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**COMPLICATIONS IN COMPLIANCE:
VARIATION IN ENVIRONMENTAL
ENFORCEMENT IN BRITISH COLUMBIA'S
LOWER FRASER BASIN, 1985-1996**

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Social and ecological systems must be more tightly coupled if the health of the biosphere is to be improved. So goes the argument of several well-known ecological thinkers and activist organizations (Laszlo and others, 1977; Daly and Cobb, 1994; Gladwin, 1992; Meadows, 1992; Suzuki, 1997). Broadly speaking, this normative position has theoretical and empirical support from organization theory, particularly from the institutional perspective (Friedland and Alford, 1991; Jepperson, 1991; Meyer and Scott, 1983). But recent new institutional research also suggests that compliance with state directives and coercive pressure is more complicated than the general theories about organizations and institutions might imagine. First, at the level of the nation-state, countries may not have equally strong policy regimes and regulatory mechanisms (Dobbin, 1994; Meyer and Scott, 1983; North, 1990; North and Thomas, 1973). Second, within a state, the regulatory domain governing the environment may not be well-developed or as affected by state strength as other domains, making coercive pressure weaker (Burstein, 1990; Dobbin and Sutton, 1998; Laumann and Knocke, 1987). Third, within the regulatory system, the legal system or legal profession may influence the enforcement of laws and standards, creating a mediating effect on compliance (Abbott, 1988; Dobbin, 1994; Suchman and Edelman, 1996). Fourth, the compo-

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nents in the regulatory system and its subsystems are likely to be loosely coupled, making systems-level outcomes unpredictable (Hironaka and Schofer, Chapter 9; March and Olsen, 1976; March, 1989; Thompson, 1967). Finally, a policy domain or regulatory system may be subject to different political regimes or modes of understanding over time (such as cognitive, regulative, and normative modes), and these modes may be somewhat independent of modes in operation elsewhere in the regulatory system or state (Hoffman, 1997; 1999; Hoffman and Ventresca, 1999; Powell and DiMaggio, 1991; Scott, 1995).

One important complication that has not been elaborated upon much in new institutional research into regulatory systems is the role of *enforcement* in compliance, especially environmental compliance outside the United States. To our knowledge, only Edelman, Pettersen, Chambliss, and Erlanger (1991) have begun to look at the actual enforcement of those policies. They examine the different roles human resources (HR) officers take in four organizational case studies of HR practices involving EEO/AA legislation. No one, to our knowledge, has examined how environmental enforcement fits into the regulatory domain. This chapter examines this question by examining variations in environmental enforcement in British Columbia's Lower Fraser Basin (LFB), a region in a well-developed, non-U.S. state—Canada (Lipset, 1960; Inkeles and Smith, 1974; Meyer, 1983). To document variations in enforcement, we focus on rates of environmental charges for noncompliance with water-related legislation from 1985 through 1996, a time following the setup of most of the important water-related laws and the local regulatory machinery. We use piecewise exponential rate models (Blossfeld and Rohwer, 1995; Tuma and Hannan, 1984) of an organization's risk of being charged in a given year to demonstrate the effects of political changes, spatial differences across three enforcement districts, and a few important organizational characteristics that are associated with noncompliance.

THE NEW INSTITUTIONAL PERSPECTIVE ON REGULATORY SYSTEMS AND ENFORCEMENT

Formally speaking, "compliance" refers to a regulated actor following the explicit and implicit laws, rules, and standards in a regulatory system—as opposed to being in "noncompliance" with them (Environment Canada, 1998; Wilson, 1989). An essential part of compliance is the regulatory framework or system on which it is based. That system includes policies guiding the system, technical bureaucrats who help develop and interpret policies, and routines and actors who apply them

to regulated actors (Downs, 1967; Krasner, 1983; North, 1990; Wilson, 1989). The system has multiple levels, from the policy level down to a technical level and to an operational level, at which point the system consists of the field of regulated actors. Compliance occurs when the policy and rules at the highest level are followed by the regulated organizations in an acceptable manner, as interpreted by technical bureaucrats and based on information received from operational agents.

A key space or domain for compliance within this regulatory system exists between the intersection of the system and the regulated field—the *domain of enforcement*. This includes the agents who monitor actors from the field, detect non-compliance, and apply sanctions to guarantee compliance, and it includes everything and everyone formally in the purview of the regulatory system. If monitored activities are within the standards of the regulatory system, then the regulated field is compliant and its activities are legitimate. But if they are outside the standards, then the activities in the regulated field are noncompliant, the actors creating them are deemed illegitimate, and the field's legitimacy as a whole is threatened. The daily struggle of the regulatory system is to minimize noncompliance, whereas the struggle of the field is to maximize freedom for its activities without losing legitimacy. This interplay creates a dynamic around enforcement that makes compliance somewhat problematic.

In older institutional theory, the key factor for understanding this dynamic was the existence of credible threat or application of formal sanctions (North, 1990; Williamson, 1985). That implies that the power of enforcing agencies and their actual sanctions need consideration. But at a deeper level, the threats and sanctions depend on having a state in which the regulatory system has embedded, legitimately, the sanctions and threats and that controls the means of power. That is, sanctions depend on state militaries, paramilitaries, and police. Legitimacy combined with force creates "coercive pressure" (DiMaggio and Powell, 1983).

Once a regulatory system creates standards or rules with the state's approval, coercive pressure will guarantee compliance by a field within low but acceptable limits. If you define compliance as zero number of actions being detected as out of noncompliance (and hence sanctioned), you would expect that following the passage of a new law or standard, the number of sanctions applied would rise to match the field's rate of noncompliance—a high level—but then both would drop dramatically, in tandem. The picture would be of a geometrically decreasing rate of noncompliance and sanctions.

However, a number of new institutionalists (Friedland and Alford, 1991; Hoffman and Ventresca, 1999; Meyer and others, 1994) have argued that the older in-

stitutional view of the regulatory system fails to include the underlying sets of interest groups and political cultures, apart from the formal stated policy of these systems. It appears that these interest groups and political cultures strongly influence enforcement. Research and theory has shown that political culture of the regulatory system shapes the creation and interpretation of regulatory policy over time (Edelman, 1992; Dobbin, 1994; Frank, 1997). Sets of understandings and interpretations of issues are likely to develop around interests and past activities. A consistent pattern of understanding and application of policy creates a "regime." In the case of enforcement, some regimes are more flexible in their interpretation and application than others. Political cultures that are more liberal, and technical bureaucrats who feel negotiation is better than direct orders in enforcement, will have different effects on enforcement than will conservative and bureaucrats believing in aggressive enforcement. Having one form of regime versus another changes what is considered an acceptable level of compliance with rules.

Furthermore, new institutionalists have documented the heterogeneity of organizational activities in fields and change in the compositions of these activities over time (Cliff, 2000; Strang and Meyer, 1994). Both the heterogeneity and the change over time have effects on the types of structures that arise and the legitimacy of activities in the field (Fligstein, 1991; Greenwood, Suddaby, and Hinings, 2001). By the same token, there would be a change in the demographic makeup of a field and the spatial heterogeneity of an organizational field to make a difference in the monitoring and sanctioning of activities across the field's members.

