textile mills situated on either side of the state border between Massachusetts and Rhode Island at the falls of the river Pawtucket. This case illustrates Carol Rose's argument according to which the conflicts over the actions of upper riparians injuring lower riparians changed riparian law in the early nineteenth century.[13] Downstream mill owners complained of the diversion of water by upstream mills, arguing that the upstream mills only had a right to residual water not needed by the downstream mills. The court rejected the claim, basing the rights of involved parties on their customary water use, and assigned to all a duty relative to their rights to adjust their water use during general dearth of water. In the opinion of the court, Justice Story declared:

> I do not mean to be understood, as holding the doctrine, that there can be no diminution whatsoever … by a riparian proprietor … for that would be to deny any valuable use of it. There … must be allowed of that, which is common to all, a reasonable use. The true test of the principle of and extent of the use is, whether it is to the injury of the other proprietors … The diminution, retardation, or acceleration, not positively and sensibly injurious by diminishing the value of the common right, is an implied element in the right of using the stream at all. … The maxim is applied, 'sic utere tuo, ut non alienum laedas'.[14]

Justice Story emphasised riparians' common ownership of water in contrast with the earlier understanding of water uses as exclusive private property. Exclusive private property rights include a right to exclusive enjoyment and possession, which can be enforced by an action based on tort law. The idea is that although the tortfeasor has done no physical harm to the plaintiff's property, he may still have to compensate because of the lost exclusive enjoyment or possession. Thus, when water uses are considered private property, the injured owner can challenge even a small interference with his or her rights in the court. Viewing water rights as being based on common ownership facilitated new uses of water, because common rights do not include a right to (individually) exclusive enjoyment or possession. This was not necessarily to the detriment of those riparians who made customary use of water. After all, Justice Story

qualified his relaxation of liability by referring to the maxim, *sic utere tuo*.

Although the new doctrine of reasonable use was developed in court cases where lower riparians complained of the use of water by upper riparians for power generation, it was soon applied to cases over the pollution of water by industrial wastes. For example, *Wheatley* v. *Chrisman* (1855), a case from Pennsylvania, involved a riparian who complained of the diversion and pollution of water by an upstream lead mine. He sought damages by alleging that the mine had rendered water unfit for his cattle. The defendant claimed a right to use a reasonable amount of water for his business. Justice Black argued in the upper court's opinion that affirmed the lower court's award of damages:

> The necessities of one man's business cannot be the standard of another's rights in a thing which belongs to both. … The defendant had a right to such use as he could make of the water without materially diminishing it in quantity, or corrupting it in quality. If he needed more, he was bound to buy it.[15]

Like Justice Story, Justice Black emphasised common ownership of water. The new doctrine created an expectation that one could initiate a developmental and polluting water use without a fear that other riparians would challenge it because of a minor interference with their rights. Of course, this doctrine left it to the courts to judge what constituted a 'material' interference. Yet the rule of reasonable use – as it was formulated by Justice Story – could have facilitated new uses of water and protected customary water uses simultaneously. New, valuable use of water could have proceeded after compensating for injuries to existing water uses or after the rights to them had been bought. However, changes soon took place in reasonable use that significantly altered its implications, as will be shown in the next section.

3. THE BALANCING TEST: REASONABLENESS AS A MORE VALUABLE USE

The doctrine of reasonable use was transformed in two mid-nineteenth century cases into a balancing test which compared the values of conflicting water uses and affirmed the more valuable one as a right. Both *Snow* v. *Parsons* (1856) from Vermont and *Hayes* v. *Waldron* (1863) from New Hampshire addressed a conflict between an upstream industrial polluter and a downstream riparian plaintiff. Both industrial defendants had large-scale operations and had invested more in their water use than the plaintiffs. The decisions in these two cases and in others that later endorsed them also expressed an explicit concern for the economic progress of the state and the defendant's contribution to it.[16]

In *Snow* v. *Parsons* (1856), a mill owner complained about an upstream tannery, alleging that its spent bark obstructed the operation of his water wheel. The trial court awarded damages for the plaintiff but the defendant appealed and

the higher court reversed and remanded the case back to the trial court. The opinion of the higher court indicates how routinely the doctrine of reasonable use was applied to industrial pollution. Chief Justice Redfield first clarifies the applicability of the doctrine of reasonable use to the case:

> The important, and as I think the only, question in this case is, whether it is proper for extensive tanneries upon moderate-size streams to expend their refuse, or spent bark, into the stream … The reasonableness of such use must determine the right, and this must depend upon the extent of detriment to the riparian proprietors below. If it essentially impairs the use below, then it is unreasonable and unlawful.[17]

Chief Justice Redfield then went on and gave a new twist to reasonable use:

> Within reasonable limits, those who have a common interest in the use of air and running water must submit to small inconveniences to afford a disproportionate advantage to others…
>
> And the reasonableness of plaintiff submitting to this inconvenience must depend upon its extent, and the comparative benefit to the defendants, to be judged by the triers of the facts.[18]

Three decades earlier, Justice Story had argued that riparians had an equal right to water use and he had ruled out superior rights based on the priority of appropriation or occupancy, for example.[19] Chief Justice Redfield now redefined reasonable use simply as a more valuable use. This balancing rule allowed a riparian who had identified a valuable water use to extinguish other riparians' incompatible and less valuable water uses without even compensating them. Ironically, unreasonable water use became the privilege of those whose water use was not particularly valuable and who injured a more valuable water use. This was the only instance in which compensation would be required to be paid.

