INTERNATIONAL LAW AND INTERNATIONAL RELATIONS

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of potential violators and made it harder to actually commit a violation. Tanker captains faced many regular autonomous decisions about whether to violate discharge standards. In contrast, tanker owners only had to decide once between violating or complying with equipment standards, and their decision required cooperation from other actors and involved major economic consequences. *** Classification societies, insurance companies, and flag state inspectors could withhold the papers necessary to conduct business in international oil markets, thereby frustrating any tanker owner's attempt to reap the benefits of sidestepping these standards.

Experience with the discharge standards had shown that many states would not enforce pollution standards ***. Given the costs of SBT, if deterrence had been the major source of compliance, one would expect some tankers initially to have violated the equipment standards in an attempt to identify which and how many states actually would enforce the rules. Yet, compliance levels did not follow a pattern of initial noncompliance followed by stiff sanctions and subsequent compliance. The compliance system of the equipment subregime succeeded by effectively restricting the opportunities to violate it rather than making the choice of violation less attractive. The very low noncompliance levels suggest that in most cases an owner simply decided it would be impossible to convince a tanker builder, a classification society, and an insurer to allow the purchase of a tanker without COW and SBT. *** [Obstacles] to committing a violation played a major role in preventing such violations. New tankers have been built initially to MARPOL standards, not retrofitted later in response to deterrence threats. ***

The equipment subregime may have been as successful as it was precisely because it produced a redundant regulatory system. It established compliance information and noncompliance response systems that prevented most violations but could successfully deter any actors who might otherwise have considered violating it. *** The initial discharge standards subregime faced problems at almost every step of the process: detecting violations, identifying violators, prosecuting violators, and imposing potent sanctions. The shift to total discharge standards eliminated or mitigated some of these problems, but the problems remaining left overall deterrent levels essentially unchanged. A tanker captain evaluating the expected costs of violating OILPOL's or MARPOL's discharge standards could only conclude that the magnitude and likelihood of a penalty were quite small. Successful deterrence strategies must ensure that the whole legal chain operates smoothly, since the breakdown of any link can significantly impair its effectiveness.

CONCLUSIONS

Nations can design regime rules to improve compliance. This article has demonstrated that, even within a single issue-area, reference to design features of compliance systems surrounding particular provisions is necessary to explain observed variance in compliance. In the regime regulating intentional oil pollution, the same governments and corporations with the same interests during the same time period complied far more frequently with rules requiring installation of expensive equipment than they did with rules limiting total discharges of oil. Where theories of hegemonic power and economic interests fail to explain this variance, differences in the subregime's compliance systems readily explain why the former subregime led powerful actors to comply with it while the latter did not.

The equipment standards elicited significantly higher compliance because they selected a point for regulatory intervention that allowed for greater transparency, increased the likelihood of forceful responses to detected violations, built on existing institutions, and coerced compliance by preventing actors from violating them rather than merely deterring actors from doing so. *** [Policymakers] can improve compliance by regulating those sectors more vulnerable to pressures for compliance and by facilitating the efforts of those governments and nonstate actors more likely to implement and enforce such regulations. This matching of regulatory burdens to expected behavior places the careful choice of the regime's primary rules at the center of any effective compliance system.

Once such primary rules have been established, careful crafting of the compliance information system and the noncompliance response system can further increase the likelihood of compliance. Oil pollution regulations succeeded by facilitating the goals of, placing responsibilities on, and removing the legal and practical barriers limiting those governments and private actors predisposed to monitor and enforce agreements, not by imposing obligations on recalcitrant actors. Inducing compliance required an integrated system of rules and processes that placed actors within a strategic triangle of compliance so that they had the political and economic incentives, practical ability, and legal authority to perform the tasks necessary to implement the treaty.[65] When such efforts succeeded, governments and private actors acted differently than they would have in the absence of the regime. *** [Negotiators] can and should design and

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[65] I am indebted to Robert O. Keohane for the notion of a strategic triangle of compliance.

redesign treaties to maximize compliance within the constraints that power and interests impose.

Eliciting compliance is only one of the criteria on which we would want to judge a regime's rules. Indeed, the value of compliance itself rests on the assumption that more compliance makes the treaty itself more effective. In the oil pollution case, compliance with the equipment rules involved at least as great a reduction in intentional discharges as did compliance with the discharge standards. Thus, we can safely infer that the higher compliance levels under the former rules also led to increased treaty effectiveness, a fact confirmed by a consensus among most experts that intentional oil discharges have declined since MARPOL took effect.[66] [Compliance levels are an important evaluative criteria in regime design.] The cheaper, more flexible, and more efficient discharge standards simply failed to induce the level of compliance needed to achieve a socially desired outcome; yet the costs of the equipment standards may have exceeded the benefits of that outcome. In cases in which more efficient solutions elicit compliance sufficient to achieve a policy goal, they are clearly preferable. If expected compliance with such solutions appears low, effective regime design requires evaluating whether the benefits of higher compliance outweigh the expense and inefficiency of alternative solutions.