The combined effects of changes in the regulatory system and changes in the activities of the organizational field may make swings in enforcement rates very possible. For instance, rates of noncompliance and enforcement may not always follow a geometrically decreasing curve, but sometimes a sine wave pattern—a cyclical pattern of increasing and decreasing as enforcement regimes in a larger regulatory system change (Lawrence, Winn, and Jennings, forthcoming).

Environmental Enforcement as a Domain

Enforcement in the environmental domain is one arena where cyclical patterns of enforcement are particularly likely. Like other enforcement domains, the natural environment is an area in most developed states and has a formal regulatory system in charge of policy creation and interpretation and application (Frank, 1997; Laumann and Knocke, 1987). In addition, most nation-states tend to have the machinery for regulation in a few closely related organizations that are in charge of wide variety of environmental laws in order to gain synergies. That is, similar to police forces, environmental agencies tend to have enforcement branches with

conservation officers (COs) who enforce these laws and draw, at times, on local police.

In addition, and quite unlike some other enforcement domains, the environmental domain often requires active negotiation by actors in the regulatory system and organizational field as to the boundaries and indicators of each (Hironaka and Shofer, Chapter 9; Jennings, Zandbergen, and Clark, 1999). Furthermore, because it has both a social and ecological component, these two dimensions often geographically delimit the subdomain for environmental enforcement (Jennings and Zandbergen, 1995). For instance, a subdomain may be defined a regional ecosystem that has natural bounds by mountains and rivers but also has social and political boundaries that roughly match the natural ones. Or it may be built around a type of community that has become somewhat sustainable in a particular locale (King, 1995). Enforcement in the regions is determined jointly by the needs of the local ecosystem for sustainability, part of which can be documented by ecologists, and by the demands of the social system for efficient regulation. In many local domains, conservation officers do not act as police officers or are military personnel, but as conservation biologists and stewards who negotiate local standards.

ONE CASE OF ENVIRONMENT ENFORCEMENT WATER REGULATION IN THE LOWER FRASER BASIN OF BRITISH COLUMBIA

To detail our argument about enforcement as a domain and how sanctions work over time within it, we examine environmental enforcement in one case: the case of water regulation in the Lower Fraser Basin (LFB) in British Columbia, one of Canada's eight provinces. Figure 3.1 shows the local enforcement domain of the LFB. The LFB constitutes the lower one-third of British Columbia; it is geographically bounded but still diverse, and it contains the majority of organizations (80,000 or so). The British Columbia Ministry of Environment, Lands, and Parks (BCMOELP) divides up the province into different enforcement "regions" and in these regions are different "districts" for enforcement.

Four acts make up the bulk of water regulation and law that influence this domain: the Water Act (WA), the Fisheries Act (FA), the Waste Management Act (WMA), and the Pesticides Control Act (PCA). The two federal acts, the FA and WA, are the oldest, but were substantially modified in the 1970s. In the early 1980s, the WMA was created by the Province, along with a new set of agencies and enforcement principles for water management. The PCA was added in 1988, partly as an elaboration of key elements of the WMA for the agricultural sector. There-

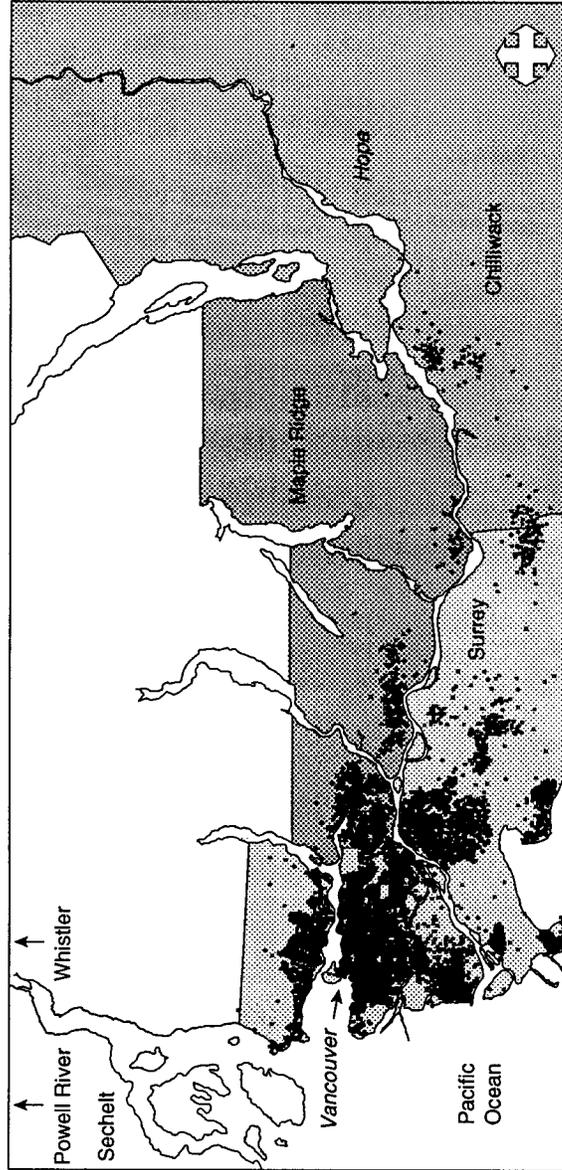
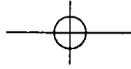
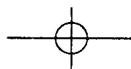


Figure 3.1 Enforcement Districts and Organizations in the Lower Fraser Basin's Field



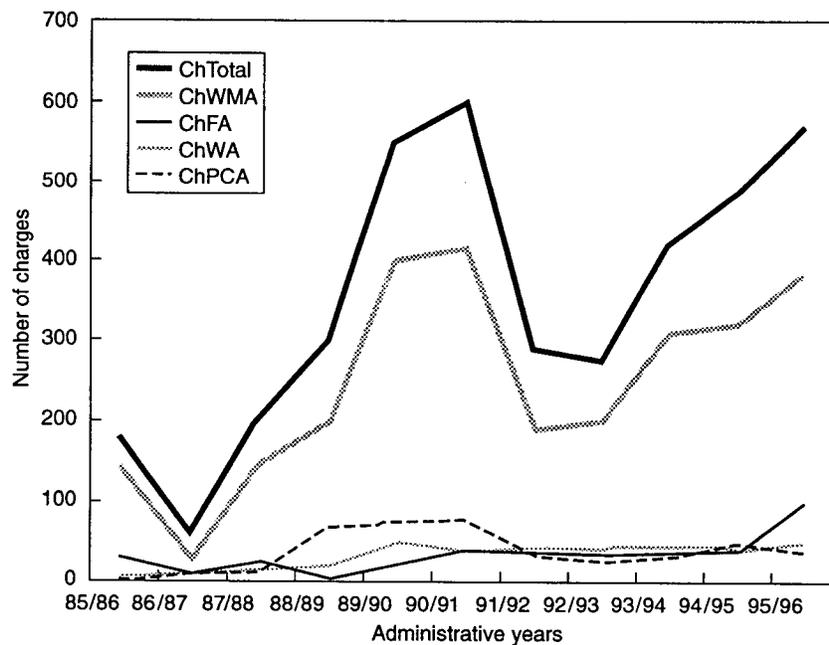


Figure 3.2 Selected Environmental Charges in British Columbia, 1985–1996

Note: Ch = number of legal charges brought against companies under four acts, WMA = Waste Management Act; FA = Fisheries Act; WA = Water Act; PCA = Pesticides Control Act.

fore, the water-related laws and the regulatory machinery for them were relatively constant (compared to laws for forest practices, wildlife, or air quality) from 1983 through 1996, the period under consideration.

