

THE REGIME COMPLEX FOR PLANT GENETIC RESOURCES

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International institutions have proliferated rapidly in the postwar period.² New treaties and international organizations have been created as new problems have risen on the international agenda. As the number of international institutions has grown, international norms have also become more demanding and intrusive.³ International institutions increasingly address topics, such as rules on intellectual property and food safety, that affect national policies far “behind the border.”⁴ The dramatic increase in international institutions coupled to their new-found intrusiveness has also led to a shift in political processes; governance systems dominated by elites have given way to more participatory and democratic modes.⁵

These trends—in particular the rising density of international institutions—make it increasingly difficult to isolate and “decompose” individual international institutions for study.⁶ Yet the vast majority of effort to build and test theories about the origins, operation and influence of international regimes has 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 administered by a

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² cite Jacobsen piece in IO on numbers of agreements. In-depth studies on particular areas of international cooperation—such as trade, arms control, human rights or natural resources—all point to the same general pattern of rising numbers of institutions.

³ cite to Chayes & Chayes; Rabkin.

⁴ cite to Brookings volume

⁵ cite to howse on the insiders in the wto.

⁶ cite KN APSA

discrete organization.⁷ Such studies occasionally note the often complicated links between and among international institutions, but the scholarly literature on cooperation has generally not focused on explaining institutional “interplay.”⁸ Those studies that have focused on institutional interactions have tended to examine hierarchical or “nested” regimes—such as regional trade agreements that are embedded within the larger global trade regime—in which some rules and norms have precedence over others.⁹ The bulk of scholarship on international regimes has also taken a functional approach to analyzing international cooperation and not given close attention to how the framing of issues affects the boundaries of regimes.¹⁰ Lack of systematic attention to setting boundaries and to the interactions between international institutions leaves a large hole in the existing body of theory about international institutions. 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 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, environmental protection, agriculture, and trade.¹¹ The PGR case is also an exemplar of

⁷ [montreal as an example]

⁸ Young 2002 and Stokke, ed., 2002.

⁹ [agarwal?]

¹⁰ cite to Young 2002 (p.113); cite to Wendt, 1999, *Social Theory of Int'l Politics*.

¹¹ There is a large and growing literature on plant genetic resources, but little of it seeks to trace and explain the causes of change in the rules that apply at the international and domestic levels. The foundational study by Jack Kloppenburg (J. R. Kloppenburg, 1988, *Seeds and sovereignty: the use and control of plant genetic resources*, Durham: Duke University Press), focuses on raw plant resources and pre-dates the propertization of the 1990s. In practice, more recent studies on the roles of raw and worked genetic resources in the industry have given little attention to the international legal norms nor have sought to explain how those norms evolve, and most scholars that focus on the economics of agricultural innovation have shifted focus to the agricultural biotechnology. (See, e.g., Philip G. Pardey, 2001, ed., *The Future of Food: Biotechnology Markets and Policies in an International Setting*; see also Robert E. Evenson, “Agricultural Biotechnology,” in Benn Steil, David G. Victor and Richard R. Nelson, eds., 2002, *Technological Innovation and Economic Performance*, Princeton: Princeton University Press, chapter 15.) The landmark comprehensive *Cambridge World History of Food* (Kenneth F. Kiple and Kriemhild Conee Ornelas, eds., Cambridge University Press, 2000) gives hardly any attention to international rules; its index does not even offer entries for the WTO, TRIPs or UPOV. There is an extensive literature advocating changes in the legal norms—most of which has arisen in the 1990s in response to the tightening of property rights and arguing that property rights should not be allowed for plant resources or that property rights are

an important contemporary phenomenon. Rather than a single, discrete regime governing the control of PGRs, there at least six major components—what we call *elemental regimes*. These elements overlap in scope, subject, and time. We term the collective of these elements a *regime complex*: an array of partially overlapping institutions governing a particular issue-area, among which there is no agreed upon hierarchy. While the PGR regime complex is unusual in its intricacy, we do not think it is unique. Indeed, it is likely to be a harbinger of things to come.

As a first cut at understanding the implications of rising institutional density, we develop and explore four broad and related conjectures about the dynamics of regime complexes. Our first conjecture is that within a regime complex, interactions among the elemental regimes significantly shape the development of substantive rules. In the existing literature on regime formation the standard, if implicit, presumption is that regimes are negotiated on a largely clean institutional slate. In regime complexes, by contrast, international negotiations occur against a rich and shifting backdrop of existing rules rather than on a clean slate. Consequently, it is difficult for governments to orchestrate negotiating strategies that achieve particular aims because it is difficult—even for powerful states—to exert leverage in many diverse fora simultaneously and consistently. The move to cooperation on "behind the border" issues only exacerbates this problem because it is no longer foreign ministries that dominate international diplomacy: instead, a raft of domestic agencies, often with quite distinct agendas, are increasingly playing active roles in international relations.

Second, the existence of distinct negotiating fora creates opportunities for forum-shopping by both states and non-governmental actors. We expect that the availability of multiple fora will lead states and interest groups to seek out the forum that is most favorable to their interests. We explore not only the degree to which forum-shopping

being unfairly allocated—but that literature does not offer solid ground for analyzing causes of change. In the literature on international relations itself, PGR has arisen mostly as an oddity at the fringes other more established topics for case studies. Scholarship on international environmental protection has touched on plant resources insofar as they are one subject of the Convention on Biological Diversity (CBD), which is one of the main global environmental treaties; scholarship on the trade regime has also touched on this subject because rules for intellectual property in PGR are included in the TRIPs agreement and the World Trade Organization. There is an extensive literature on most of the individual agreements that we discuss but few studies examine the interactions between treaties—as we do. Those that do examine such interactions focus mainly on the conflicts in norms between the CBD and TRIPs because that was the

occurs but also the impact forum-shopping has on the evolution of rules within regime complexes. Factors such as barriers to entry, voting rules, and linkages among issues help to explain forum selection.

Third, the existence of a dense array of international institutions makes it likely that countries will adopt rules in one forum that are inconsistent with those in another and then discover the conflicts as they attempt to implement both rules simultaneously. One result, we hypothesize, is a greater reliance on broad ex ante rules and in turn a greater reliance on ex post implementation and interpretation of those rules. We find that the participants in the PGR regime complex contend with rule inconsistencies in two ways. When feasible, they adjust the norms through interpretation and implementation. And in some cases, where the inconsistencies are fundamental, attempts to implement conflicting rules are treated as laboratories for experimentation and learning. Solutions worked out “on the ground,” in turn, focus subsequent efforts to make formal changes in the rules.

Fourth, we hypothesize that the evolution of rules and norms in a regime complex is driven in large part by efforts to resolve legal inconsistencies between substantively overlapping rules developed in different fora. Scholars have noted the move to law in world politics, but one unexplored implication of legalization is how the pressure to assure legal consistency among regimes affects world politics.¹² Consistency—treating like situations alike -- is a core element of the legal paradigm, and we examine how efforts to attain legal consistency affect substantive outcomes. There is often, as in the PGR case, no formal hierarchy among elemental regimes and hence consistency must be achieved through negotiation; efforts at ensuring consistency are in turn an important driver of rule change.

In examining these broad hypotheses, we also make several claims about the specific evolution of rules in the PGR regime complex—a largely ignored topic in international relations, but one that is increasingly significant. For most of history, PGRs--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

political hotbed in the 1990s, but as we show the conflicts and synergies extend over many other agreements and norms and began long before the 1990s.

¹² Legalization volume.

and owned by none. By the end of the 1990s, however, the normative framework that governed PGRs was radically transformed—though as we show, this transformation occurred unevenly. Genetic resources were no longer considered to be common heritage; rather, new international and domestic rules declared them to be sovereign property, subject to private ownership through intellectual property rights such as patents. We draw on the theory of property rights developed by Harold Demsetz to argue that the rise of property rights in PGR was the result of the rising value of PGR, which in turn was largely the product of exogenous technological changes. We examine the rules that govern PGRs in their natural state— “raw” resources—as well as the “worked” resources that consist of the intellectual property built up through improvements to the plant genomes. Raw PGRs are those found in the wild, such as a flower in the rainforest that contains a yet undiscovered gene that cures cancer. Worked genetic resources, by contrast, are the products derived from that flower—such as the cancer-fighting drug.