The balancing test was soon endorsed in New Hampshire, Maine, Wisconsin, Minnesota, and Indiana, for example. In *Hayes* v. *Waldron* (1863), a riparian landowner from New Hampshire complained that the shavings and sawdust discharged by an upstream saw mill were deposited on his land but the trial court found for the defendant. The plaintiff appealed, complaining of the instructions to the jury to consider the universal practice in the industry when deciding whether the discharge of wastes was reasonable. The higher court granted a new trial, arguing that allowing proof of industry practice opened up a door for unproductive and endless inquiries. Most of the opinion reviews applicable legal principles. In the opinion, Justice Bellows first endorses the established definition of reasonable use[20] and argues that reasonability of water use depends on its circumstances and must be determined on the basis of the facts in a trial. Justice Bellows then moves on to endorse the balancing test:

> Whether … it [disposal of wastes] may be rightfully done must depend upon the question whether … it is or is not a reasonable use of the stream; and in

> determining that question, the extent of the benefit to the mill-owner, and of inconvenience or injury to others, may … very properly be considered.[21]

Most of the cases discussed so far addressed a conflict in which one riparian discharged wastes to the injury of another. More complex conflicts appeared in the late nineteenth century and the courts responded to them by allowing several plaintiffs to join and defendants to be joined in one suit. For example, in *Woodruff* v. *North Bloomfield Gravel Mining Co.* (1883) a Californian land owner complained in a federal court of hydraulic mining companies upstream on the Yuba river, alleging that their solid discharges were deposited on his land. The case was important because prime agricultural land far downstream in the Sacramento Valley had been covered by thick gravel deposits as deep as 15 feet. The defendants demurred to their joining in a single suit. The federal district court overruled the demurrer and allowed the suit to proceed. In the court's opinion, Justice Sawyer argued:

> No inconvenience or additional costs can result to the several defendants … joined with others, who also contribute to the same nuisance by originally independent action – action in its inception and first stages several, but ultimately, co-operating to produce the nuisance. On the contrary, it is convenient to dispose of it in one case, and the costs are diminished to each individual rather than increased by a single suit.[22]

Similarly, in *Lockwood Co.* v. *Lawrence* (1885), owners of a Maine textile mill complained of the discharge of shavings and sawdust from sawmills upstream on the Kennebec river. The plaintiff and the defendants had made large investments in the use of waterpower and were important for the state's economy. The plaintiff sought injunction in a suit in which the defendants were joined. The trial court granted the injunction with respect to most of the discharges and dischargers. In anticipation that the defendants – who according to the facts appeared to make a less valuable use of water than the plaintiffs – cannot buy their way of continuing their waste disposal, Justice Foster declared that

> Neither should this injunction issue immediately. The respondents must have a reasonable time in which to prepare for the disposal of such waste as is inhibited from going into the river.[23]

A variant of balancing test which favoured a water use wherein the public interest was seen to lie was adopted in a few jurisdictions in the nineteenth century. This rule is worth discussing as the nadir of legal protection of customary water uses. The categorical balancing rule was formulated in *Pennsylvania Coal Co.* v. *Sanderson* (1886). In this complex case, a riparian from Pennsylvania complained of a coal mining company, alleging that its acid mine drainage had spoiled a brook's water, killed all the fish, and corroded a water distribution system at his farm. The Court of Common Pleas first denied a right

of action in trial. The plaintiff appealed and the higher court remanded the case for trial. The trial court then awarded damages for the plaintiff. Now the defendant appealed but the damages were affirmed. The plaintiffs then disputed the amount of damages, and the determination of damages was remanded to the trial court. The lower court altered the damages, after which the defendants appealed. In the final hearing eight years after the filing of the suit (and after the plaintiff had died and his wife had resumed pursuit of the case), the Supreme Court of Pennsylvania reversed its position, aligned with the defendant, and denied compensation:

> The plaintiff's grievance is for a mere personal inconvenience … [which], arising in this way and under such circumstances, must yield to the necessities of a great public industry, which, although in the hands of a private corporation, subserves a great public interest. To encourage the development of the great natural resources of a country trifling inconveniences to particular persons must sometimes give way to the necessities of a great community.[24]

Industrial defendants made numerous pleas for the endorsement of the Sanderson rule but most courts refused to do so. In Pennsylvania, the court's decision in *Robb* v. *Carnegie Bros. & Co.* (1891) confined the Sanderson rule to conflicts involving mine drainage. Still, the rule had significant consequences: it left all riparians injured by the discharge of mine drainage without legal remedy in the state of Pennsylvania and licensed private mine operators to take their property without compensation. It took until the court's decision in *Pennsylvania Railroad Co.* v. *Sagamore Coal Co.* (1924) before the preferential treatment of mining ceased. Without abandoning the public interest-based balancing rule, the court in this case decided that the public interest lay in public water supply instead of in draining mines.[25]

To conclude, the concept of balancing facilitated new, developmental water uses. In essence, balancing test was a 'rule of capture'; any riparian who identified a valuable water use could extinguish incompatible and less valuable water uses without compensation. Similarly, the Sanderson rule allowed the taking of private property for an alleged public use without compensation. This meant that the customary uses of water by riparian farmers and owners of small traditional mills which had depended on certain level of water quality had to yield to the polluting water use of new, increasingly large industrial establishments. Not surprisingly, the balancing test was not accepted everywhere and the courts improved the protection of both customary and new water uses during the Progressive Era. This counter-reaction will be will be discussed in greater detail in the next section.