Figure 3.2 shows the variations in the charges under water-related acts for LFB companies from 1985 through 1996. The total number of charges accelerates, then drops, then accelerates, then levels—creating almost two full oscillating cycles of charges. The first oscillation lasts from 1985 to 1991, and the second from at least 1991 to 1996. Two changes in two other indicators of enforcement, the number of hours spent enforcing all environmental acts and the strongest of the Acts that existed throughout the same time period (the WMA), roughly parallel the pattern for total charges. Although the LFB was growing during that time period, and hence the number of charges might be expected to increase, the rate of growth does not match the rate of growth in charges, the latter being much steeper. In addition, the charge rate oscillates, which is not explained just by the number of regulated actors in the system or growth in the system itself. What, then, explains these variations in charges?

EXPLAINING VARIATIONS IN ENVIRONMENTAL ENFORCEMENT

Changing Policy and Enforcement Regimes

Changes in enforcement regimes should affect changes in enforcement rates. An enforcement regime is the result of the interaction between the policy approach and the monitoring and control exercised by the regulators in a domain. A strong enforcement regime for environmental issues is one where the policy approach is liberal (pro-environmental) and the monitoring and control is quite active. A moderately strong regime is one where the policy is more conservative, but the monitoring and control is active. A somewhat weaker regime is one where the policy regime is more liberal, but monitoring and control is passive. And the weakest regime is where policy is conservative (not environmental) and the monitoring and control passive.

For instance, in the United States there was a moderately strong regime for enforcement in the early 1970s under the conservative government but with the new EPA in place; but that regime was considerably weaker in the mid-1980s under the conservative government that was busy trying to dismantle key pieces of enforcement machinery in the EPA and putting discretionary monies in sinkholes such as the Superfund. A geometric increase in lawsuits occurred from 1970 to 1978, followed by a slight dip, then a rise, then a drop again in the mid-1980s (Hoffman, 1997: 88–91).

In Canada, the enforcement regimes for water regulation are more local in nature. Even though Canada is a well-developed nation-state (Lipset, 1960; Inkeles and Smith, 1974; Meyer, 1983), Canada's Environmental Protection Act (CEPA) is much weaker than the U.S. National Environmental Protection Act (NEPA) and similar legislation in other countries. CEPA was passed in 1989 to supplement and coordinate existing legislation (Dorsey, 1991b; Rankin, 1991; Thompson, McConnell, and Huestis, 1993). But in fact it gave the provinces and provincial laws more influence over water regulation and enforcement (Dorsey and Ruggerberg, 1989; Rankin and Finkle, 1983), which makes focusing on provincial level variations in enforcement critical.

The Effects of Regimes in B.C.

In British Columbia in the 1980s, a conservative (Tory) government was in control. Its formal opposition party, the NDP (National Democratic Party), was explicitly associated in the press and in political campaigns with unionism and environmentalism (Dyck, 1995). And starting in the mid-1980s, federal and

provincial regulators were increasingly active in their approach to environmental issues (Dorsey, 1991a; Huestis, 1993; Jennings and Zandbergen, 1995). Joint provincial-federal programs were developed in 1985 to handle noncompliance and pollution problems in a number of industries. These multistage programs had an enormous effect for several years, one documented by a three-case study done of industries in British Columbia (Krahn, 1998). In 1987 and 1988, the fourth stage of the antisapstain and the pulp and paper program began, one that forced compliance directly with charges, fines, and possibilities of business closures caused: firms to begin to comply (Krahn, 1998: 19). This period matches the increase in enforcement of environmental laws in the Province.

But this aggressive enforcement effort eventually ran afoul of the conservative government: in mid-1990 the conservatives vetoed legislation strengthening water-related measures, putting a brake on some of the administrative fervor for cleaning up industries and waterways (Dyck, 1995). At the same time, the head of this party, Bill Vander Zalm, was under pressure to resign due to improprieties, and a new election was on the horizon within a year. The decrease in charges matches this time period.

In the fall of 1991 there was an election, and a new, more liberal government took power at the provincial level and immediately signaled its willingness to increase enforcement activities and to demand more than voluntary compliance. This new government wanted to distance itself from the former conservative party that had ruled the province for most of the two previous decades, and it wanted to address the local and international perception that the province lacked state-of-the-art environmental technology and standards. The focus of the new government was on forest-related matters: it developed the Forest Practice Code legislation that was eventually passed in 1995. In the area of water quality and pollution, its plan was to extend the funding of programs like FBMP and FREMP out more years rather than to increase it, and to only modestly increase the number of conservation officers in the LFB districts (BCMOELP 1997; BCMOELP 1999).

However, in 1994 the leader of the new party and the Forest Practice Code initiative, Premier Mike Harcourt, like Vander Zalm before him, had to resign due to some improprieties in his party. He was replaced in the next year by a premier who was more concerned about jobs for union members than environmental constraints on the industries that employed them. Ironically, during the time when the liberal government was in power in the province and concerned with the environment, the federal government and the Canadian people became less interested in social programs and initiatives like the environment (Blake, 1996). Instead, the attention was on balancing jobs and environmental conservation and reducing the federal deficit. The legal policy instruments encouraged in the 1980s were still be-

ing used, but the administration of the laws and the pursuit of enforcement by the federal groups became less dramatic, partly because departments like DFO were cutback and reorganized a number of times during this period. The outcome was a more passive stance towards enforcement in the 1994–96 period, but under the aegis of a liberal regime (Dyck, 1995).

To summarize and simplify this more complex historical picture about policy and enforcement regimes, one might say that the earliest period under study was a conservative policy starting with passive but ending with increasingly active enforcement. The second period was characterized by conservative policy conducted by an embattled government yet with aggressive enforcement, but near election time enforcement activities dropped dramatically. The third period, beginning just after the election, is defined by liberal policy with increasingly active enforcement—but in selected environmental areas. And the fourth period is one of liberal policy with somewhat passive enforcement. In other words:

Hypothesis 1: Due to changes in policy regimes, the rates of enforcement were highest in Period 3 (1991–1994), then Period 2 (1988–1991), followed by Period 4 (1994–1996), and lowest in Period 1 (1985–1988).