Over the course of the 20th century both worked and raw plant genetic resources became much more important. Technological change permitted new and far-reaching techniques of genetic manipulation, creating greater value-added in novel worked products. Raw resources also rose in perceived value—both as an input to innovation and as a valuable environmental good in their own right. New ideas—often linked closely to new technologies—also caused leading firms, governments and NGOs to believe that genetic resources were significantly rising in value, and that in turn induced them to create new rules that allowed them to claim property rights on these resources.¹³ We show how the combination of new technologies and ideas contributed, along with exogenous shocks and other factors, to change in governing norms. Subsequent events have demonstrated that the rise in PGR value has been much lower than many anticipated; nonetheless, the PGR case illustrates that *perceived* value change can be as significant as real value change for a Demstezian transition.

¹³ As such, this study contributes to the literature on the political influence of ideas. See, e.g., Judith Goldstein and Robert O. Keohane, 1993, *Ideas and Foreign Policy: Beliefs, Institutions and Political Change* (Ithaca: Cornell University Press. Whereas many of the case studies on the influence of “ideas” have focused on grand notions that diffuse broadly—such as the idea of trade liberalism, norms against slavery, or the protection of human rights—our study shows the importance of a more narrowly focused set of ideas on how firms, NGOs and governments calculated the value of genetic resources.

In this article we do not and cannot attempt a full derivation or rigorous test of our hypotheses about the dynamics of a regime complex, nor do we present an exhaustive case study of the evolution of the PGR regime complex. Rather, our aim is to introduce the concept of a regime complex and show, through our discussion of the PGR case, that there is utility in thinking systematically about regime interactions. We first summarize the PGR case and theorize about the changes in property right norms over the last century. While the specific claim of a Demsetzian transition to property rights does not depend on the regime complex notion, we show how the regime complex developed, identify the specific elemental regimes, and illustrate the dynamics of the interactions among these elemental regimes. These dynamics, we argue, are critical to understanding the evolution of the PGR regime complex. We then return to the concept of a regime complex and explore its significance for the theories of international institutions, focusing on the four conjectures described above.

Explaining Norm Change: The Rise of Property Rights in Plant Genetic Resources

PGRs have been a central part of human civilization since its inception, though genes per se were not well understood until recently. The improvement of wild genetic resources is a hallmark of organized agriculture, and the surplus of productive agriculture is what has allowed civilizations to develop. Whether in the wild or in seed banks, for centuries PGRs were viewed as a resource that was shared in common and accessible to all—a system that disallowed private ownership of these resources and later became labeled the "common heritage of mankind."¹⁴ We call this basic structure of property rights the "common heritage-open access" system. Common heritage was the rule of ownership: PGRs could not be owned by individuals or states. Open access meant that state did not generally restrict others from obtaining small samples of PGR, such as seeds or small clippings from plants.¹⁵

¹⁴ Common heritage as a legal principle can be found in other arenas; for example, it had been applied to ownership of seabed resources in the UN Law of the Sea Convention.

¹⁵ Exceptions do exist, such as the (unsuccessful) efforts to keep the rubber tree a monopoly of Brazil in the 19th century.

In the 20th century this structure of property rights changed for both the raw genetic resources that are found in the wild as well as genetic resources that had been worked by farmers and seed companies to yield improved varieties. By the 1990s, governments increasingly viewed PGRs as *sovereign resources* rather than common heritage; increasingly, governments also afforded individuals a wider range of varied *intellectual property rights*, including full utility patents, and they negotiated international trade agreements and treaties that required other governments to do the same. Other international agreements did not embrace this approach, and for some time there was considerable conflict among the various regime rules (as we show, this conflict still persists in some areas). Ultimately, however, a consensus approach emerged, most fully in the late 1990s. We call this new system of propertization the “sovereign resources—intellectual property rights” approach.

To describe and explain this fundamental normative shift toward enclosure we look to the theory of property rights famously developed by Harold Demsetz.¹⁶ Demsetz suggested that the development of property rights is a function of changes in value: “property rights arise,” he argued, “when it becomes economic for those affected by externalities to internalize benefits and costs.”¹⁷ In other words, when the value of a good rises, potential owners will agitate to change property rules so that it becomes easier for them to seize the added value. The rise of for-profit seed companies in the 1920s, based on expensive R&D to breed and test new crops, began to eclipse publicly funded agricultural research as a source of new value in crops and also created the first push for protection of intellectual property. But it was technological changes in the 1970s and 1980s—in particular, the rise of biotechnology and genetic engineering—that created a strong push for intellectual property protection because investors had the impression that these changes would transform agricultural breeding just as they were transforming the pharmaceutical industry. In both these industries—agriculture and pharmaceuticals—the new business model required strong intellectual property rights.

At the same time, tropical nations began to view raw PGR as a new source of wealth—the cure for cancer, for example, could be found in a tropical plant extract. New assay machines made it possible to screen the properties of a much larger quantity

¹⁶ Demsetz, *Toward a Theory of Property Rights* 57 *American Economic Association* (1967)

of raw PGRs at lower cost, raising the value of raw PGRs. The biotechnology revolution in the pharmaceutical industry created the impression that if valuable PGRs were discovered they could be transformed readily into “blockbuster” drugs. Most importantly, Southern, biodiverse states sought to ensure that they would be compensated for harboring these important resources. The result of all these changes was significant pressure to replace the "common heritage-open access" with the current "sovereign rights-intellectual property rights" system. Rather than the commonly held and shared resources, raw PGRs are now sovereign resources just like oil or timber. And rather than unprotected innovations, worked PGRs are now protected by a wide range of intellectual property rights in nearly all states.

This section tells the story of the shift to propertization and examines the role of international cooperation and institutions in that process. The transformation did not occur smoothly according to a single plan or initiative; nor did the 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 the strands constitute what we call an elemental regime—an institution, based on a treaty or agreement, that reflects agreed principles and norms and codifies specific rules and decision-making procedures:

- the *UPOV Convention*, which codifies “plant breeders’ rights”, a form of intellectual property protection for plant varieties widely implemented in industrialized countries;
- the Food and Agriculture Organization’s (FAO) *Undertaking on Plant Genetic Resources* and, most recently, *International Treaty on Plant Genetic Resources*;
- Diverse *international programs* for protecting and utilizing PGR, notably the gene banks and research centers of the Consultative Group on International Agricultural Research (CGIAR);

¹⁷ id.

- the World Trade Organization (WTO)'s *Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)* which sets minimum international standards for the protection of intellectual property rights;
- the *Convention on Biological Diversity (CBD)*, which coupled PGR issues to the broader environmental agenda.

In addition to these five international institutions, the PGR regime complex has been influenced by activities at the domestic level, notably the rules about protection of intellectual property in the United States, the main center of agricultural and pharmaceutical innovation. The US has been a key driver of change in the intellectual property field; innovations that began in the US, such as the patenting of life-forms, have subsequently been enshrined, partly as a result of US insistence, in agreements such as TRIPs.

No single institutional strand dominates the development of new PGR rules, however. Rather, these strands arise at different times, interact and are often in tension with one another. We probe the interactions between elemental regimes and argue that the elements constitute, and are best understood as, a regime complex. We examine the century-long shift in principles and norms that govern PGRs and focus on how the regime complex has responded to the exogenous shock of genetic engineering and to the attempts to claim value in PGRs.

Three of the relevant international institutions in this account are agricultural. The first is the 1961 International Convention for the Protection of New Varieties of Plants (UPOV), as amended in 1978 and again in 1991, which governs the property rights that plant breeders can claim over new plant varieties that they breed intentionally. The second is the Consultative Group on International Agriculture Research (CGIAR), an international network of research centers that investigates ways to increase the productivity of the key staple crops. Efforts to breed improved crops have been aided enormously by the tremendous wealth of genetic samples in CGIAR's "gene bank" collections. The third elemental regime is the UN Food and Agriculture Organization, or FAO, which has been the locus for negotiation of two key international agreements: the 1983 International Undertaking on Plant Genetic Resources and the 2001 International

Treaty on Plant Genetic Resources. Two non-agricultural institutions also play central roles in the PGR regime complex. The Agreement on Trade-Related Property Rights, or TRIPs, establishes minimum standards for intellectual property protection in all WTO member states, and includes specific provisions on PGRs. The 1992 UN Convention on Biological Diversity (CBD) is aimed at the protection of global biodiversity, but simultaneously promotes the sharing of the economic benefits that arise from the utilization of genetic resources—an issue that continues to arise on the international agenda.

Each of these strands is complicated, in part because many of these institutions were established not only to regulate activities related to PGR. We aim to present only the most fundamental points of each, but the story is nonetheless detailed and complicated. These details are important because the interactions between these diverse institutions have focused and constrained how the international rules governing PGRs change over time. In particular, we show that sometimes arcane conflicts between rules in each of these regimes sets the agenda for where governments, firms and NGOs focus their efforts at altering domestic and international rules. Because of this process, we argue that regime complexes, in which multiple elemental regimes address different facets of the same broad issue-area in different ways, are a distinct phenomenon in international policies. We argue that this phenomenon is understudied and that an understanding of the phenomenon is essential to understanding an increasing number of substantive outcomes in international cooperation.