4. THE RETURN TOWARDS REASONABLENESS AS NON-INJURIOUS USE

In a number of states such as New York and New Jersey, courts repeatedly rejected the balancing test because of its problematic distributive implications. The categorical balancing test formulated in the *Sanderson* case met even stronger resistance. There was also a marked increase in the late nineteenth century in the willingness of courts to award injunctions. Several reasons contributed to this counter-reaction. Firstly, important new uses of water had emerged since the early nineteenth century and many of them – including the use of water for industrial production and public water supply – were injured by industrial discharges. Secondly, technological advancement had made it possible to abate certain industrial discharges at a relatively low cost. Thirdly, the court decisions responded to broader social concerns in the United States at the turn of the twentieth century, which included the rising power of corporations and big business and its misuse. Finally, many states had already established statutory water pollution control programs for the protection of public health by the turn of the twentieth century. This legitimised a stricter attitude by the courts towards all polluters.[26]

One case in which the Sanderson doctrine was firmly rejected was *Columbus Coal & Iron Co.* v. *Tucker* (1891). In this case, a riparian from Ohio complained of an upstream coal mine, alleging that coal slack, dirt, and refuse were washed from its dumps to the adjacent creek, killing the fish, making its water unfit for cattle, filling the creek bed and causing the flooding of his land, destroying a spring on his land, and covering his land with coal debris. The trial court awarded damages and on the defendant's appeal, the circuit court affirmed the verdict. The defendant appealed to the Supreme Court of Ohio, sought the endorsement of the Sanderson rule and argued that public interest lay on its side. Justice Spear responded:

> Nor is it of consequence that the operation of the company's mines tends to the development of the country's natural resources. But few enterprises … fail to advance the general good. Along with many evils … valuable services have been rendered to the public by them, and many comforts and necessaries are afforded the people by them which the capital of single individuals would be inadequate to produce. At the same time they are not … public enterprises, but, on the contrary, are organized and maintained wholly and entirely for private gain; and as soon as gain ceases to follow their operation, just so soon do the operations themselves cease.[27]

The Sanderson doctrine was also rejected in *Beach* v. *Sterling Iron & Zinc Co*. (1895). In this case, an owner of a paper mill from New Jersey complained of the discoloration of a stream by an upstream mine and sought an injunction.

The defendant's mine shaft had penetrated through a layer of groundwater-bearing rock, causing a rapid flow of a suspension of water and colourful clay into the shaft. The pumping of this suspension into the stream had discoloured it. The discoloration disappeared when the defendant built settling ponds, except after larger gushes of coloured water into the shaft or operational failures. The defendant resisted the granting of an injunction by an appeal to the Sanderson doctrine and to the fact that he had eliminated the reason for complaint. The Chancery Court granted the injunction, arguing that it established the plaintiff's right without burden to the defendant. In the court's opinion, Vice Chancellor Pitney responded to the defendant's arguments:

> Whether you flood the farmer's fields, so that they cannot be cultivated, or pollute the bleacher's stream, so that his fabrics are stained, or fill one's dwelling with smells and noise, so that it cannot be occupied in comfort, you equally take away the owner's property. … in each case the utility of his property has been impaired by a direct invasion … This is the taking of his property in a constitutional sense.[28]

The attitude of Vice Chancellor Pitney is partly explained by the fact that there was no need to bow to the mining industry in New Jersey – its economy was more diverse than those of other states. The rejection of the Sanderson doctrine by the Supreme Court of Ohio in *Columbus Coal & Iron Co.* v. *Tucker* was therefore all the more remarkable, because Ohio's economy rested more on the mining and steel industry. The attempts of industrial defendants to have the Sanderson rule endorsed also failed elsewhere. Even states that initially adopted the Sanderson rule ultimately ceased to follow it.[29]

The ordinary balancing test fared better than the Sanderson doctrine. It was incorporated into the first *Restatement of the Law of Torts* and is followed in a number of jurisdictions today. However, balancing was also rejected by many courts because it has disturbing distributive implications. For example, in *Strobel* v. *Kerr Salt Co*. (1900) a group of downstream mill owners from New York complained of an upstream salt factory, alleging that it had unreasonably diverted and polluted water so that they had lost water power and been injured because of the corrosion of their machinery and equipment. The plaintiffs sought an injunction, but both the Supreme Court (New York's trial court) and its Appellate Division denied it. The trial judge had cited *Sanderson* and a similar Indiana case, *Barnard* v. *Shirley*, to support his decision. In the opinion of the Court of Appeals of New York, which reversed the lower courts' verdicts, Justice Vann first criticised the trial judge's finding:

> trial judge was of the opinion that the plaintiffs … could not prevent the defendant … from devoting the stream to a new and unusual use, diverting the water, and turning 'a fresh-water stream into a salt-water stream'. This would amount to a virtual confiscation of the property of small owners in the interest of a strong combination of capital.[30]

Justice Vann then continued:

> While the courts will not overlook the needs of important manufacturing interests … they will not permit substantial injury to neighboring property … They will not change the law relating to the ownership and use of property in order to accommodate a great business enterprise. …the fact that he has invested much money and employs many men … does not … permit him to … so pollute the rest of the stream as to render it unfit for ordinary use.[31]

In his opinion, Justice Vann effectively endorsed the original definition of reasonable use by Justice Story. Justice Vann's opinion appealed to other courts, which cited *Strobel* v. *Kerr Salt Co.* approvingly when deciding against big industrial water polluters. The courts' stricter attitude at the turn of the century also reflected their familiarity with the fact that industrial discharges could often be abated at a relatively low cost.[32]

The stricter attitude towards industrial polluters is best expressed in *Whalen* v. *Union Bag & Paper Co*. (1913). In this case, a riparian from New York complained of an upstream pulp mill, alleging that its effluents made water unfit for domestic use and cattle. The plaintiff sought an injunction to prevent future