Spatial Differences and Heterogeneity of Organizational Activities in the Field

Policy and its enforcement should vary across social and political boundaries within domains. Strang and Meyer (1994) demonstrated in their study of school districts that the history and demographics of districts may make them more likely to adopt new practices—or resist them (also see Baron, Mittman, and Newman, 1991). In the case of the environment, initiatives are pursued within defined administrative and ecosystem boundaries. Highly urbanized districts face different problems than less urbanized districts. For instance, the former have a much denser set of organizations to monitor, and a much higher likelihood of non-point pollution because of all the runoff from paved areas. The types of remediation detection that can be done in the urban area are also quite different from the rural area. It is difficult to turn the city back into countryside (Zandbergen, 1999).

Within the regional ecosystem defined by the LFB, there is one highly urban, enforcement district (Surrey), one suburban district (Maple Ridge), and one rural district (Chilliwack). Variation exists across districts in terms of their budgets, officers, and the profile of the organizations being monitored. In 1995, the Surrey district contained over 65,000 organizations of all sizes, many involved in service businesses; the Maple Ridge district had just over 10,000, with a mix of industries;

and the Chilliwack district had the remaining 6,000 or so firms, many directly or indirectly involved in agriculture (Jennings and Zandbergen, 1999[1995 in refs and elsewhere. Fix? Or is this a new cite that needs to be added to the refs?]). Along with the administrative office, monitoring groups, and local volunteers, the Surrey district has had an average of six conservation officers; the Maple Ridge, four; and Chilliwack, two full-time and one part-time officers. In terms of resources and regulations, we might expect the most rural district, Chilliwack, to have the highest enforcement rates per organization.

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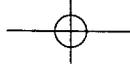
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But besides the resource issue, there is a deeper policy issue around enforcement that may be associated with districts. In the 1980s, following the 1970s Fraser River projects and the Waste Management Act's passage, the focus in the LFB was on cleaning up industrial areas affecting waterways (Dorsey, 1976; 1991a). In the mid-1990s, the focus in the LFB appeared to shift somewhat toward agricultural issues, such as runoff and aquifer pollution (Lavkulich, Hall, and Schreier, 1999). These are more rural in nature. The suburban district is a mix of urban and rural. One might expect that the suburban district would be affected by both tendencies in policy and have its own unique issues around expansion onto agricultural reserves. But one might also argue that it will not be as affected as either district, given its different mix of organizations. The main contrast is between the urban and rural districts:

Hypothesis 2: The rates of enforcement will be higher in the rural than the urban enforcement district.

Rates of enforcement within an enforcement subdomain should also vary with the types of organizations being monitored and controlled. Not only is the sheer number of organizations being monitored (that is, in a district) important, but also the types of activities of these organizations make a difference for their likelihood of being charged. In this case, we are concerned with the actual establishment of an organization in the LFB, for it is the establishment that is monitored and fined by the regulatory agency.

There are two ways of assessing the activities of establishments: one in terms of more observable regulations and resources and activities in the regulatory system (an older institutional view), and one in terms of the less observable activities that help guarantee legitimacy and negotiate understanding in the system (the newer institutional view). The amount of pollution that an establishment produces is a critical consideration in whether it will be charged for an environmental offense. However, without having direct indicators of pollution amounts, given how much variation there is in types of pollution, the lack of systematic monitoring, and



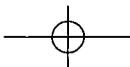
the large number of establishments, the size as an indicator of scale of operation can act as a proxy for the amount of pollution activity (Kolluru, 1994; Porter and van der Linde, 1995; Schmidheiny, 1992). In addition, from the older institutional point of view, large establishments that cause a lot of pollution may be more worth prosecuting, because they are more visible. Prosecuting them sends observable signals to others in the system that pollution is *not* okay (BCMOELP, 1997; Krahn, 1998).

However, from the new institutional point of view, a large establishment is concerned with legitimacy and being caught polluting can damage the establishment's standing in the local community as well as its legitimacy with regulators (Scott, 1995; Scott, Meyer, and associates, 1994). Large establishments depend more on their standing and legitimacy than smaller ones, and large establishments know that they are more visible (Meyer and Scott, 1983; Scott, 1995), so they should try harder not to pollute. Hoffman (1997; 1999) suggests that many such establishments are adopting more advanced environmental management systems and the philosophy of strategic environmental management in order to clean up their acts.

On balance, it seems that from within the intersection of the regulatory system and the organizational field, size is more representative of scale of pollution and visibility of signal to the other establishments than of how concerned an establishment will be with not polluting. This is particularly true if other measures about reputation, such as membership in environmental associations, are considered, as they are below. In other words, we expect:

Hypothesis 3: The rates of enforcement will be higher against larger establishments.

Similarly, from within the enforcement domain, being an older establishment and/or being a manufacturing establishment should lead to higher rates of enforcement. Age and manufacturing are proxies for older technology and technologies that involve more pollution. Besides having the higher likelihood of older technologies, older establishments are better known to the regulatory institutions and thus monitoring their behavior may be easier. By the same token, establishments in heavy manufacturing, mining, and agriculture are often monitored by the Ministry because they are the sources of many of the substances listed in the water quality standards, such as dioxin, lead, arsenic, and PCP's (Dorsey, 1991a; Hall, Schreier, and Brown, 1991). More permits are also issued in this sector (Dorsey and Ruggeberg, 1989). In fact, studies have shown that older establishments in



heavy manufacturing tend to be prosecuted more for pollution (Brander, 1995; Hoffman, 1997).

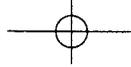
Hypothesis 4: The rates of enforcement will be higher against older establishments.

Hypothesis 5: The rates of enforcement will be higher for establishments in primary manufacturing than for those in secondary manufacturing, and lowest for those in nonmanufacturing sectors.

Establishments that are part of multiunit establishments may also experience different rates of environmental enforcement than single unit establishments, even when controlling for size and industrial variation. Being a multiunit operation means that there are two or more branch plants and a headquarters unit. From an institutional theory point of view, the existence of multiple branch plants means that there is less monitoring in each plant and thus a greater chance that operations in one unit might fail, causing pollution, and that this pollution might be detected. To new institutional theorists, a branch plant means that an establishment is less tied to the local community and probably less concerned with legitimacy locally. This is particularly true when the headquarter unit is outside of the LFB or British Columbia. Research on plant location has documented the higher rates of plant closure and community impact of branch plants (Erickson, 1980). In either case we would expect that:

Hypothesis 6: The rates of enforcement will be higher for branch plants than for locally owned and/or operated establishments.