The Common Heritage-Open Access System

PGRs were governed by the common heritage-open access system for most of human history. Though genes themselves were not known until the twentieth century—and their functions are still not fully understood—the economic importance of genetic resources had been long recognized. Nonetheless, under the original “system” there were no property rights in genetic resources, nor did states bar access to genetic resources per se. As a result there was much international diffusion of genetic resources, particularly as long-distance trading expanded and as imperial nations established

central collections, such as Kew gardens outside London, stocked with plants sampled from around the globe.¹⁸ Nations tried but often failed to maintain control over genetic resources; for example, China went to great lengths to preserve the silkworm monopoly, but ultimately lost it to two enterprising Nestorian monks in the middle ages.¹⁹ Silkworms, rubber trees and a few other special resources of obvious high value were the exception—otherwise, genetic resources were free for anyone who bothered to take them.

Under the common heritage-open access system there was little difference in treatment between what we term "raw" and "worked" PGRs. In the agricultural context, the dividing line between raw and worked was and often remains indistinct because worked materials, alongside with raw materials collected in the field, are the source of new worked materials.²⁰ The first moves toward intellectual property protection in PGRs addressed worked resources. As agriculture slowly industrialized in the 20th century, plant breeders started to seek protection for their innovations. The first moves were domestic. Through the early 20th century, most agricultural innovation was funded by governments and performed in research centers and universities and there was no pressure to assure protection of the intellectual property as an incentive for innovation. By the 1920s a limited, organized industrial business of breeding had emerged, and with it pressure for protection arose. The most prominent innovative activity was on hybrid plants, which had their own built-in mechanism for protecting intellectual property—hybrids lose their vigor after one generation, and thus farmers would be required to purchase new seed every season. But many other innovations would require new legal mechanisms for protection; for example, plants that propagate asexually (e.g., cuttings from fruit trees or flowering plants). In response, in 1930 the US

¹⁸ Kloppenburg book.

¹⁹ See Stone, C., 1994, What to do about biodiversity: property rights, public goods, and the earth's biological riches, *Southern California Law Review*, 68(3):602-605 on silk and general issues; and Paul Raeburn's account of the smuggling of rice from Italy in *The Last Harvest: The Genetic Gamble that Threatens to Destroy American Agriculture*, 1995, Simon & Schuster, New York, NY, USA. The governing rule was thus something like trade secret.

²⁰ Indeed, one of the major areas of contestation in this issue-area has been the treatment of traditional crop varieties that have been improved incrementally and informally by generations of farmers. This is the so-called "farmers' rights" issue; we discuss this briefly below.

passed the Plant Patent Act for plants that are reproduced by asexual means.²¹ Other countries—such as the Netherlands (1942) and Germany (1953) also offered limited forms of intellectual property protection for breeders. Such rights allowed breeders to bar competitors from copying their innovations but did not prevent breeders from using a competitor's improved variety as an input to their own new (protected) variety. This was an important step toward property rights in PGR. Nonetheless, the primary focus of agricultural policy was on subsidization rather than intellectual property rules as mechanisms for fostering innovation—farmers in the US, for instance, were given free seed until the 1920s.²²

Internationally, property rights for worked PGR were first introduced through the 1961 UPOV Agreement, which revolved around the concept of "plant breeders rights."²³ Plant breeders' rights are a weak form of intellectual property protection in comparison to patents, but the eligibility requirements are more easily met. At the time of the first UPOV Agreement, no major domestic legal system permitted the patenting of plants, though various forms of plant breeders' rights were common in countries where commercial breeding was most active. Plant breeders were concentrated in the industrialized states, and as a result UPOV largely reflected their interests. As of January 2002, 50 states were parties to at least one of the UPOV agreements.²⁴ While UPOV introduced some form of property right for worked PGR—the plant breeder right—raw PGR was still treated as common heritage. Plant breeders and seed companies, as well as the major botanical institutions, such as Kew Gardens, continued to gather PGR from around the world in the belief that genetic information was scientific knowledge and could not be owned.

The Demise of the Common Heritage-Open Access System

²¹ Charles Rories, Does the US PTO have Authority to Grant Patents for Novel Varieties of Sexually Reproducing Plants? 83 J. of the Patent and Trademark Office Society (2001).

²² Pioneer Hi-Bred v. JEM Ag Supply. (2001)

²³ John H. Barton, The International Breeders Rights System and Crop Plant Innovation, 216 SCIENCE 1071 (1982)

²⁴ All but two of which were parties to the 1978 UPOV (29 states) or the 1991 (19 states). [check numbers against source] Helfer FAO report

While change was already afoot by the early 1960s, the major shock to the common heritage-open access system was the invention of recombinant DNA technology in the 1970s.²⁵ By allowing innovators to work directly at the genetic level, the scope for innovation in plant resources was dramatically increased. This technological change markedly raised the perceived value of PGRs. It first stimulated interest in more fully protecting worked PGR through intellectual property rights, and ultimately stimulated interest in extending protection to raw PGR as well. In Demsetzian fashion, property rights emerged in response to perceived scarcity and rising value. Much of the key activity at this point occurred in the US domestic context, but this domestic-level activity created pressure for later changes in international rules—rules which the US, wielding its market power, successfully extended globally.

The biotechnology revolution that began in the 1970s led to many new firms engaged in genetic engineering, and to the creation of broad "life sciences" companies focused on biological innovation. At the same time, a more general change in the role of intellectual property in the economic system was underway. Patents began to be perceived as strategic assets, and intellectual property law became a major field, particularly in the US. A critical breakpoint in the US was the Supreme Court's 1980 decision, in the landmark case of *Diamond v. Chakrabarty*, that patent protection extended to "anything under the sun made by man."²⁶ Before *Diamond* the patentability of genetically-modified living things, outside the narrow confines of the 1930 Plant Patent Act, was unclear. After *Diamond*, and some subsequent cases, US firms could safely employ the full panoply of genetic engineering techniques and receive complete utility patent protection.²⁷ That same year (1980), Congress passed the Bayh-Dole Act, which was intended to encourage innovation by allowing universities and private firms to claim property rights on research funded by the government. In response to this Act, most research universities established technology transfer offices and required university researchers to claim rights in their innovations.²⁸ In short, these two changes--

²⁵ cites.

²⁶ cite.

²⁷ cited in in re hibberd; also note on JEM Ag putting the nail in the coffin. See also Barton, The Impact of Patent Law on Plant Biotechnology Research, in Intellectual Property Rights III Global Genetic Resources: Access and Property Rights (Steve A. Eberhart et al. eds., 1998).

²⁸ cite Dick Nelson's study on the impacts of Bayh-Dole.

one judicial and one legislative--transformed the US domestic playing field with regard to property rights in genetic resources. Since 1980, the conventional wisdom in the U.S. has been that strong IPR is essential to the modern biotechnology-based innovation system—that view has been driven especially by the experience with pharmaceuticals, but agriculture has been carried in the coattails of the drug companies' interests.²⁹

The increasing protection of worked PGR under both industrialized country domestic laws, as well as the UPOV Agreement, led developing countries to organize a counteroffensive: the 1983 FAO Undertaking on Plant Genetic Resources. The FAO Undertaking, which is non-legally-binding, was put on the FAO's agenda with pressure from developing countries, mainly from Latin America, and a small number of industrialized countries, in particular Spain. Often rich in biodiversity, developing countries have been the source of many commercially valuable genetic samples, yet have received little compensation. The concern within developing countries that their plant resources were being exploited resonated with the existing fear of powerful multinational corporations and the then-recent effort to establish a New International Economic Order aimed at a redistribution of global wealth through new international institutions. The FAO Undertaking sought to rectify the imbalance in PGR power by changing the property rights rules. Institutionally, the FAO Undertaking also created the Commission on Plant Genetic Resources, which is now the central FAO forum for handling PGR issues. (Notably, the Commission helps to set policy for managing a network of all the major international collections of plant germplasm, including the CGIAR network).