FIGURE 4. Glen Sulphite Mill in Ballston Spa. This mill's discharges were at stake in *Whalen v. Union Bag & Paper* (1913). It discontinued its operation after the granting of injunction. Photo courtesy of the Collection of Brookside Museum, Saratoga County Historical Society.

injury and damages for past injuries. The trial court awarded both. On appeal, the Appellate Division partly reversed and partly modified the judgement so as to reduce the damages and to eliminate the injunction. The plaintiff accepted the reduced damages but appealed on that part of the judgement that had eliminated the injunction. The Court of Appeals of New York then reversed the Appellate Division's judgment and granted the injunction. In the opinion of the court, Justice Werner declared that

> The setting aside of the injunction was apparently induced by a consideration of the great loss likely to be inflicted on the defendant by the granting of the injunction as compared with the small injury to the plaintiff's land by that portion of the pollution which was regarded as attributable to the defendant. Such balancing of injuries cannot be justified by the circumstances of this case.[33]

Justice Werner continued:

> Although the damage to the plaintiff may be slight as compared with the defendant's expense of abating the condition, that is not a good reason for refusing an injunction. Neither courts of equity nor law can be guided by such a rule, for if followed to its logical conclusion it would deprive the poor little litigant of his little property by giving it to those already rich.[34]

The injunction awarded by the *Whalen* court put out of business a pulp mill that had employed 500 people when the annual damages the court had awarded for past injuries were $ 100. The plaintiff either refused to bargain or asked a price that was beyond the defendant's ability and willingness to pay. At the same time, the defendant must have been unable or unwilling to abate its discharges. The *Whalen* decision was followed as a precedent in New York for over half a century until it was overruled in *Boomer* v. *Atlantic Cement Co*. in 1970 – another controversial case that involved an industrial polluter.[35]

The stricter attitude towards industrial polluters at the turn of the twentieth century moved the courts closer to Justice Story's original definition of reasonable use. The courts now often required industrial polluters to compensate for the injuries they created, to abate their discharges, or, if they could not do it, to buy off the rights of injured water users. This obviously improved the protection of customary and new uses of water, or at least their economic value. However, this protection remained weak. The following section explains why this was so.

5. THE PERFORMANCE AND CHANGE OF RIPARIAN LAW

It is fair to conclude that riparian law did not give good protection to the value of riparians' water rights nor to the quality of water. This weak performance resulted from certain features of riparian law as a governance institution. These features also partly explain the change of riparian law in the nineteenth century.

In what follows, I will first examine the performance of riparian law and then move on to investigate the reasons for its change.

Under riparian law, the riparians had to protect their water use in the courts on their own initiative. In order to protect their rights, the riparians also had to monitor the water use of other riparians. Private monitoring was unproblematic because riparians could usually easily detect who injured their water use by solid, organic, acidic, or toxic industrial discharges. However, private enforcement of riparian rights was a problem for customary water users. Although the courts could redistribute litigation costs, injured riparians had to initiate suits at their own cost and to face the prospect of having to carry them. Costs of litigation could easily exhaust its benefits, because customary water uses were not particularly valuable. Case evidence supports this reasoning. Court proceedings against industrial polluters were often initiated by industrial water users whose water uses were valuable.[36]

The incentives of industrial polluters were quite different because their water use was valuable and they obtained all benefits of defensive litigation. Industrial polluters thus had resources and incentives to litigate as long as it took to obtain a favourable decision. Sometimes, as in the *Sanderson* case, an industrial polluter obtained favourable decision after a long litigation. There are also cases such as *Whalen* and *Columbus Coal & Iron* where industrial polluters exhausted all opportunities before failing to obtain a favourable decision. In contrast, when plaintiffs stubbornly sought to enforce their rights, as in *Sanderson* and *Whalen*, they appear to have endured long litigation knowing that even a favourable decision would not make them even in monetary terms. The majority of plaintiffs probably ceased unfavourable litigation much earlier.

The level of protection enjoyed by customary water users also depended on the prevailing rules of water use. Adherence to a rule that strictly denied interference with other water uses gave a better protection for customary water uses than the rule of reasonable use. A balancing rule comparing the pecuniary value of incompatible water uses gave even weaker (if any) protection for customary water uses. In fact, where the balancing test was applied, a customary water user could hardly expect to prevail in the court at all. While the counter-reaction at the turn of the twentieth century improved the protection of most water uses that depended on certain water quality, it had less influence on water quality. Even when the courts denied a right to the disposal of industrial wastes, the polluters could – if they made a valuable use of water – buy out incompatible rights or compensate their owners.

Usual explanations for institutional changes such as those of riparian law are that they 1) improve social welfare or 2) benefit a powerful group. The first explanation – the so-called naïve theory of institutional change – argues that beneficial institutional rules are simply chosen. The second theory draws attention to rent seeking by powerful interest groups, which may improve social welfare, just redistribute it, or reduce it.[37] However, these theories do not

satisfactorily explain the change of riparian law in the nineteenth-century United States.

The adoption of the doctrine of reasonable use benefited industrial polluters without necessarily making other riparians worse off. The adoption of the balancing test also benefited industrial polluters. However, the balancing test allowed industrial polluters to take the rights of others without compensation, thus making them worse off. Strict liability would have generated the same water use pattern but would have required compensation. Thus the main consequence of the balancing test was a redistribution of wealth from injured riparians to industrial polluters. Finally, the counter-reaction benefited most water users and burdened industrial polluters. However, the polluters' losses were mitigated by the availability of abatement methods. The first and third institutional changes most likely improved social welfare, while the second one was primarily redistributive.