Headquarters of a multiunit establishment located in the LFB may also in experience different rates of environmental enforcement than single unit, locally owned and operated establishments. From an institutional standpoint, the strategic planning and responsibility for the establishment is located in the headquarter and whenever there is ambiguity about who should be cited for an environmental offense, the top managers will be the default. The law does hold managers and directors of companies liable, lending some support for this view (Dorsey, 1991a). From a new institutional point of view, the headquarters is concerned with image and legitimacy in the establishment. Headquarter units are likely to take more responsibility, and if there are any operations on site along with the headquarters (which does happen), then these operations are more likely to be in compliance than more distant operations. Both viewpoints have merits in terms of how head-



quarters might be evaluated in the enforcement subdomain. Therefore, we argue that:

Hypothesis 7: The rates of enforcement will be differ for headquarters of multiunit establishments from the rates for locally owned and/or operated establishments.

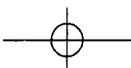
A final consideration is that some establishments are allowed to use more resources and must create more waste than others. The Ministry keeps track of these establishments and these establishments keep track of their resource use and waste through permits. From the point of view of the regulator, if an establishment has a permit, it is more likely to be monitored by the agents of the Ministry. On the one hand, this may make the establishment more conscientious and less likely to be charged; on the other hand, because more monitoring is occurring, it may mean that the establishment is more likely to get charged. Even if the monitoring rates are low, if a establishment is caught violating its permit, the establishment may be more likely to be charged because it should have been in compliance.

Within the subdomain of enforcement, we think that having a resource use permit simply means that the resource covered by the standards and the legislation of the system is in heavy use and that pollution is more likely—and hence so is a fine. Permits are signals that establishments need extra attention, even if monitoring is known to be sporadic:

Hypothesis 8: The rates of enforcement will be higher for establishments with resource use permits.

A final, important consideration is whether an organization is a member of a professional environmental association. If it is, it may respond differently to pressures for compliance than one that is not. New institutional theory maintains that professional associations act as independent bodies that enhance mimetic and normative forces, and even help block coercive ones (Powell and DiMaggio, 1991; Scott, 1995). Having a representative of the organization as a member in an environmental association may provide it with more expertise to address its environmental problems. It may also increase the normative pressure to conform to the association's standards—or face charges of hypocrisy.

Dobbin and Sutton (1998) and Edelman (1990; 1992) have argued that professional associations may have mediating effects on important institutional outcomes. Their studies of legal professionals in the adoption of HR departments and practices show that having a legal professional may actually substitute for an HR



department, depressing the rate of department adoption or practice use. However, being a member of an environmental association is not the same as having an environmental lawyer on retainer. It does not bring the legal field into action and barely activates the field of environmental specialists on the establishment's behalf. We feel, then, that there will be mostly a main and not mediating effect in this case:

Hypothesis 9: Rates of enforcement will be lower against companies that have a member in or are members of one of the locally recognized environmental associations.

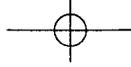
METHODOLOGY FOR ASSESSING VARIATION AND ITS SOURCES

To test our hypotheses, we collected episode data on enforcement, as well as some panel data on government changes, enforcement districts, and organizational characteristics in the LFB. In addition, we interviewed enforcement officials in the Ministry in 1995 and 1999 about enforcement policies and practices during the 1980s and 1990s, and we interviewed other selected members of the organizational field about environmental management during the same years. We analysed the longitudinal data with event history models and used the interview data as anecdotal material whenever we felt it fit.

Sample

Our sample consists of all firms in the LFB that existed from 1984 to 1996 ($N = 58,172$). We used 1994 data collected by Contact Target Marketing Service on all registered establishment in the LFB's municipalities ($N = 85,443$) and selected only establishments that were ten years old for the study. Although the surviving population differs in size from the full population, t-tests on comparable variables showed no major differences. Both samples are characterized by a high number of small organizations, primarily in nonmanufacturing and with private ownership.

Rates of enforcement came from a number of small data sets on enforcement actions per year (about 300 per year) collected by the B.C. Ministry of the Environment. The 1980s data was in hard copy by administrative year (July 1–June 30) and had to be collected in the provincial capitol, integrated into a larger data set, and matched with the data on existing firms. Charges against individuals were not used, only those against companies. In the case of multiunit organizations, we recorded only offences against the subunit whenever possible. If the subunit was not clear, we recorded it against the headquarters unit. Most establishments had



one establishment, most multiunit establishments had only two or three branches, and few establishments had multiple charges in a single year.

Variables

The main dependent variable is being charged or not during an administrative year (Table 3.1). “Charged” refers to legal charges laid by BCMOELP under the Water Act (WA), the federal Fisheries Act (FA), the Waste Management Act (WMA), and the Pesticide Control Act (PCA). These four water-related acts, like a number of other water-related standards and laws, overlap and are often used in conjunction. Hence, we code whether or not a company was charged under any one of them in a given year as a “charge.” There were 634 charged establishments over the eleven periods (see Table 3.1).

The periods in the analyses were created based on the historical record, encoded in Hypothesis 1, and on visual examination of Figure 3.2. The first period is from 1985/86 through 1987/88; the second period is from 1988/89 through 1990/91; the third period is from 1991/92 through 1993/94; and the fourth period is from 1994/95 through 1995/96. The first is labeled as “conservative, passive,” the second as “conservative, aggressive,” the third as “liberal aggressive,” and the fourth as “liberal passive.” Note that the regime labels and the tendency that they capture do not exactly match oscillations found in Table 3.1. The figure might lead us to believe that a much more passive enforcement system was at work during the 1991–1993 period than the case history of the system actually demonstrates.

The enforcement districts in the analyses are based on Hypothesis 2. We coded an urban and a suburban district and contrasted them with the rural district as the omitted baseline. The urban district refers to the Surrey enforcement area, which includes Vancouver, Burnaby, Richmond, and Surrey. The suburban district includes Langley, Delta, and parts of Surrey, Maple Ridge, and Coquitlam. The rural district includes Abbotsford, Chilliwack, Matsqui, and areas surrounding Hope. The boundaries for these districts did not change substantially in the 1985–96 period, although there was one unit, “Industrial Investigations,” associated with the Surrey office and one associated with the Maple Ridge office and the latter unit was closed in the late 1990s. The data for these units were rolled into the offices in question.

The independent variables for the organization’s characteristics are quite similar, with the addition of a few covariates. Size refers to size of the establishment at that particular location in number of employees. Contact Marketing only provided categories of size, for 1–10, 10–20, 20–50, 50–100, 100–250, 250–500, and 500+ employees. We used the midpoint of the size classes to create an interval level



Table 3.1
Frequencies, Means, Standard Deviations, and Correlation
for Selected Determinants of Environmental Enforcement

<i>Variables</i>	<i>Frequency (Number)</i>	<i>Means (Standard Deviation)</i>	<i>Correlation with Being Charged</i>
Charged vs. not charged	(634) 1%		
Period			
Conservative, passive:			
1985/86–1987/88	(6) 1%		
Conservative, aggressive:			
1988/89–1990/91	(190) 30%		
Liberal, aggressive:			
1991/92–1993/94	(262) 41%		
Liberal, passive:			
1993/94–1995/96	(176) 28%		
Nonrural district			
Urban district	(47,743) 82.1%		-.040**
Suburban district	(6,790) 11.7%		.038***
Organization			
Organizational size		11.23 (39.01)	.088***
Organizational age		21.18 (24.80)	.012***
Primary manufacturing	(9,582) 16.5%		-.004
Secondary manufacturing	(18,538) 31.9%		.077***
Branch plant	(14,345) 24.7%		.118***
Headquarters	(2,621) 4.5%		.012***
Permit	(626) 1%		.392***
Environmental association	(595) 1%		.276***

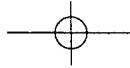
$N = 58,172$ firms existing in Lower Fraser Basin 1984–1996.