The FAO Undertaking was driven by the fact that developing countries resented the lack of open access to improved varieties bred by seed companies, some of which were the products of raw germplasm samples that developing countries themselves had provided under the common heritage rule. This was, of course, exactly the result that the UPOV Agreement aimed at. The FAO Undertaking attempted to counter the emergence of property rights in worked PGR by defining all genetic resources--raw and worked--as "common heritage." In its most controversial wording, the Undertaking

²⁹ For more on the perceived role of IPR in the pharmaceutical business see Gary P. Pisano, 2002, "Pharmaceutical Biotechnology," in Benn Steil, David G. Victor and Richard R. Nelson, eds., *Technological Innovation and Economic Performance* (Princeton: Princeton University Press).

propounded the "universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction;" PGRs should be available "free of charge...or on the most favorable terms." In practice, the Undertaking's common heritage approach to all PGR was only a symbolic victory. The industrialized countries relied on the principle to continue their open access to raw PGR yet refused to accept the Undertaking's principle of open access to worked PGR. The Undertaking was adopted with reservations by eight industrialized countries, all lodged because of conflict with the protection for worked PGR enshrined in UPOV and domestic law. FAO soon adopted an annex to the Undertaking to provide an "agreed interpretation" that papered over the common heritage principle and allowed the industrialized countries to join.³⁰ Most did, though the US, Canada, and Japan stayed out.

Biodiversity & Bioprospecting

The slow and uneven dissolution of the common heritage-open access system in the 1980s dovetailed with a new change afoot in an unlikely source: international environmental cooperation. Protection of special habitats such as wetlands and special animals such as whales were among the first topics for global environmental cooperation in the late 1960s and early 1970s. By the 1980s, however, conventional wisdom among international environmental experts was that the focused approach was inadequate; moreover, conservation biologists were stressing the need to think about protecting species and ecosystems in terms of biological diversity, which included genetic diversity.³¹ That conceptual shift led to the negotiations, consummated as part of the 1992 UN Rio Summit, of the Convention on Biological Diversity.³² This agreement propounded a new approach to conservation, one predicated on habitat and ecosystems and oriented around diversity at the genetic and species level rather than specified, and

³⁰ Annex 1, 1989.

³¹ [add citation to the literature on the sources of this intellectual shift toward the "ecosystem concept." Also cite to origins of CITES as a compromise between the focused approach and the ecosystem concept advanced by IUCN in the 1960s.]

³² Raustiala and Victor, *Biodiversity Since Rio: The Future of the Convention on Biological Diversity*, *Environment* 1996;

often charismatic, species such as elephants, pandas and whales. The destruction of tropical rain forests in particular had become a popular political issue, leading the industrialized countries to also seek controls on forest degradation. Developing countries, unhappy with this perceived intrusion, reacted by asserting sovereign control over forest resources—including genetic resources. The battle over forests and the biodiversity within them spurred attention to the value of the forests—not only the value of forests as timber, but also the value of genetic resources.³³ Protecting these resources, which the NGOs of the industrialized countries sought, became integrated with the mission of identifying and controlling access to the resources that lay undiscovered in the forest.

The touchstone for this shift to property rights in raw PGR was the notion of "bio-prospecting."³⁴ One rationale for biodiversity protection is the value embedded in genetic resources. Environmentalists eager to promote conservation suggested that genetic diversity was itself an important source of value in ecosystems like forests, one that was potentially much larger than timber or farmland value. Firms could prospect for these resources just as miners had prospected for gold in centuries past. Enclosure, rather than commons, was now attractive for raw PGR, at least in the eyes of the biodiverse-rich South.

Thus in the late 1980s developing countries began to see property rights in PGRs as a mechanism of wealth, rather than a mechanism that Northern pirates had rigged against them. The famous 1991 Merck-INbio deal, in which the US-based pharmaceutical giant contracted with a Costa Rican conservation institute for bioprospecting rights in the Costa Rican rainforest, signaled to many the dawn of a new era of bio-prospecting.³⁵ In the same period, the increasing sophistication of genetic manipulation techniques meant that a raft of new plant innovations were arriving on markets, such as Monsanto's Round-up Ready soybeans containing a gene that conferred resistance to a powerful herbicide. These developments in the field of biotechnology had two effects. One was to cement the perception that raw PGR was extremely valuable—the Merck-Inbio deal became a symbol for the revenues that every

³³ Cite to David Tilford, Case Western Res. JIL article 1998.

³⁴ WRI book.

³⁵ id.

tropical government hoped to reap. The simultaneous emergence of engineered crops also created the impression that the entire industry was poised to change to a new more profitable business model. Subsequent economic analyses—as well as a dearth of realized profits—suggest that the value of rain forest genetic resources was considerably overestimated, but in the 1990s the hopes for transformation were a more powerful elixir than the econometrics. The other effect was that engineered crops became entangled in political controversy—opposed by many environmentalists, who feared their impact on ecosystems, but also by many developing countries who feared that if they allowed any engineered crops in their soils that all of their agricultural products might be barred from markets where engineered crops carried a stigma.³⁶ While this debate is complex and ongoing, it became enmeshed in the PGR regime complex through the inclusion, in the Convention on Biological Diversity, of a provision calling for the negotiation of a protocol on "biosafety."

The Legalization of Sovereign Rights and Intellectual Property Rights System

The early 1990s represented a watershed period in the development of the PGR regime complex. The Biodiversity Convention negotiations underscored the value of PGRs to the industrialized world and also revealed that the developing countries would seek to control access to their PGRs as a new form of leverage. Yet the CBD was a broad agreement dominated by relatively weak environment ministries and had little capacity to alter the rules that governments adopted to control the flow of genetic resources. At the same time that the CBD was finalized, governments—represented by more powerful trade ministers—were also in the final stages of negotiating a new round of international trade rules. These negotiations included a novel set of rules on intellectual property—put on the trade agenda because firms in software, pharmaceuticals and other “knowledge industries” insisted that their governments (notably the U.S.) demand better international protection of intellectual property. By itself, agribusiness would not have been able to advance this agenda, but with powerful allies—notably pharmaceutical and media companies—their concepts arrived at the center of the WTO

³⁶ Robert L. Paarlberg, 2001, *The Politics of Precaution: Genetically Modified Crops in Developing*

negotiations. With U.S. power they were codified into TRIPs. TRIPs sets minimum standards for intellectual property protection that forced parties to approximate an industrialized country model, and in practice these standards were closely modeled on U.S. or E.U. law.³⁷ Moreover, TRIPs was folded into the new WTO structure, which included a powerful, retooled dispute settlement system. Thus a large number of developing countries joined the WTO seeking the benefits of freer trade, but their membership also required a transformation in their domestic rules for protection of intellectual property.

TRIPs contains specific language on genetic resources, which mandates that countries must grant patents for microorganisms, and in Article 27.3b requires *either* patents or a "sui generis" system for worked PGR.³⁸ The UPOV system of plant breeder rights was likely the concept that some TRIPs drafters had in mind for sui generis system, but not all states wanted to endorse UPOV. Lingering resistance to the notion of protecting living things through intellectual property rights, and concern about the North-South dimensions of the plant breeders' rights issue, forced the drafters to leave this provision open-ended and subject to review in 1998. (As of 2002 this review has barely commenced, though the statement launching the Doha Round of trade talks suggested that the review process will continue.)

Within the FAO, a major change also occurred in the early 1990s: the negotiation of an additional Annex to the 1983 FAO Undertaking. The 1991 Annex signaled a fundamental shift in the terms of debate over PGR protection within that institution and, subsequently, in most others. The Annex stated that "the concept of mankind's heritage, as applied in the [1983 Undertaking], is subject to the sovereignty of states over their plant genetic resources." This transformation was highlighted by an additional statement that flatly asserted that "nations have sovereign rights over their plant genetic resources." This reference to sovereign rights as the governing international rule, rather than common heritage, was almost the exact language in the draft texts, then-circulating, of the Biodiversity Convention.³⁹ The Biodiversity Convention also made clear that

Countries (Baltimore: Johns Hopkins Press).

³⁷ Keith Maskus book on global IP.

³⁸ A "sui generis" system simply means a unique system tailored, in this case, to the needs of PGR.

³⁹ The only difference being that the Biodiversity language referred to all biological resources, not just genetic resources.

states controlled access to PGR and that the open-access norm of the past was gone. Through this assertion of sovereign rights, a new approach to PGR, in which state sovereignty and intellectual property rights were the core norms, coalesced.

Regime Complex in Action

The 1990s offer a snapshot of how legal norms change in a regime complex. During this critical decade, propertization triumphed. The FAO Undertaking process abandoned common heritage for PGR by 1989, and the Biodiversity Convention explicitly and centrally proclaimed genetic resources to be sovereign property by 1992. Both TRIPs and the Biodiversity Convention entered into force in 1994 (though their negotiations took years) and patent protection for PGR, as well as other life forms, continued to be incrementally extended in US and EU domestic law throughout the 1990s. As the varied international agreements began to be implemented, such as through national capacity building programs in the biodiversity context that included model legislation on sovereign ownership of resources, the debate over rules of ownership--common heritage vs. state sovereignty--was largely put to rest.⁴⁰ Figure 1 depicts the evolution of the regime complex graphically.