While rent-seeking theory suggests an explanation for the adoption of the balancing test, it cannot explain the adoption of reasonable use in the early nineteenth century when industry was weak in comparison with other water users, or why it could not have its way at the turn of the twentieth century when it was very powerful indeed. The naïve theory, which views judges as a sort of Walrasian auctioneers [38] who unerringly choose welfare-maximising rules, has also difficulties in explaining all changes of riparian law. The adoption of the doctrine of reasonable use may have indeed improved social welfare while, perhaps, making industrial water polluters better off and other water users worse off. Similarly, the counter-reaction may have yielded a welfare improvement, because a greater number of valuable water uses were injured by industrial waste disposal than earlier, and abatement costs were lower. However, this reasoning fails to explain the adoption of the balancing test, which did not yield welfare improvements over what alternative rules could yield. The usual theories have to be stretched to explain the change of riparian law – judges were benevolent social welfare maximisers most of the time, but lost their grip in the middle of the nineteenth century.[39]

I argue that the way in which collective choices were organised by riparian law largely explains its change. Under riparian law, rules of water use emerged as the result of litigation. The plaintiffs set the agenda for collective choice by making complaints in the courts. The judges then either affirmed the existing rules of water use or formulated new ones. The resources plaintiffs and defendants commanded determined the degree to which they could participate in collective choice. The probability and prospective gains of winning litigation determined their willingness to litigate and thus to participate in collective choice. Both the resources and prospects of winning litigation favoured industrial polluters. When polluting water uses were the most valuable ones, litigation logically resulted in gradually weakening protection of customary water rights.

Similarly, when a number of new, valuable water uses appeared and the costs of abatement were reduced, litigation resulted in somewhat improved protection of water uses. That is, as a governance institution, riparian law mainly gave effect to economic motives and an ability and willingness to pay.

Yet the judges were not insulated from broader social developments and thus their decisions reflected changes in values in the nineteenth and early twentieth centuries. Strict protection of property rights in the early nineteenth century was compatible with the early republican thought, which attributed intrinsic value to property; it was the foundation of propriety and political participation in the society and the source of the citizen's independence. Utilitarian values gained prominence throughout the nineteenth century, culminating in the Progressive Era when Gifford Pinchot promoted the use of water and forest resources for 'the greatest happiness for the greatest numbers'. The mid-nineteenth century case reports indicate that for judges industry was the vanguard of economic development that benefited everybody. Public opinion turned against corporations and big business at the end of the nineteenth century, when their misuse of power had been amply demonstrated. By then it was considered that social welfare and the interests of large corporations were not compatible.[40]

6. CONCLUSIONS

The development and consequences of riparian law in the nineteenth century exemplify problems embedded in environmental governance based on market logic. Riparian law changed in the nineteenth century United States as a response to market signals, so as to allocate water resources to those who made most valuable use of them. This reallocation took place as a result of legal change and did not involve voluntary consent of or compensation for those whose water rights were sacrificed. As industrial water users gained control of watercourses, they were put to increasingly polluting uses. In short, riparian law generated economic and environmental outcomes that can hardly be described as just or fair.

The story that was told above in the context of water use and law was replicated in other contexts. The use of nuisance law in the United States to govern air quality tells a broadly similar although somewhat more complex story because of the association of bad odours with health hazards (and thus the legitimacy of using police power to abate them) during most of the nineteenth century. In Europe, industrialisation also resulted in weaker protection of rights to environmental quality. For example, the doctrine of reasonable use was imported to England and in other ways too English water law changed so as to accommodate injurious industrial water uses. The same trend characterised legal developments elsewhere. In Finland statutory water law changed so as to

facilitate the use of water resources for injurious and polluting industrial purposes, such as the floating of logs.

The capability of riparian law to resolve conflicts was (and is) confined to situations where only a limited number of parties were (or are) involved and their interests can be expressed well in economic terms. This is why riparian law ceased to be the primary institutional arrangement for the governance of water resources at the turn of the twentieth century. Sewage pollution had emerged by this time as the foremost water pollution problem and its public health consequences threatened the health of a great number of people. Riparian law and common law in general could not satisfactorily resolve the new conflicts that involved the public health consequences of sewage pollution. A layer of statutory law emerged to govern water uses that threatened public health. Subsequently, new layers of statutory law have been added to protect other diverse interests, such as those in the recreational uses of water resources and ecosystem services provided by water resources.

NOTES

[1] This article is based on a paper presented at the 'Water in History and Development' conference of the International Water History Association (IWHA) August 10–12, 2001 in Bergen, Norway. I thank William Beinart, Paula Saukko, Allan Schmid, Joel Tarr and the two reviewers for helpful comments and suggestions. As usual, shortcomings are mine.

[2] Ronald Coase, 'The Problem of Social Cost', *Journal of Law and Economics* 3 (1960): 27.