Can we apply the findings developed from studying these two oil pollution cases to other issue-areas? Initial selection of a difficult collaborative problem with characteristics common to many international collaboration problems provides some confidence that we can do so. Other treaties provide anecdotal support for some of the findings reported herein. *** [Confirming the conclusions arrived at here requires considerably more research.] The solutions adopted in the oil pollution regime also undoubtedly cannot be applied to all regimes or even to all environmental regimes. Wildlife and habitat protection, for example, can rarely be achieved through technological solutions or quantitative requirements that can be easily monitored. *** The strategies available to international regulators will depend at least in part on features unique to the problem being addressed. Analysts have already shown how regimes influence behavior in realms involving security.[67] How the impacts of similar

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[66] See Ronald B. Mitchell, "Intentional Oil Pollution of the Oceans," in Haas, Keohane, and Levy, *Institutions for the Earth*, pp. 183–248.

[67] See Robert Jervis, "Security Regimes," in Krasner, *International Regimes,* pp. 173–94; and Duffield, "International Regimes and Alliance Behavior."

compliance systems vary across security, economic, human rights, or environmental regimes remains one of many important future questions.

Whether the nations of the world can collaborate to resolve the many international problems, both environmental and otherwise, that face them will depend not on merely negotiating agreements requiring new behaviors but on ensuring that those agreements succeed in inducing governments, industry, and individuals to adopt those new behaviors. *** [Careful] crafting and recrafting of international treaties provides one valuable means of managing the various problems facing the nations of the world.

26

The Regime Complex for Plant Genetic Resources

Kal Raustiala and David G. Victor

International institutions have proliferated rapidly in the postwar period. As new problems have risen on the international agenda, the demand for international regimes has followed.[1] At the same time, international norms have become more demanding and intrusive.[2] *** Governance systems dominated by elites have given way to more participatory modes; the policy process has become more complex as a growing array of [actors] *** become engaged in decision making.[3] ***

These trends – in particular the rising density of international institutions – make it increasingly difficult to isolate and "decompose" individual international institutions for study.[4] Yet efforts to build and test theories about the origins, operation, and influence of international regimes have typically been conducted as though such decomposition was feasible. Most empirical studies focus on the development of a single regime, usually centered on a core international agreement and

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administered by a discrete organization. * Such studies occasionally note the complicated links among international institutions, but [do not focus] systematically on explaining institutional "interplay."[5] A few studies have explored institutional interactions in hierarchical or nested regimes in which certain rules have explicit precedence over others, but the theoretical implications are limited because international agreements are rarely hierarchical.[6] The prevailing scholarship on regimes has also taken a functional approach to analyzing cooperation and has not given close attention to how the legal and intellectual framing of issues affects the boundaries of regimes.[7] Lack of systematic attention to boundaries and to the interactions among institutions leaves a large hole in the existing body of theory. Yet the rising density of the international system makes it likely that interactions among regimes will be increasingly common.

In this article we address this gap in theory by advancing several arguments about regime interactions under conditions of rising institutional density. We develop and explore these arguments through the lens of an understudied issue in international relations: the control of plant genetic resources (PGR). The PGR case is important because it lies at the nexus of critical areas of world politics – intellectual property (IP), environmental protection, agriculture, and trade.

For most of history, PGR – such as genetic codes, seed varieties, and plant extracts – were treated as the "common heritage of all mankind." They were understood to be freely available to all and owned by none.[8] During the twentieth century, those rules changed radically; today, international and domestic rules declare PGR to be sovereign property and subject to private ownership through IP rights such as patents. We explain that transformation by examining the rules that govern PGR in their natural state – "raw" genetic resources – as well as the "worked" resources that humans improve through breeding and other [techniques.] Raw PGR are those found in the wild, such as a flower in the rain forest that contains a yet-undiscovered gene that could cure cancer. Worked genetic resources, by contrast, are the products derived from that flower – such as the marketed cancer-fighting drug. * Drawing on the work of Harold Demsetz, we show how new technologies allowed firms

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[5] The few exceptions, using the term "interplay," include Young 2002; and Stokke 2001. See also Leebron 2002 for discussion of "conglomerate" regimes; and Weiss 1993 for a warning about "treaty congestion."

[6] Aggarwal 1985. ***

[7] Exceptions include Young 2002; Wendt 1999; and Sebenius 1983.