* $p =$ ** $p =$ *** $p =$

variable. The average size of firms was 11 persons. Industry refers to being in primary, secondary, or tertiary industries, where primary refers to agriculture, mining, and construction, secondary to manufacturing and heavy utilities, and tertiary to all other industries—mostly services. Producing in a tertiary industry is the omitted category in all analyses. As expected, the bulk of organizations are in services. The establishment type refers to being a local firm, a branch plant, or a headquarter with branch plants in the LFB and elsewhere. A dummy variable is constructed for the analyses with being a locally owned and operated company as the

Note:
Need further
info
* $p =$

- 6 & 5



omitted category. About a third of companies are nonlocal branch plants. Age is the number of years from 1995 to date of incorporation. Having a resource use permit refers to having a water permit on file with the Ministry of Environment that existed for at least one year, 1984–1996, based on 1999 data of all permits and permit dates provided by the Ministry. Few companies have a water permit (626 in Table 3.1). Being a member of an environmental association refers to being registered in 1999 by one of four known environmental associations that have some representatives in British Columbia: the Canadian Environmental Industry Association-B.C. Chapter (CEIA-BC) the Industrial, Commercial, Institutional Environmental Managers Association (ICIEMA), the Canadian Environmental Certificates Approval Board, and the Canadian Water Resources Association. Data from the last two groups was eventually dropped because they are new associations. Again, the rates here are low ($N = 595$ in Table 3.1).

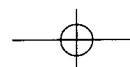
Methods of Analysis

Dobbin and Sutton (1998) and Edelman (1990; 1992) in their studies of the evolution of HR policy and practices employ event history models to determine whether variation is more strongly associated with time periods, types of states, or time periods. We follow a similar strategy. Like the other authors, we use piecewise, exponential hazard rate models (Allison, 1984; Cox, 1972; Blossfeld and Rohwer, 1995; Tuma and Hannan, 1984) to estimate effects of the determinants on charges. In the piecewise exponential model, the hazard rate is a function of time periods and proportional covariates:

$$r_{jk} = \exp[a_1^{(jk)} + A^{(jk)}a^{(jk)}], \text{ if } t \in I(l) \quad (\text{Eq. 1})$$

where $r_{(jk)}(t)$ is the transition rate, and for each transition (j,k) , $a_l^{(jk)}$ is the constant coefficient associated with the l th time period, $A^{(jk)}$ is the row covariates, and $a^{(jk)}$ is an associated vector of coefficients assumed not to vary across the periods (Blossfeld and Rohwer, 1995: 111–117). We also employ exponential models with period-specific effects to capture the impact of constant covariates within each of the four time periods in question. This model is a slightly more general model than the one in Equation 1, where t varies only within each time period and not for all.

Maximum likelihoods are shown in the tables to assess the overall fit of the model, based on $-2 \times \text{loglikelihood}$ having a chi-squared distribution with N degrees of freedom ($N = \text{difference between the prior and the next model}$). Student t -tests are used to examine the significance of specific coefficients. However, we have selected what amount to the known population of surviving firms from



1985–1996, so it might be argued that all the coefficients are significant, even if some have more variation around their estimates than others.

RESULTS

The Effects of Regimes and Enforcement Districts

Table 3.2 shows the exponential models of being charged, with pieces for the time period for enforcement regimes. We step in the regime periods and then district characteristics to test our argument about the existence and operation of this subdomain. The third column has the full model to see if the subdomain's effects are robust and as direct as we have argued. All three models in Table 3.2 show significant effects for the pattern we expected, providing strong support for Hypothesis 1: enforcement regimes have different effects which, over time, create cyclical variations in enforcement.

More specifically, we argue that the second and third period would have the highest rates of being charged, followed by the fourth and then the first. The results show that the third period has the highest rates (least impact) on being charged, followed by the second and fourth and then by the first period. Period 1 (1985/86–1987/88) is one of policy development under a conservative local government and with a weak enforcement tradition, whereas Period 2 (1988/89–1990/91) is one with focused policy implementation and enforcement, particularly in pulp and paper. Period 3 (1991/92–1993/94) is one of a liberal government with strong policy and increasingly strong enforcement in the last year and a half of the period. Period 4 (1994/95–1995/96) is one of instability. The enforcement rates remained somewhat high but leveled. In part, this is due to a provincial change in government (again!) and to a freeze, then a cut, in resource in the ministry.

As we argued in Hypothesis 2, the policy domain of enforcement also appears to have a spatial component. Table 3.2 shows that enforcement varies by district, with lower rates of enforcement occurring in the urban district relative to the omitted baseline, the rural Chilliwack enforcement area. No effect is found for enforcement in the suburban district versus the rural one. The results support the argument that resources for enforcement per regulated organization were quite low in the urban area, as well as the argument that rural issues came to dominate the forefront of enforcement in the basin in the 1990s.

Although the piecewise model supports the existence of period and spatial effects, analysts may find it hard to accept the claim that these effects are actually

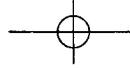
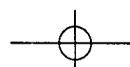


Table 3.2
Piecewise Exponential ML Estimates of the Determinants of Being Charged

<i>Variables</i>	<i>Periods</i>	<i>Periods and Districts</i>	<i>Periods, Districts, Organization</i>
Period			
Conservative, passive: 1985/86–1987/88	–9.872*** (.408)	–9.491*** (.427)	–11.620*** (.446)
Conservative, aggressive: 1988/89–1990/91	–6.821*** (.0725)	–6.439*** (.1445)	–8.536*** (.194)
Liberal, aggressive: 1991/92–1993/94	–6.494*** (.062)	–6.111*** (.140)	–8.150*** (.189)
Liberal, passive: 1993/94–1995/96	–7.177*** (.075)	–6.794*** (.146)	–8.691*** (.193)
Nonrural district			
Urban district		–.577*** (.140)	–.6631*** (.144)
Suburban district		.312** (.155)	.1925 (.158)
Organization			
Organizational size			.0024*** (.0003)
Organizational age			.0049*** (.0015)
Primary manufacturing			.9838*** (.139)
Secondary manufacturing			1.1223*** (.1094)
Branch plant			1.6966*** (.1097)
Headquarters			1.2245*** (.1849)
Permit			2.7532*** (.1052)
Environmental association			1.4457*** (.1443)
Log-likelihood	–4,953.96***	–4,913.07***	–3,847.978***
Degrees of freedom	(4)	(6)	(14)

Note: All models use 12 periods with 634 events across the periods with the total number of spells of 58,172. The constant in the model is constrained to zero, and the log-likelihood of the constant's model is –5,071.12.