[3] On capital subsidy, see Morton J. Horwitz, *The Transformation of American Law, 1780–1860* (Cambridge, MA: Harvard University Press, 1977). See also James Willard Hurst, *Law and Economic Growth: The Legal History of the Lumber Industry in Wisconsin, 1836–1915* (Cambridge, MA: Belknap Press, 1964); E. P. Krauss, 'The Legal Form of Liberalism: A Study of Riparian and Nuisance Law in Nineteenth Century Ohio', *Akron Law Review* 18 (1984): 223–53; John S. Martin, 'Water Law and Economic Power: A Reinterpretation of Morton Horwitz's Subsidy Thesis', *Virginia Law Review* 77 (1991): 397–426; Harry N. Scheiber, 'Property Law, Expropriation, and Resource Allocation by Government: the United States, 1789–1910', *Journal of Economic History* 33 (1973): 232–51; Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991). On denial of capital subsidy, see Gary T. Schwartz, 'Tort Law and the Economy in Nineteenth Century America: A Reinterpretation', *Yale Law Journal* 90 (1981): 1717–75; Alan Watson, 'The Transformation of American Property Law: A Comparative Approach', *Georgia Law Review* 24 (1990): 163–221. On efficiency arguments, see Richard A. Posner, *Economic Analysis of Law*, 4th ed*n* (Boston: Little and Brown, 1992); Gary D. Libecap, 'Economic Variables and the Development of the Law: The Case of Western Mineral Rights', *Journal of Economic History* 38 (1978): 399–458. The efficiency argument and capital

subsidy argument are not necessarily in conflict: in theory, the redistribution of environmental resources may maximise wealth.

[4] On riparian law, see Henry P. Farnham, *The Law of Waters and Water Rights*, vols. 1–3 (Rochester: Lawyers' Cooperative Publishing Company, 1904); American Law Institute, *Restatement of the Law of Torts* (St Paul: American Law Institute, 1934–39); T. E. Lauer, 'Reflections on Riparianism', *Missouri Law Review* 35 (1970): 1–25; Anthony Scott and Georgina Coustalin, 'The Evolution of Water Rights', *Natural Resources Journal* 35 (1995): 821–979. Conflicts over industrial pollution were typically litigated under riparian law, because industrial discharges mainly injured downstream riparians' water use. Municipal sewage pollution endangered health and interfered with the enjoyment of residences by strong odours. Conflicts over them were thus litigated under nuisance law. See Peter N. Davis, 'Theories of Water Pollution Litigation', *Wisconsin Law Review* (1971): 738–816.

[5] On definitions of environmental governance, see Oran B. Young, *International Governance: Protecting the Environment in Stateless Society* (Ithaca: Cornell University, 1994). On governance approach in general, see Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990); Jean-Marie Baland and Jean-Philippe Platteau, *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* (Oxford: Clarendon Press, 1996); Erling Berge and Nils Christian Stenseth (eds), *Law and the Governance of Natural Resources: Studies from Northern Europe and Africa* (San Francisco: ICS Press, 1999).

[6] On theories of institutional change, see Thrainn Eggertsson, *Economic Behavior and Institutions* (Cambridge: Cambridge University Press, 1990), 247–80. On naïve theory, see Harold Demsetz, 'Toward a Theory of Property Rights', *American Economic Review* 57 (1967): 347–73. On rent seeking theory, see James M. Buchanan, 'Rent Seeking under External Economies', in *Toward a Theory of the Rent-Seeking Society*, eds. James M. Buchanan, Robert D. Tollison and Gordon Tullock (College Station: Texas A & M University Press, 1980), 183–94; Anne O. Krueger, 'The Political Economy of the Rent-Seeking Society', *American Economic Review* 64 (1974): 291–303; Robert D. Tollison, 'Rent Seeking: A Survey', *Kyklos* 35 (1982): 575–602.

[7] On early riparian law in general, see Joseph Angell, *A Treatise on the Law of Watercourses*, 5th edn (Boston: Little & Brown, 1854); John M. Gould, *A Treatise on the Law of Waters, Including Riparian Rights, and Public and Private Rights in Waters Tidal and Inland* (Chicago: Callaghan, 1883); Farnham, *The Law of Waters*. Early English law is usually considered to have strictly protected property rights. See Robert G. Bone, 'Normative Theory and Legal Doctrine in American Nuisance Law: 1850–1920', *Southern California Law Review* 59 (1986): 1101–1226; Joel Franklin Brenner, 'Nuisance Law and the Industrial Revolution', *Journal of Legal Studies* 3 (1973): 403–33; Daniel R. Coquillette, 'Mosses from an Old Manse: Another Look at Some Historic Property Cases about the Environment', *Cornell Law Review* 64 (1979): 761–821; Carol M. Rose, 'Property Rights, Regulatory Regimes and the New Takings Jurisprudence – An Evolutionary Approach', *Tennessee Law Review* 57 (1990): 577–96. For more complex interpretations, see Scott and Coustalin, 'The Evolution of Water Rights'; Paul M. Kurtz, 'Nineteenth Century Anti-Entrepreneurial Nuisance Injunctions – Avoiding the Chancellor', *William and Mary Law Review* 17 (1976): 621–71. See also John P. S. McLaren,

'Nuisance Law and the Industrial Revolution – Some Lessons from Social History', *Oxford Journal of Legal Studies* 3 (1983): 155–221. The rule of 'no interference' was not absolute: the courts had to recognise a cause of action and its determination required an assessment of the significance of the complained injury.

[8] On Mill Acts, see Horwitz, *Transformation of American Law*; A. Allan Schmid, *Evolution of Michigan Water Laws: Response to Economic Development* (East Lansing: Michigan State University, Agricultural Experiment Station, Circular Bulletin No. 227, 1960). On transactions, see John R. Commons, *Institutional Economics: its Place in Political Economy* (New Brunswick: Transaction Publishers, 1990). On injunctions and trading, see Louise A. Halper, 'Nuisance, Courts, and Markets in the New York Court of Appeals, 1850–1915', *Albany Law Review* 54 (1990): 301–357; Christine Rosen, 'Differing Perceptions of the Value of Pollution Abatement across Time and Place: Balancing Doctrine in Pollution Nuisance Law, 1840–1906', *Law and History Review* 11 (1993): 303–381.