[insert figure 1 about here]

The rapid transformation in international rules did not occur at the same pace in all of the elemental regimes; nor did the key stakeholders in each regime view the issues identically to their counterparts in other regimes. In some instances the interactions between elemental regimes were supportive--as in the FAO Annex employing language drafted for the Biodiversity Convention. But in many other cases the norms in the different elemental regimes were in conflict. The Biodiversity Convention, for example, contained language on the scope of intellectual property rights and requirements that

⁴⁰ Though not totally, as evidenced by the announcement at the 2002 World Social Forum in Porto Alegre of a campaign to introduce a new treaty to "share the genetic commons." See http://www.ukabc.org/genetic_commons_treaty.htm

governments adopt schemes to share the benefits of worked PGR—language that the US government saw as aimed at undermining TRIPs.⁴¹

⁴¹ Concern over the implications of the Biodiversity Convention for TRIPs was one of the chief reasons the first Bush Administration refused to sign the Biodiversity Convention. Raustiala, *Domestic Politics and International Regulatory Cooperation: Comparative Responses to the Convention on Biological Diversity*, **World Politics** (1997)

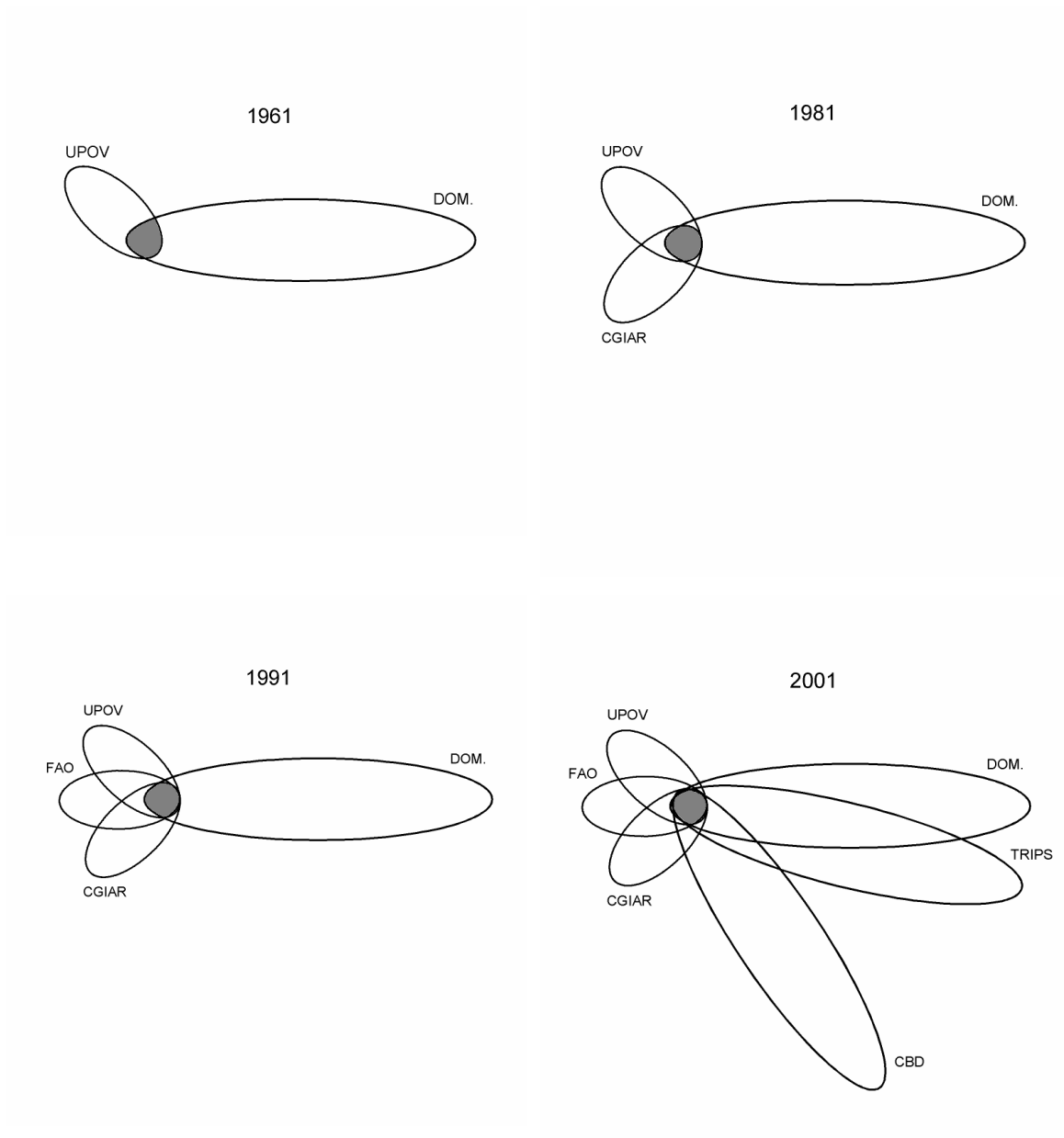


FIGURE 1: THE DEVELOPMENT OF THE REGIME COMPLEX, 1961-2001

Legend

This figure depicts the interactions that form the PGR regime complex. Central shaded area represents the issue of property rules for plant genetic resources. Ovals represent

the substantive scope of the elemental regimes and of national law. Larger ovals encompass more non-PGR issues than do smaller ovals. “Dom” = Domestic IP law in the US and EU

In essence, the debates over the international rules occurred broadly in two dimensions as shown in figure 2. One dimension concerned the mechanisms for ownership of PGR—from “common heritage-open access” to some form of exclusive property right. By the early 1990s rules over ownership had shifted to the right—to sovereign and private ownership—but the extent of the shift was still hotly contested. For example, in the TRIPs review process as well as in the negotiation of a "Biosafety Protocol" to the Biodiversity Convention, developing countries, sometimes joined by the EU, evinced a strong desire to limit the scope of protection for worked PGR. This effort was strongly opposed by the US, which sought to treat genetic innovations like other innovations, and sought the widest possible ambit for intellectual property law. Similarly, as a consensus emerged in favor of ownership of PGR, new conflicts emerged about the acceptability of the patenting of life-forms.⁴²

The other dimension shown in figure 2 was the mechanism for allocating the benefits from raw and worked PGRs—whether a market-based system, or a system in which public institutions intervened. Even as the norms of ownership over PGR converged there remained strong disagreements over whether the market should be left to itself to allocate the benefits of PGR or whether the allocation of benefits should be regulated. Developing countries desired rules that would force PGR innovators to share the benefit stream with those states that provided the raw PGR. In other words, they wanted "bio-pirates" to disgorge a share of profits to those who now, thanks to the new normative framework of sovereign property rights, owned and controlled access to raw PGR. The Biodiversity Convention in particular became a focal point for the elaboration of benefit-sharing schemes.

[insert figure 2 about here]

While the basic international norms governing PGR had been transformed, states now addressed the many remaining, and more fine-grained, differences over the precise scope and nature of PGR protection. Real and perceived conflicts in these rules in turn

⁴² Such as the Harvard onco-mouse, a mouse genetically modified to get cancer.

animated searches for solutions that would reconcile the varied strands of the regime complex. The search process occurred through a wide array of institutions—the numerous working groups within the CBD, TRIPs, FAO, and, most recently, the World Intellectual Property Organization. Depending on how you count, by the 1990s more than a dozen intergovernmental committees worked on the PGR issue, spread across several disparate elemental regimes.⁴³ Moreover, governments were also fragmented in their representation within each of these regimes. Agriculture ministries dominated the FAO, plant breeders populated UPOV, environment ministries held court in the Biodiversity Convention, and intellectual property lawyers along with trade negotiators concentrated their focus on TRIPs.

Although it involved many disparate actors, the process of adjusting the rules in the PGR regime complex had a common focus: the inconsistencies between the elemental regimes. The inconsistencies focused the agenda for policy reform, which actors in these disparate institutions pursued in two different ways. First, diplomats and stakeholders sought to resolve differences in the treatment of PGRs through practice and the interpretation of existing rules—what might be called a “bottom up” approach. Second, simultaneously, they sought to change the rules as well—through new, and some cases continuing, international negotiations on PGR issues. The most important of these was the FAO's negotiation, completed in late 2001, of a new International Treaty on Plant Genetic Resources, but there were many smaller examples. Here we illustrate both modes of change—interpretation and legalization.

⁴³ cites from linkages, bridges etc. on the various committees.