[8] Kloppenburg 1988.

to create greater value in novel worked products, which in turn spurred them to demand special new forms of IP for worked PGR.[9] Raw PGR also rose in perceived value – both as inputs to the innovation of new worked products and as valuable environmental goods in their own right.

While new technologies and ideas created pressures for enclosure, the composition and configuration of international institutions created a highly uneven process of change. Rather than a single, discrete regime governing PGR, the relevant rules are found in at least five clusters of international legal agreements – what we call *elemental regimes* – as well as in national rules within key states, especially the United States and the European Union (EU). These elemental regimes overlap in scope, subject, and time; events in one affect those in others. We term the collective of these elements a *regime complex*: an array of partially overlapping and nonhierarchical institutions governing a particular issue-area. Regime complexes are marked by the existence of several legal agreements that are created and maintained in distinct fora with participation of different sets of actors. The rules in these elemental regimes functionally overlap, yet there is no agreed upon hierarchy for resolving conflicts between rules. Disaggregated decision making in the international legal system means that agreements reached in one forum do not automatically extend to, or clearly trump, agreements developed in other forums. We contend that regime complexes evolve in ways that are distinct from decomposable single regimes.

In this article we do not attempt a full derivation of a theory of regime complexes. Rather, our aim is to demonstrate, through our discussion of the PGR case, that there is utility in analyzing regime interactions systematically and guided by the concept of regime complexes. We explore four conjectures.

First, we expect that regime complexes will demonstrate path dependence: extant arrangements in the various elemental regimes will constrain and channel the process of creating new rules. The existing literature on regimes implicitly presumes that regimes are negotiated on a largely clean institutional slate. *** In regime complexes, by contrast, the array of rules already in force channel and constrain the content of new elemental regimes.

Second, we expect that the existence of distinct negotiating fora will spur [forum shopping.] We explore not only the factors that we expect will affect the degree of forum shopping – such as barriers to entry,

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[9] See Demsetz 1967; Libecap 1989 and 2003; and Merrill 2002.

membership, and linkages among issues – but also the practical impact that forum shopping has on the evolution of regime complexes.

Third, we expect that a dense array of international institutions will lead to legal inconsistencies. Scholars have noted the move to law in world politics.[10] One implication is that much diplomatic effort will be focused on [assuring] consistency – treating like situations alike – because consistency is a core element of the legal paradigm. In standard theories of regimes, regime development is driven by political contestation over core rules. In regime complexes, we argue, that evolution is mediated by a process focused on inconsistencies at the "joints" between elemental regimes. *** There is no single, omnibus negotiation – rather, there are multiple negotiations on different timetables and dominated by different actors. The move to cooperation on issues that were previously the sole domain of domestic policy only exacerbates this harmonization problem, because it is no longer foreign ministries that dominate international diplomacy: instead, a raft of domestic agencies, often with distinct agendas, increasingly play active roles.[11]

Fourth, we explore how states contend with inconsistencies through the process of implementation and interpretation. The literature on domestic policy implementation has demonstrated that when the legislative agenda is complex and contested, lawmakers often adopt broad, aspirational rules.[12] *** Earlier studies of treaty implementation echo these findings, showing that diplomats often negotiate broad *ex ante* rules and then defer the task of working out detailed implications to the process of implementation.[13] We expect regime complexes to be particularly prone to such behavior. Where interests are varied and complex it is difficult to specify precise rules *ex ante,* and the transaction costs for making formal changes to rules that span multiple regimes is high. *** Consequently, states often work out solutions "on the ground" and, in turn, align formal changes in the rules with the most successful implemented remedies.

We begin by summarizing the PGR case and theorizing about the dramatic change in property right norms during the past century. We introduce each element of the regime complex and show how the interactions between elemental regimes have become more numerous as the international rules have become more expansive, intrusive, and demanding.

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[10] Goldstein et al. 2001.
[11] Slaughter 1997.
[12] See Ingram 1977; Bardach and Kagan 1982; and Stewart 1975.
[13] See Victor, Raustiala, and Skolnikoff 1998; Weiss and Jacobson 1998; and Chayes and Chayes 1995.

We then explore the significance of the concept of a regime complex for the theories of international institutions ***.

EXPLAINING NORM CHANGE: THE RISE OF PROPERTY RIGHTS IN PLANT GENETIC RESOURCES

PGR have been a central part of human civilization since its inception, though genes were not well understood until recently. *** Whether in the wild or in seed banks, for centuries PGR were viewed as a resource that was shared in common and accessible to all – a system that did not assign private ownership of these resources and later became labeled the "common heritage of mankind." * We call this basic structure of property rights the "common heritage" system. While a particular specimen of a plant could be owned, genetic resources per se were not owned by individuals or states. Common heritage was coupled to open access, which meant that states did not generally restrict others from obtaining small samples of PGR, such as seeds ***.