[9] Traditional seasonal ponds created by dams a few feet high grew into large, permanent ponds with dams over 10 feet high. See Rose, 'Property Rights and Regulatory Regimes'; Steinberg, *Nature Incorporated*. On 19th century water law, see Glen J. MacGrady, 'The Navigability Concept in the Civil and Common Law: Historical Development, Current Importance, and Some Doctrines that don't Hold Water', *Florida State University Law Review* 3 (1975): 511–615; Schmid, *Evolution of Michigan Water Laws*; Scott and Coustalin, 'Evolution of Water Rights'.

[10] See Davis, 'Water Pollution Litigation'. See also John T. Cumbler, 'Whatever Happened to Industrial Waste: Reform, Compromise, and Science in Nineteenth Century Southern New England', *Journal of Social History* (Fall 1995): 149–171; Terence Kehoe, *Cleaning Up the Great Lakes: From Cooperation to Confrontation* (DeKalb: Northern Illinois University Press, 1997); Steinberg, *Nature Incorporated;* Joel A. Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Akron: University of Akron Press, 1996).

[11] For the nature and intensity of water pollution litigation, see Davis, 'Theories of Water Pollution Litigation'. On early water pollution problems see Cumbler, 'Whatever Happened to Industrial Waste'; John Duffy, *The Sanitarians: A History of American Public Health* (Urbana: University of Illinois Press, 1990); Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: University of Chicago Press, 1960). Fish protection statutes existed where fishing was important. See Edwin B. Goodell, *A Review of Laws Forbidding Pollution of Inland Waters in the United States,* 2nd edn (Washington: U.S. Geological Survey; Water-Supply and Irrigation Paper No. 152, 1905). See also *State* v. *American Forcite Powder Manufacturing Co*, 50 N.J. L. 75, 11 A. 127 (1887); *State* v. *Kroenert*, 13 Wash. 644, 43 P. 876 (1896); *Commonwealth* v. *Sisson*, 189 Mass. 247, 75 N.E. 619 (1905). One reason for weak protection of fisheries was the enthusiasm for artificial fish propagation: it was thought that rivers could be restocked if fisheries are destroyed. See Donald J. Pisani, 'Fish Culture and the Dawn of Concern over Water Pollution in the United States', *Environmental Review* 8 (1984): 117–131; John F. Reiger, *American Sportsmen an the Origins of Conservation*, rev. ed. (Norman: University of Oklahoma Press, 1986); Philip V. Scarpino, *Great River: An Environmental History of the Upper Mississippi, 1890–1950* (Columbia: University of Missouri Press, 1985).

[12] See Rose, 'Property Rights and Regulatory Regimes'; Rose, *Property and Persuasion: Essays on the History, Theory, and Rhetoric of Ownership* (Boulder: Westview Press, 1994).
[13] See Rose, 'Property Rights and Regulatory Regimes'. See also Scott and Coustalin, 'Evolution of Water Rights'.
[14] *Tyler* v. *Wilkinson*, 24 F. Cas. 472, (No. 14,312 (C.C.D.R.I. 1827, 474).
[15] *Wheatley* v. *Chrisman*, 24 Pa. St. 298, 64 Am. Dec. 657 (1855, 658).
[16] See *Snow* v. *Parsons*, 28 Vt. 459, 67 Am. Dec. 723 (1856) and *Hayes* v. *Waldron*, 44 N.H. 580, 84 Am. Dec. 105 (1863). These cases were endorsed later in *Jacobs* v. *Allard*, 42 Vt. 303, 1 Am. Rep. 331 (1869); *Hazeltine* v. *Case*, 46 Wis. 391, 1 N.W. 66 (1879); *Canfield* v. *Andrews*, 54 Vt. 1, 41 Am. Rep. 828 (1882); *Red River Roller Mills* v. *Wright*, 30 Minn. 249, 44 Am. Rep. 194 (1883); *Lockwood Co.* v. *Lawrence*, 77 Me. 297, 52 Am. Rep. 763 (1885); *Barnard* v. *Sherley*, 135 Ind. 547, 34 N.E. 600 (1893), 47 N.E. 671 (1897).
[17] *Snow* v. *Parsons*, 28 Vt. 459, 67 Am. Dec. 723 (1856, 724–725).
[18] *Snow* v. *Parsons*, 28 Vt. 459, 67 Am. Dec. 723 (1856, 725).
[19] Priority by a long enough period of time may give rise to a prescriptive right and Story did not deny that. Prescriptive rights are exclusive private property rights and superior to common riparian rights. What Justice Story had in mind was to deny that priority of use or occupancy could rank ordinary claims to the use of water among the equally situated riparians. See *Tyler* v. *Wilkinson*, 24 F. Cas. 472, (No. 14,312 (C.C.D.R.I. 1827, 474).
[20] Justice Bellows argued 'The general principles that govern the use of running streams … must also govern in respect to the deposit in the stream of waste matter and foreign substances and resulting from the process of manufacture; namely, that a reasonable use may be made, and nothing more'. *Hayes* v. *Waldron*, 44 N.H. 580, 84 Am. Dec. 105 (1863, 106–107).
[21] *Hayes* v. *Waldron*, 44 N.H. 580, 84 Am. Dec. 105 (1863, 108).
[22] *Woodruff* v. *North Bloomfield Gravel Mining Co.*, 16 F. 25 (1883, 30). On mining controversies in the 19th century California, see Robert L. Kelley, *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley – A Chapter in the Decline of the Concept of Laissez Faire* (Glendale: Arthur H. Clark Co., 1959).
[23] *Lockwood Co.* v. *Lawrence*, 77 Me. 297, 52 Am. Rep. 763 (1885, 778).
[24] *Pennsylvania Coal Co.* v. *Sanderson and Wife*, 113 Pa. 126, 6 A. 453 (1886, 459).
[25] See *Robb* v. *Carnegie Bros. & Co. Limited*, 145 Pa. St. 338, 22 A. 649 (1891); *Pennsylvania Railroad Co.* v. *Sagamore Coal et Al.*, 126 A. 386 (1924).
[26] For accounts on the Progressive Era, see Richard Hofstadter, *The Age of Reform: From Bryan to F..D.R.* (New York: Vintage, 1956); Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890–1920* (Cambridge, MA: Harvard University Press, 1959); Samuel P. Hays, *The Response to Industrialism, 1885–1914*, 2nd edition (Chicago: University of Chicago Press, 1995).
[27] *Columbus & H. Coal & Iron Co*. Tucker, 48 Ohio St. 41, 26 N.E. 630 (1891, 632).
[28] See *Beach* v. *Sterling Iron & Zinc Co.*, 54 N.J. Eq. 65, 33 A. 286 (1895).
[29] See *Beach* v. *Sterling Iron & Zinc Co.*, 54 N.J. Eq. 65, 33 A. 286 (1895, 288–290). See also the opinion of the Supreme Court of Indiana in *Barnard* v. *Sherley* (1897). *Barnard* v. *Sherley*, 135 Ind. 547, 34 N.E. 600 (1893), 47 N.E. 671 (1897).
[30] *Strobel et. al.* v. *Kerr Salt Co.*, 164 N.Y. 303, 58 N.E. 142 (1900, 145).
[31] *Strobel et. al.* v. *Kerr Salt Co.*, 164 N.Y. 303, 58 N.E. 142 (1900, 147–148).