Figure 2: Two Dimensions of Debate. Debates over international rules to govern PGR have focused on choices in two dimensions: the rules of ownership and the mechanisms for allocating benefits from PGR shown in the horizontal and vertical dimensions above. The cells denote the formal rules in particular elemental regimes at particular key moments in time. Note that the FAO Treaty distinguishes the rules that apply to both raw (“R”) and worked (“W”) PGRs for a core group of 35 staple crops, denoted “R35” and “W35”. The CGIAR gene banks (and other international gene banks) traditionally operated on the principle of open access (with regulated benefits—in the sense that the system was organized and maintained for public purposes not private, market-based innovations), but the creation of the CBD in 1992 posed a challenge to that system by claiming sovereign ownership of raw PGR. The FAO 2001 Treaty eliminated that challenge for the most important crops.

		Principal for Assigning Ownership of PGR		
		<i>Common Heritage</i>	<i>Property Rights</i>	
			<i>Sovereign (state-owned)</i>	<i>Private</i>
Mechanism for allocating benefits from PGR	<i>Market-based</i>	Traditional 19 th century system		20 th century national patents: -U.S. -E.U. TRIPs UPOV treaties
	<i>Regulated</i>	FAO 1983 Undertaking FAO 2001 Treaty (R35, W35) CGIAR gene banks	FAO 1989 and 1991 revisions to Undertaking CBD (1992) FAO 2001 Treaty (other raw) CGIAR gene banks (immediately post 1992, before FAO 2001 Treaty)	FAO 2001 Treaty (other worked)

The practices of the CGIAR system in the 1990s manifest the first approach. The CGIAR attempted to resolve the conflict between its practices—which had been based on open access—with the new rules that called for sovereign ownership by attempting to keep separate the pre-1992 and post-1992 collections in its gene banks. The pre-1992 collection would be able to travel under open-access rules, whereas samples from the later collection would require some form of compensation if they yielded useful products. In practice, that distinction was impossible to maintain, so CGIAR also sought to create material transfer agreements in which the supplier of genetic material would agree to allow free access—in essence, superseding the CBD and restoring the pre-1992 status quo.⁴⁴

This bottom-up approach is also evident in several debates that continued unresolved through the 1990s, such as over the assignment of "farmer's rights." Farmers' rights are "rights arising from the past, present and future contribution of farmers in conserving, improving, and making available plant genetic resources..."⁴⁵ The underlying idea was to compensate farmers for the slow, incremental, and collective innovations they create through their normal agricultural practices—as a counter to the plant breeder rights assigned to commercial innovators by UPOV.. At bottom, the farmer's rights debate addressed the dividing line between raw and worked PGR, and asserts that much of what is taken to be raw is in fact worked. This debate continued through floor speeches at UN fora and through efforts to challenge the expansion of PGR patentability in many industrialized states--in particular the US. Having lost the debate over whether life forms could be patented at all, opponents, which included many NGOs, shifted their arguments and claimed that patent rights were too broad—"novel" products were not novel but, rather, built on traditional knowledge accumulated over generations. Most famous are challenges to the Neem and Ayahuasca patents; both reflect efforts by farmers or indigenous peoples to claim rights for

⁴⁴ [verify MTAs] John H. Barton & Wolfgang E. Seibeck, Material Transfer Agreements for the International Agricultural Research Centers?, (Paper Presented for the International Plant Genetic Resources Institute (IPGRI), Final Draft, March 11, 1994).

⁴⁵ CPGR-6/95/8 pp. 12 "issues for consideration in stage II"

traditional knowledge and to determine what is and what is not subject to intellectual property rights, and, if property rights exist, who the rights holder should be.

The second approach—the commencement, at the international level, of new negotiations and the continuation of older negotiations, is manifested in TRIPs, the CBD, and in the new FAO treaty. In TRIPs, the major issue has been the review of Article 27.3b, which addresses PGR. In particular, states have been grappling with the meaning of an "effective sui generis system" (the language used in 27.3b) for protecting plant innovations. In the CBD, the focus has mainly been on the development of rules for benefit sharing, which are called for in the treaty. Yet the Biosafety Protocol, while not directly addressing PGR issues, also clearly seeks to limit the marketing of genetically-modified organisms. Finally, the 2001 FAO Treaty is the culmination of years of negotiation explicitly aimed at reconciling the FAO Undertaking with the CBD and TRIPs. The 2001 Treaty's aim is to facilitate the exchange of seeds and other germplasm between member states. It does so by creating a "multilateral system" to which members will be granted preferential access:

In essence, the multilateral system is a communal seed treasury composed of 35 food and 29 feed crops now held by governments...and by CGIAR...in exchange for access to this common seed pool, those who commercialize products that incorporate plant genetic resources received from the multilateral system must pay a percentage of their profits into a fund to be administered by the Treaty's Governing Body. That fund will be used to promote conservation and sustainable use of plant genetic resources, particularly by farmers and indigenous communities, whose rights and contributions to genetic diversity the [2001 Treaty] expressly recognizes.⁴⁶

The 2001 FAO Treaty embodies many of the themes that are woven through the PGR debate: the desire to share the benefits of propertization collectively; the concern with

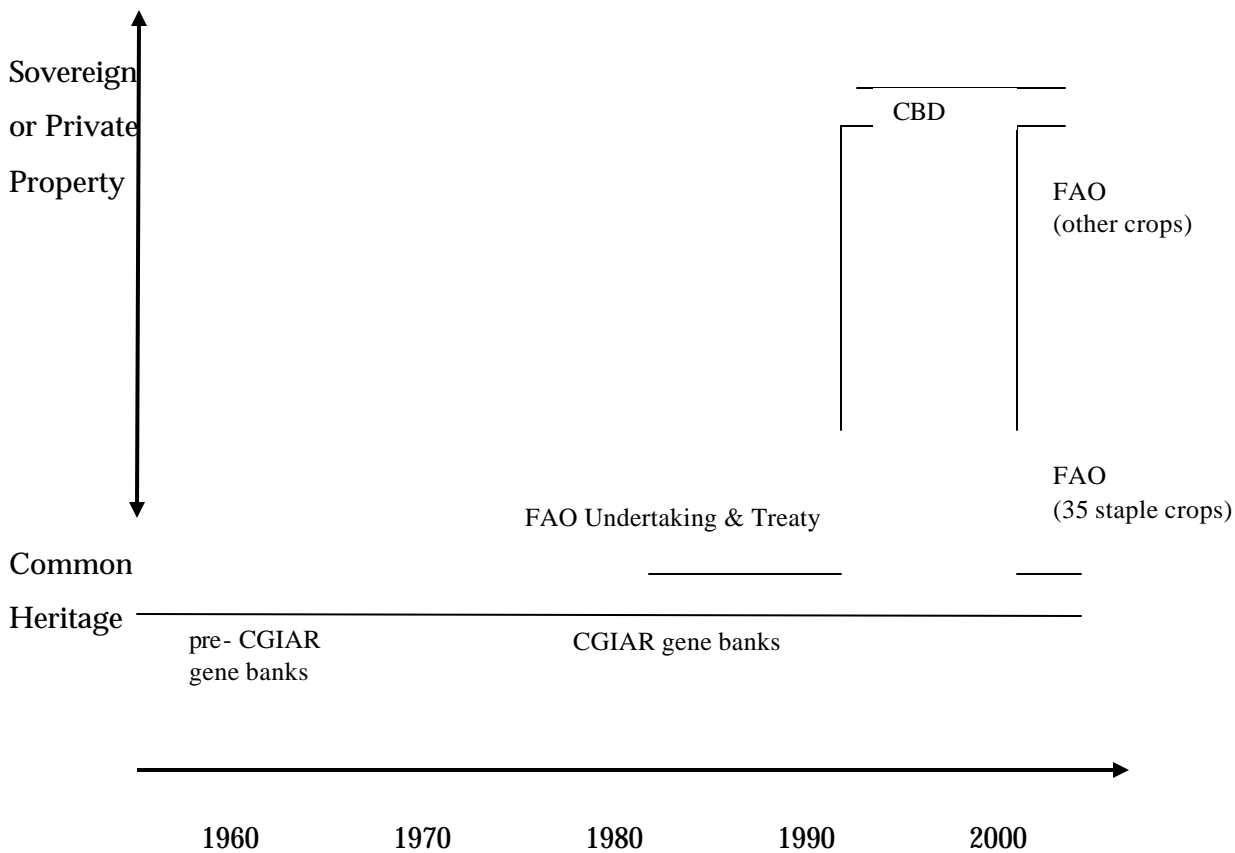
⁴⁶ Helfer Report, at 50.

food security; the need to keep the CGIAR system open; the rights of farmers and other informal innovators. The core of the new PGR order, nonetheless, remains unchallenged: for all but a few major food crops, property rights and sovereign control are the rule.