In the twentieth century, this structure of property rights changed markedly. By the 1990s, governments viewed raw PGR as a sovereign resource rather than as common heritage; increasingly governments also afforded individuals a wider range of varied IP rights for worked PGR ***. [Not] all international agreements embraced this approach, and for some time there was considerable conflict among the various regime rules. (In some areas, the conflicts persist.) Ultimately, however, a broad consensus emerged ***. We call this new system the "property rights" approach. Some states kept those property rights for the state itself, often with the state asserting not just control over these rights but direct ownership. Many other states, however, permitted the creation of individual property rights and increasingly this is the norm.

To describe and explain this fundamental normative shift toward enclosure we look to the theory of property rights famously developed by Demsetz and elaborated by Libecap and others.[14] Demsetz suggested that the development of property rights is primarily a function of changes in value: "the emergence of new property rights," he argued, "takes place in response to the desires of the interacting persons for adjustment to new benefit-cost possibilities."[15] When the private value of a good rises, potential owners will agitate governments to change property rules

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[14] See Demsetz 1967; and Libecap 1989.
[15] Demsetz 1967, 350.

to allow capture of the added value. An increase in the value of the resource because of an exogenous circumstance, such as a technological development, *** may create a sufficient incentive for the development of property rights ***.

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One dimension of this *** debate concerned the rules for ownership of PGR – common heritage versus some form of property right. The other dimension was the mechanism for allocating benefits from raw and worked PGR. Even as states, in a Demsetzian dynamic, converged on a property rights approach there remained strong disagreements over the allocation of benefits. Developing countries desired state-controlled mechanisms that would force PGR innovators to share the benefits with those states that provided the raw PGR; industrialized states preferred a more free-market approach.

The transformation of property and allocative rules over PGR did not occur smoothly or according to a single plan ***. Nor did this transformation occur through a single, omnibus negotiation aimed at the creation of a new international regime. Rather, as we describe, there were six distinct strands of activity, each of which addressed some important, but partial, aspect of the PGR issue. Five of these strands are what we call an elemental regime – an international institution, based on an explicit agreement, that reflects agreed principles and norms and codifies specific rules and decision-making procedures. Three of these elemental regimes are focused on agriculture, and two extend far beyond agriculture to broader issues:

- The 1961 International Convention for the Protection of New Varieties of Plants (UPOV), as amended in 1978 and 1991, governs property rights over intentionally bred plant varieties. These treaties require members to recognize "plant breeders' rights," a form of IP protection widely implemented in industrialized countries.
- The United Nations (UN) Food and Agriculture Organization (FAO) is the locus for negotiation of two key accords: the 1983 International Undertaking on Plant Genetic Resources and the 2002 International Treaty on Plant Genetic Resources. ***
- The Consultative Group on International Agriculture Research (CGIAR) is an international network of crop research centers. Efforts to breed improved crops have been aided enormously by the tremendous wealth of samples in CGIAR's "gene banks."

- The World Trade Organization (WTO)'s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) sets minimum international standards for the protection of IP rights.
- The 1992 UN Convention on Biological Diversity (CBD), which originated in efforts to protect global biodiversity as a natural resource, simultaneously promotes the sharing of the economic benefits that arise from the use of genetic resources.

In addition to these five international institutions, the PGR regime complex has been influenced by activities at the domestic level, notably in the United States, and, to a lesser degree, in the EU. The United States has been a key driver of change in the IP field. Innovations that began in the United States, such as the patenting of life-forms, have subsequently been enshrined, partly as a result of U.S. insistence, in agreements such as TRIPs. U.S. firms are also the dominant innovators in both the pharmaceutical and agricultural industries.

Figure 26.1 illustrates these two dimensions of rules – ownership and allocative mechanisms – and summarizes the complicated story that we present below about the transformation from the common heritage system to sovereign and private property rights.

The Common Heritage System

For most of human history, the rule of common heritage governed PGR. *** [Under this system] there were no property rights in PGR, nor did states bar access to genetic resources per se. As a result there was much international diffusion of PGR, particularly as long-distance trade expanded and imperial nations established central collections, such as Kew Gardens outside London, stocked with plants from around the globe.[16] To be sure, nations tried but often failed to maintain control over certain genetic resources; for example, China went to great lengths to preserve the silkworm monopoly, but ultimately lost it to two enterprising Nestorian monks.[17] Silkworms, rubber trees, and a few other special resources of obvious high value were the exception, however – otherwise, genetic resources were free for anyone who bothered to take them.

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[16] Kloppenburg 1988.
[17] Stone 1994.