[32] See *Worthen & Aldrich* v. *White Spring Paper Co.*, 74 N.J. Eq. 647, 70 A. 468 (1908). The courts in Massachusetts were also strict toward industrial polluters but followed different legal reasoning. See *Parker* v. *American Woolen Co.*, 195 Mass. 591, 81 N.E. 468 (1907); *MacNamara* v. *Taft*, 196 Mass. 597, 83 N.E. 310 (1908). Abatement methods are discussed in e.g. *Strobel et. al.* v. *Kerr Salt Co.*, 164 N.Y. 303, 58 N.E. 142 (1900); *Parker* v. *American Woolen Co.*, 195 Mass. 591, 81 N.E. 468 (1907); *MacNamara* v. *Taft*, 196 Mass. 597, 83 N.E. 310 (1908).

[33] *Whalen* v. *Union Bag & Paper Co.*, 208 N.Y. 1, 101 N.E. 805 (1913).

[34] *Whalen* v. *Union Bag & Paper Co.*, 208 N.Y. 1, 101 N.E. 805 (1913).

[35] Whalen is discussed in *Driscoll* v. *American Hide & Leather Co.*, 170 N.Y. Supp. 121 (1918) and overruled in *Boomer* v. *Atlantic Cement Co.*, 26 N.Y.2d 29, 25 N.E.2d 870, 309 N.Y.S.2d 312 (1970). Union Bag and Paper was probably not very keen on continuing the operation of the mill – the case precedes by a few years a massive relocation of pulp and paper industry from the northern states to the South.

[36] In most cases the plaintiffs easily identified the source of water pollution. Sometimes it was the next mill a few hundred yards upstream. See e.g. *Palmer* v. *Mulligan*, 3 Caines 307 (N.Y.), 2 Am. Dec. 270 (1805); *Snow* v. *Parsons*, 28 Vt. 459, 67 Am. Dec. 723 (1856); *Hayes* v. *Waldron*, 44 N.H. 580, 84 Am. Dec. 105 (1863). At other times the source was further away, but usually not more than half a dozen miles upstream. See *Lockwood Co.* v. *Lawrence*, 77 Me. 297, 52 Am. Rep. 763 (1885).

[37] On theories of institutional change, see Eggertsson, *Economic Behavior and Institutions*. See also Demsetz, 'Toward a Theory of Property Rights'; Buchanan, 'Rent Seeking under External Economies'; Krueger, 'The Political Economy of the Rent-Seeking Society'; Tollison, 'Rent Seeking'.

[38] Walras postulated a hypothetical auctioneer who ensured that optimal outcomes were reached in his groundbreaking general equilibrium theory which set the foundations for contemporary economic theory.

[39] On cost-benefit theories of institutional change see North and Thomas, *The Rise of the Western World*; North, *Structure and Change in Economic History*; Posner, *Economic Analysis of Law*. On injunctions, see Gregory M. Travalio, 'Pay Up or Shut Down: Some Cautionary Remarks on the Use of Conditional Entitlements in Private Nuisance Cases', *University of Florida Law Review* 38 (1986): 209–251; A. Mitchell Polinsky, 'Resolving Nuisance Disputes: The Simple Economics of Injunctive and Damage Remedies', *Stanford Law Review* 32 (1980): 1075–1112; A. Mitchell Polinsky, 'Controlling Externalities and Protecting Entitlements: Property Right, Liability Rule, and Tax-Subsidy Approaches', *Journal of Legal Studies* 8 (1979): 1–48.

[40] On early republican conceptions of property, see Rose, *Property and Persuasion*; Gregory S. Alexander, 'Time and Property in the American Republican Legal Culture', *New York University Law Review* 66 (1991), pp. 273–352. On utilitarianism and the Progressive Era, see Hofstadter, *The Age of Reform*; Hays, *Conservation and the Gospel of Efficiency*.