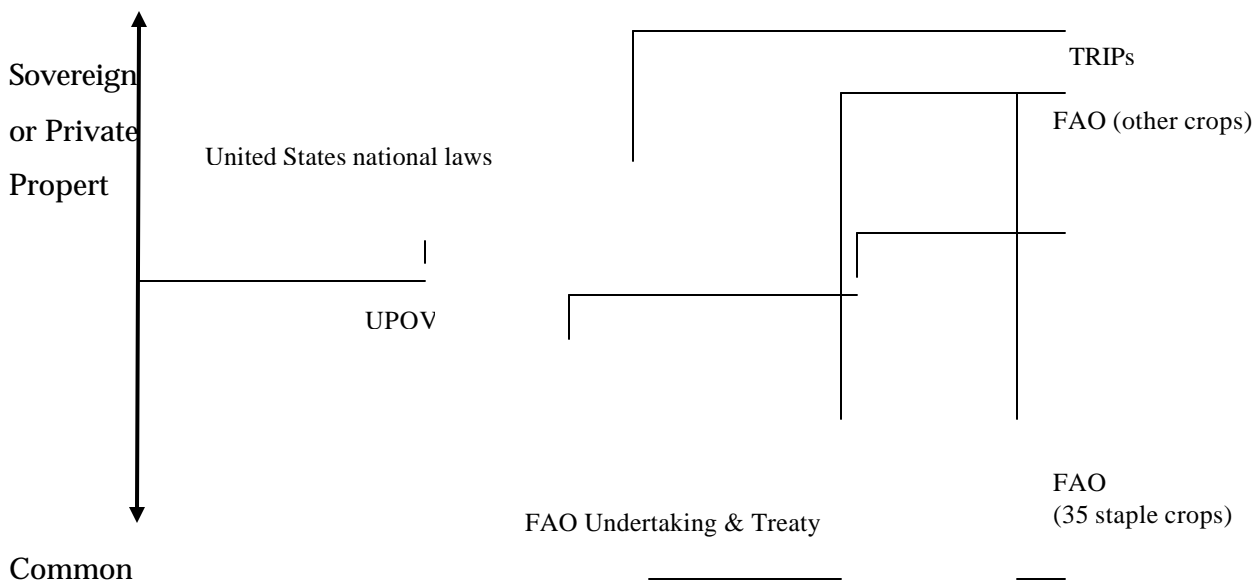
In sum, by the end of the 20th century the international rules governing PGR were radically different from those that existed 50 years earlier. The common heritage principle, which had persisted for so long, had been replaced by a system of sovereign control over genetic resources. While states now owned and controlled access to PGR, private entities could obtain intellectual property rights in PGR. Figure 3 summarizes this shift—for raw PGR (panel a) as well as “worked” PGR (panel b). Our claim is that the development of a property rights system is best understood as a Demsetzian transition. As new plant breeding techniques and recombinant DNA technology transformed the scope of plant innovation, the value of PGR, both raw and worked, rose dramatically. As Demsetz suggested, this rise in value led to increasing demands for property rights. Decisions such as the US Supreme Court's in *Diamond* paved the way, as they both recognized and substantially reinforced the rise in value associated with PGR. The demands for property rights in PGR were largely met by the mid-1990s; enclosure triumphed over common heritage and open-access.

[insert figure 3 about here]

Panel A: “Raw” Plant Genetic Resources



Panel B: “Worked” Plant Genetic Resources



Heritage



Figure 3: Changes in Property Norms for Raw (panel A) and Worked (panel B) Plant Genetic Resources. Institutions shown only on panels for which they have relevant rules; UPOV, for example, relates only to worked PGR. CGIAR gene banks are shown as “raw” although perhaps 2/5 of their collections have been worked in some way. CBD is not shown on panel B, although the CBD does include a clause that pertains to worked PGR. Lines shift at major events that alter the rules within a given institution. Major events for raw PGR: the Annex to the International Undertaking (1991); the FAO Treaty that distinguishes rules for 35 staple crops from those for non-staples (2001). Major events for worked PGR: the PVPA (1970) and the *Diamond* case in the U.S. (1980); revisions to UPOV (1978, 1991); the annex to the International Undertaking (1991).

The last decade has nonetheless witnessed continuing contestation over the international rules governing PGR, as states and various stakeholders seek to refine property rights and determine their precise scope and meaning. Because much is at stake, both economically and ideologically, these battles are often hard fought. At the same time, states have struggled to reconcile the competing approaches found in the various elemental regimes that the PGR regime complex comprises. Through practice, interpretation, negotiation, and specialization, norms and rules have gradually, though not completely, adjusted to the existence of the regime complex and crystallized around a common normative core. The 2001 FAO Treaty simply represents the latest salvo in this interactive process—one more attempt to refine a set of rules acceptable to the primary stakeholders across the PGR regime complex.

III. Regime Complexes and the Study of Regimes

Many studies have noted the tremendous rise in the number of international treaties and organizations, particularly since 1945.⁴⁷ The implications of increasing institutional density nonetheless have received little attention. There has been some concern among international lawyers with “treaty congestion.”⁴⁸ More recently, Oran Young has explored what he terms “institutional interplay.” But for the most part scholarship on international cooperation has proceeded as if rising institutional density is immaterial for theories of international regimes. As the PGR case illustrates, however, rising density has led to overlapping regimes, often with conflicting rules, and these overlapping regimes interact in important ways. Rather than a single discrete regime governing PGR, there is a regime complex. By conceptualizing the PGR case as governed by a regime complex, and carefully analyzing the interactions among the elemental regimes comprised by the complex, we can more accurately describe and better understand the evolution of substantive rules in the PGR issue-area.

In the remainder of this article we use the PGR case to illustrate and probe the conjectures about regime complexes described in the introduction.

⁴⁷ Meyer et al;

⁴⁸ E. Brown Weiss.

No Clean Slate

Existing scholarship on international regimes has generally, if implicitly, assumed that the process of regime formation begins with an institutional clean slate. In most empirical studies of regime formation negotiators arrive at the task of forming a regime without any explicit international rules or strong shared expectations in place. To be sure, in some cases regimes are “nested” and one agreement builds on another. But in such cases the connections are relatively clear.⁴⁹ By contrast, by definition in a regime complex the institutional slate is not clean. Several overlapping international agreements exist, each of which addresses some aspect of the issue in question. Ideas, interests and expectations are already aligned around some set of existing rules and concepts, though these rules and concepts can and often do contradict one another. Power, interests and ideas as a result do not directly map to outcomes in the rules and behavior in the regime, and analysts cannot therefore trace rule content or evolution neatly back to changes in these underlying driving forces. We expected that the complexity of interests and the existence of overlapping rules and norms would lead to distinctive processes of institutional development.

The best example of how prior expectations and institutional accretion affect outcomes in a regime complex is the provision on PGR protection in TRIPs, known as Article 27.3b. When negotiators in TRIPs began crafting rules on intellectual property for PGR in the late 1980s there were several sets of rules and expectations already firmly in place. For decades, the community of plant breeders had built up the concept of a “plant breeder’s right” and enshrined it into both international and domestic law. Interests that were opposed to even this weak form of intellectual property right, predominantly concentrated in the developing world, had already established a marker in the 1983 FAO International Undertaking. Yet these opponents to intellectual property rights in plants were fragmented by the early 1990s because at the very time that TRIPs was taking shape many of the governments in developing countries were shifting positions on property rights, at least for raw PGR. Newly aware of the rising value of

PGR, they sought to assert sovereign rights and to reverse the long-standing principle of treating raw resources as the common heritage of mankind. That same principle had informed their earlier opposition to enshrining property rights for worked resources.

In this state of flux it was impossible to gain consensus on a single approach. Yet the TRIPs negotiation, part of the omnibus Uruguay Round, could not be halted, so the negotiators agreed on a broad umbrella approach. TRIPs decreed that plant varieties must be protected either by patents or by an “effective sui generis system,” and this compromise would be reviewed after four years. This approach, which in turn focused subsequent efforts to clarify the meaning of article 27.3b, traces directly to the multiple interests, rules and expectations that already existed in the PGR regime complex. It contrasts sharply with more familiar cases such as that of the Montreal Protocol on ozone depletion, where negotiators had diverging interests but the negotiation process was unconstrained by existing rules on ODS. Faced with a clean institutional slate, the Montreal Protocol negotiators could strike a political compromise that directly reflected relative power, interests, and knowledge. Indeed, when negotiators in the Montreal Protocol regime inserted language about trade measures with regard to non-parties, they were not much constrained by existing trade rules or expectations about the use of sanctions to enforce international environmental agreements.⁵⁰ The negotiators of PGR provisions in TRIPs, the 2002 FAO Treaty, the Biodiversity Convention and so forth faced a quite different situation. A multiplicity of overlapping rules and norms existed, against which they crafted new rules. As we discuss further below, the preference for consistency, in particular legal consistency, played a major role in constraining rule choices. At times, however, negotiators embraced inconsistency, employing what we term strategic inconsistency as a way to shift rules across fora. In both situations, however, the existence of overlapping and inconsistent elemental regimes plays an important role in the development of the regime complex.