* $p > .10$ ** $p > .05$ *** $p > .01$



indicators of changes in the enforcement subdomain, one driven by a great deal of provincial policy development and implementation. Many researchers would need more evidence. Table 3.3 offers some of that evidence in the form of time period models for being charged (Blossfeld and Rohwer, 1995: 115). If there is a dynamic going on within the enforcement subdomain, then we might also anticipate that the various enforcement regimes will have different influences on the impact of enforcement districts and organizational characteristics. In Table 3.3, we see that being in a particular period does influence the pattern of effects. Being in an urban versus rural district has the strongest effect in Periods 3 and 4, and being in a suburban district, has positive effects in the late 1980s but negative effects in the 1990s. It appears that the urban district was “where the action was” in the 1980s, whereas the rural districts were where the action was in the 1990s. The variation over time is greater for district characteristics than most organizational characteristics. Most organizational characteristics, except age, appear to have a uniformly positive effect on enforcement. We discuss these effects in more detail soon, but the point here is that the elements of enforcement domain do indeed vary over time and have documented effects. This supports the claim that environmental enforcement is a subdomain.

When we interviewed conservation officers in 1995 and in 1997, we found that they were aware of some shifts in focus and some policy changes over the years. The chief conservation officer (CO) for the LFB in the early 1990s noted that there was a large concern with agricultural runoff and with specific farms that could not be named at the time (BCMOELP, 1997). When asked about increases in enforcement, the chief CO agreed that the Ministry had spent a lot of time in the late 1980s and early 1990s investigating pulp and paper and chemical firms. In the words of the CO, “It was a blitz.” But neither the older nor newer officer acknowledged changes in the provincial capital, or changes in parties, as having a direct effect on their enforcement practice. The most they would say was that if someone phoned in from higher in the ministry with a particular issue, often one hot on the front page of the newspaper, they would probably have to move investigations around to place that issue forward in the queue. Such was the case with wildlife enforcement in 1994–95 (BCMOELP, 1997), and, more recently, with mushroom composting and Burns Bog (BCMOELP, 2000).

The Effects of Heterogeneous Organizational Activities

When considering the regime and district effects explicitly—that is, the context of enforcement, what are the effects of organizational characteristics on being charged for an environmental offence? In Table 3.2, we see that, as predicted by

Table 3.3
Piecewise Exponential ML Estimates of the Determinants
of Being Charged by Time Period

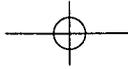
<i>Variables</i>	<i>1985/86– 1987/88</i>	<i>1988/89– 1990/91</i>	<i>1991/92– 1993/94</i>	<i>1994/95– 1995/96</i>
Constant	–27.7244 (75.3601)	–9.578*** (.3892)	–7.7435*** (.2731)	–8.4752*** (.3655)
Urban district	7.9085 (70.4398)	–.2503 (.2911)	–.9772*** (.2112)	–.8663*** (.2692)
Suburban district	8.4740 (70.3561)	.8852*** (.2936)	–.4603** (.2480)	–.5997** (.3236)
Organizational size	.0048*** (.0020)	.0009 (.0008)	.0040*** (.0005)	.0008 (.0010)
Organizational age	–.0141*** (.0290)	.0109*** (.0023)	–.0079*** (.0029)	–.0057* (.0039)
Primary manufacturing	8.3664 (27.0137)	.1628 (.2861)	1.5254*** (.2215)	1.6834*** (.3051)
Secondary manufacturing	7.6628 (27.0165)	1.0072*** (.1796)	1.4809*** (.1751)	1.5217*** (.2744)
Branch plant	–1.6042 (1.1855)	2.1842*** (.2580)	1.7652*** (.1642)	.5517*** (.2272)
Headquarters	–1.6076*** (1.7448)	2.0887*** (.3449)	.7374*** (.3209)	1.0936*** (.3222)
Permit	5.3345*** (.1123)	4.1446*** (.1612)	–.1753 (.2416)	3.4616*** (.2098)
Environmental association	.6562 (1.3150)	–11.4195 (49.3741)	2.8678*** (.1581)	2.8738*** (.2162)
Log-likelihood (total)	–3,511.954**			
Degrees of freedom	(44)			

* $p > .10$ ** $p > .05$ *** $p > .01$

Hypotheses 3–7, being large and old and in manufacturing (primary or secondary), being multiunit (a branch or headquarters), and requiring a resource permit all have a positive effect on the likelihood of being charged from 1985–1996. This supports the claim that size, age, industry, configuration, and resource use are visible signals and proxies for actual resources flows when seen from the policy subdomain. These elements tend to be monitored and controlled, even if in other fields they might actually be proxies for legitimacy, especially for firms that have experience with handling pollution, such as those dealing in the environmental management field (Hoffman, 1997; Lex and Jennings, 1998).

However, contrary to our prediction in Hypothesis 8, being a member of an environmental association does not decrease the likelihood of being charged for an environmental offense:—it increases it. A cynic might say that the common sense interpretation should be exactly that: environmental associations mean little and are just covers for polluters. But new institutional theory has consistently shown the positive impact of professions and professional associations on organizational outcomes, so it cannot be dismissed blindly. One possibility is that the environmental associations are not that professional, but this is unlikely given the very formal designation of the associations by federal and provincial bodies and given the “blue chip” membership list of many of them. Another possibility is that the impact of the associations on practice may not have occurred yet. Perhaps in most cases professionals begin to make a difference only in places where they are first really needed. This is a definite possibility, because two of the four associations had to be dropped from our data sources for being too new, and the other two were established only in the early 1990s.

Table 3.3 shows the effects for the organizational characteristics over time. We find that the effect of organizational signifiers in the system may change, but they do not appear to have changed much between 1985 and 1996. Whenever effects are registered, they tend to be positive. Being large, in manufacturing, in a multiunit firm, having a resource permit, and in an environmental association increases the likelihood of being charged. Being an older firm tends to increase charges only in Period 2, but actually decreases them in Periods 1, 3, and 4. We do not have a good theoretical explanation based on the regimes or nature of the variable to explain this. However, given the time-related character of this variable, we think it is worth exploring as a time-dependent covariate. It may be better recoded as a more explicit set of categories for very old versus moderately old versus younger firms, because our argument is that age is a signal in the subdomain and we could actually try to see if there is a discrete element to that variable.



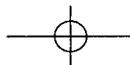
Nevertheless, one question worth pondering is whether organizational characteristics should show more variation across enforcement regimes than they do. If an enforcement regime is “passive and conservative,” then the view of the regulated members of that domain might differ from the views when it is “active and liberal.” In our interviews, we asked how officers view organizations and how their firms respond to their investigations. One CO said, “It doesn’t matter: we’re coming in to get our information whether they want us or not.” That person related a story of how a firm tried to stonewall and the firm’s manager was very surprised to see the CO back a day or two later with a court order to seize documents. But another CO also noted that “there are good firms and bad firms.” She felt particularly bad about having to charge a good firm twice, a couple of years apart, because “you could see that they were trying.”

In other words, there is some anecdotal evidence that people in the enforcement agency conceptualized firms in different manners, even if they claimed they don’t negotiate and treat all companies the same way. But there was little evidence of a conscious reconceptualization of the role of firms in the system. Instead, officers wrestled more with their own roles and activities within their agency. Some COs expressed interest in having the enforcement branch join the policing unit; others acknowledged that conservationists had their own ethic and the movement was best left under the Ministry of Environment. In a sense, this reinforces the view that environmental enforcement is a unique subdomain, one that reflects a broader set of tensions but one with its own systematic sets of effects.

IMPLICATIONS

In this chapter we elaborated a new, important complication with compliance—large variations in enforcement due to variations in enforcement regimes (Edelman, 1992; Dobbin and Sutton, 1998). We also demonstrated spatial variation in these enforcement effects (Haveman, 1995; Wade, Swaminathan, and Saxon, 1998; Strang and Meyer, 1994). Finally, we found that, in the context of the enforcement regime, organizational characteristics (such as size) act as consistent signals in the environmental enforcement process—leading to charges.

We also confirmed three complications with compliance found by other institutional researchers: first, a state may be relatively well developed but may not have well-articulated environmental policies and regulation and enforcement systems (Dobbin and Sutton, 1998; Edelman, 1990; 1992; Meyer and Scott, 1983); second, within the environmental domain of a state, enforcement may be even weaker and less systematic than in enforcement in other policy-making and regulatory do-

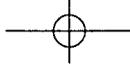


mains (Burstein, 1990; Dobbin and Sutton, 1998; Knocke and Laumann, 1987); third, the components in the regulatory system and its subsystems, such as enforcement, are likely to be loosely coupled, making systems-level outcomes less predictable (Hironaka and Schofer, Chapter 9; March and Olsen, 1976; March, 1989; Thompson, 1967).

These results for enforcement, taken jointly, suggest that a policy domain or regulatory system may reflect deeper understandings and interpretation of regulation, an understanding that changes over time. For instance, enforcement may appear to be more cognitive, normative, and regulative (rule-following) during different time periods (Powell and DiMaggio, 1991; Scott, 1995). In our longitudinal data on British Columbia, we found evidence that a normative mode of regulation was becoming more regulative and coercive over time, even if there was still a lot of variation in the regulatory side and the cognitive views of the system were still being worked out. This is in contrast to the finding of Hoffman (1997; 1999) for the United States, which showed cognitive understanding to be superseded by regulative rather than normative standards in the period between 1970 and 1993. Finally, while there is still some evidence that a normative regime exists in some areas of water management, we did not find that it had an impact on professional associations when it comes to regulatory outcomes. Perhaps this is not due to errors in the data or the coding of the variable, but may be due to a lag effect that has not yet appeared. For example, associations and organizations present in the Lower Fraser Basin take them seriously, but being a member of an association has not yet had an impact on the firm. But we do not think it is just a matter of time. In the United States, it appears that the dominant logic or regime had to become more regulative as a whole and then move towards a normative mode before professional associations could make a difference in strategic environmental management (Hoffman, 1999). Similar shifts in regimes and understandings have been shown by Frank (2001) and Hironaka and Schofer (Chapter 9) to lay the groundwork for professional effects. Once such shifts occur, we have little doubt that the large volume and variety of environmental professionals who live and work in the Lower Fraser Basin will have a more noticeable impact on enforcement.

Implications for Institutional Theory and the Natural Environment

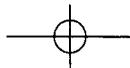
Our results and the patterns they uncover and confirm have some broader implications for both old and new institutional theory (Hirsch and Lounsbury, 1997). Whereas institutional economists such as North (1990; North and Thomas, 1973) have discussed the powers of the state and use of coercive force by agents across economies, they should incorporate enforcement procedures more directly in

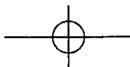


their historical studies of regulatory systems if they wish to elaborate on the importance of enforcing contracts. Although new institutional sociologists interested in policy regimes, regulatory systems, and their effects acknowledge their importance, they need to incorporate the role of the enforcement process more explicitly into compliance and isomorphism (Dobbin, 1994; Dobbin and Sutton, 1994; Edelman, 1990, 1992; Edelman and others, 1991; Meyer and Scott, 1983; Scott, Meyer, and associates, 1994). If a policy regime is strong and regulatory machinery is elaborate, but enforcement weak, then noncompliance may increase. The consequence is, despite apparent coercive pressure, that only moderate isomorphism may occur in the field.

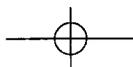
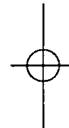
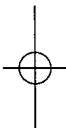
In the case of new institutional work on the natural environment, our work questions this assumption by showing that enforcement activity—that cognitive regimes are replaced by regulative (Hironaka and Schofer, Chapter 9; Hoffman, 1997, 1999; Hoffman and Ventresca, 1999). Canada is moving toward more of a regulatory regime characterized by higher rates of enforcement during the last fifteen years—away from the more normative and conciliatory approach of earlier periods. It may be that the locus of action or level of analysis for this pattern of replacement of regimes is not only at the national but the international level. On the one hand, the increasing rationalization and legalization found around the world may have unifying, isomorphizing effects on all of the member communities of the polity (Frank, 2001; Meyer and Scott, 1983; Meyer and others, 1994). Most countries then will experience an increase in regulation. On the other hand, there may only be a country-to-country diffusion effect of policy regimes (Hironaka and Schofer, Chapter 9). If so, Canada would be highly influenced by its trade with, and social and cultural proximity to, America. The normative models for professional environmental management would become increasingly important. Still, under either the world polity or the national diffusion type of model, any normative and cognitive shifts in policy within Canada are likely to be built on increasingly elaborate regulatory regimes for environmental policy.

Finally, the context for assessing environmental processes is strongly influenced by the mode or regime that the investigator perceives to be in operation. In our study, the boundaries of the natural system are contiguous with the boundaries defined by the regulatory system (at three levels of analysis—the local to the provincial to the federal). Within this bounded system, investigators have shown that water quality and riparian health have generally decreased over the last twenty years (Lavkulich and others, 1999; Rees and Wackernagel, 1994, 1999; Zandbergen, 1999; but see BCMOELP, 2000). If a different mode or regime were perceived to be in operation and used to define the boundaries of the natural system,





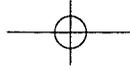
then the complications in compliance would become even more complex and the outcomes more difficult to assess. Ultimately, trying to examine the effects of these fluctuating systems on ecological outcomes as regimes cycle and trying to build some form of control and feedback across them is the real complication of compliance.



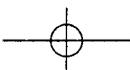
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