Forum shopping

⁴⁹ Oran young [here or in text explain that nested regimes have explicit legal hierarchy and typically formally delineate boundaries between each nested unit.]

The defining characteristic of a regime complex is the existence of multiple, overlapping elemental regimes. Given the availability of multiple fora, we expected to observe countries and interest groups selecting the forum that best suited their interests, and pursuing rule development there. The PGR case study is consistent with this expectation.

The FAO, for example, served as the negotiating forum for the 1983 Undertaking that sought to declare all PGR, both raw and worked, to be the common heritage of all mankind. The FAO was a favorable site for assertions of redistribution and had, as part of the UN system, open access rules that permitted many states to participate. By contrast, the WTO served as the site for negotiation of new intellectual property rules for PGR. The US and to a lesser extent the EU used the omnibus nature of the WTO to force developing countries to accept a wide array of intellectual property rules that were arguably of detrimental to their interests.⁵¹ To be sure, the acceptance of stronger intellectual property protection was part of a broader shift toward economic liberalization in the 1990s. Moreover, the US did not get everything it wanted with regard to PGR: rather than strict patent rights or even plant breeders rights on the UPOV model TRIPs merely requires an “effective sui generis system.” This formulation reflects the divide between North and South but also between the US and EU on the propriety of intellectual property rights in living organisms. This debate continues today.

At the same time that TRIPs was under negotiation the Convention on Biodiversity was negotiated. The rules in the two treaties on genetic resources, and in particular on the scope of intellectual property rights, are nonetheless distinct. Indeed, in the view of some countries, most notably the US, the rules in the Convention on Biodiversity undercut those in TRIPs. This divergence in substantive rules occurred despite the fact that the Biodiversity Convention and the WTO have roughly the same membership. Developing countries used the biodiversity agreement to push for technology transfer and to ensure that whatever private property rights were granted to genetic resources would work to the benefit of the developing countries that supplied raw PGR (Though also sought, and secured, a statement that genetic resources were

⁵⁰ The protocol was negotiated before *tuna-dolphin* catapulted the trade-environment linkage to the front of the international agenda.

⁵¹ Cite:bhagwati, others. Sell article in io.

sovereign resources). Developing countries were able to achieve this outcome because the broader goal of the Biodiversity Convention—the protection of biodiversity—was something many advanced industrial states sought. The leverage that developing countries possessed in this forum was not matched in the WTO-TRIPs negotiations: there, it was the US and EU that had the market access developing countries desired, and as a result the US and EU were able to successfully negotiate strict property rights.

Regime Development through Implementation

In the traditional model of regime development changes in power, interests or knowledge yield changes in regime rules. Parties who seek a change in the rules press their cause through international negotiations and the implementation process follows thereafter. For example, as the European countries became greener in the early 1990s and as new studies showed that the modest rules of the Montreal Protocol would fail to stem the depletion of the ozone layer, countries sought new and tighter rules on ozone depleting substances.⁵² In negotiating new rules member states were certainly constrained by domestic factors—such as the cost of implementing the rules at home and the cost of contributions to the international fund for compensating the developing countries—but essentially all of the effort at changing the rules focused on the international fora. In turn, in the traditional model the implementation process often reveals that existing rules are inadequate, spurring another round of negotiations to tighten the screws. Indeed, scholars and practitioners sometimes refer to the process as a “ratchet.” A set of rules is adopted, they provide a baseline for implementation, and then the next round makes them tighter.

The PGR case suggests that in a regime complex the evolution of regime rules occurs much more through a bottom-up process. The formal international rules do not operate mainly as a ratchet but, rather, as a point of focus for a decentralized learning process. The outcome is rules that are more carefully tailored to local interests and capabilities—not always rules that are “tighter.”

⁵² Benedick (DATE), Parson, 2002, and Brenton (1995??).

This process—adjustment through implementation and interpretation—occurs slowly and unevenly. Negotiators know that they are adopting broad rules that often conflict and provide poor direct guidance to the implementation process, but they adopt broad rules nonetheless because it is extremely difficult to work out the fine detail for all contingencies and local situations *ex ante*. This approach—the use of broad and often inconsistent general rules—reflects the lack of an institutional clean slate. It also reflects that as the regime complex develops it often encompasses new elemental regimes—and with each node in this network of rules and institutions it becomes harder to coordinate and avoid inconsistencies.

We hypothesize that as the scope of the regime complex grows, the style of rule change shifts ever more to this “bottom-up” style and away from the top-down system that is implicitly assumed in the dominant approach to the study of regimes. We also suggest that the parties are not content just to allow different interpretations to flourish through the implementation process—rather, they use the experience in implementation as a direct guide for subsequent formal changes and clarifications of the rules. In the PGR case rule change was guided—and, at times, driven—by lessons learned through focused attempts at implementation. Three episodes in the history of the PGR regime complex reveal this process—one episode has now largely run its course, and two are still in motion. First, the evolution of rules for gene banks in the CGIAR system shows how incompatible interests led diplomats to adopt broad and conflicting rules. In turn, solutions were worked out through implementation. The origins of that episode were the shift in preferences in the late 1980s by developing countries in favor of sovereign rights over raw PGR. These countries inserted language into the Biodiversity Convention underscoring that approach, knowing that it would conflict directly with the FAO Undertaking as well as long-established practice in the international gene banks, which were conceived and operated according to the principle of open access and common heritage.

At first the CGIAR gene banks attempted the easiest solution to this inconsistency: ignore the CBD rules or segregate their collections into pre-1992 (open access) and post-1992 (regulated access). Segregation proved expensive, contrary to the open-access culture that pervaded CGIAR, and would have required the herculean task

of tracing the elements of an improved seed variety back to its pre-1992 and post-1992 traits. Modern crop varieties are built from dozens of strains from raw materials preserved in seed banks; allocating the improvements based on the national origin of the material was nearly impossible. But the strategy of simply ignoring the CBD rules did not prove sustainable. It directly conflicted with the CBD and was controversial with developing country governments and NGOs that sought regulated access as a way to channel some of the benefits of raw PGR back to the countries of origin, thereby halting “biopiracy.” Ultimately, diplomats in the FAO concluded that a change in the rules would be required. At the same time the FAO was renegotiating the FAO Undertaking to bring it into line with the CBD. Developing countries refused to abandon the principle of sovereign rights for raw PGR, but they did accept common heritage status for a list of 35 staple crops. For these crops the gains from sovereign ownership were small and strong property rights would undercut the goal of food security. Consequently, the new International Treaty on Plant Genetic Resources explicitly exempts these 35 crops from the principle of sovereign ownership. Attempts at implementation of the conflicting rules in the Undertaking, gene banks, and CBD revealed the need for this change in rules; yet the general principle of sovereign ownership remained intact. The parties started with broad and conflicting rules and then tried to work out the problems—with the strategies that were easiest to implement first, followed by those that required progressively greater legal coordination and content.

Two other examples of evolution through implementation in the PGR case are still unfolding, and we mention them only briefly. One is reconciling the various weak forms of intellectual property that can be asserted over improved plant varieties—such as the different types of plant breeder rights that are embodied in the different UPOV agreements—with the strong, patent-based rights that many countries, led by the U.S., are now allowing for innovators. Article 27.3b in TRIPs accepts all of these systems but envisions that several years after the creation of the WTO (in 1995) a review would take stock of the various efforts and propose a coherent route forward. The architects of TRIPs built in to the agreement the very process that is a hallmark of a regime complex because they knew that the many varied interests and competing schemes made it

impossible for them to adopt a precise rule. Rather, they enshrined a general approach and then hoped that the implementation process would lead to a specification of the international rules that was more precise yet still compatible with the diverse interests involved. The 27.3b review is proceeding slowly—more slowly than envisioned by the TRIPs architects—which reveals another point about the dynamics of a regime complex: the codification of international norms is driven by credible deadlines, but the implementation process often drags on because politically the easiest solution in the face of rule conflict is to keep the rules broad and then defer the details until later.

The third example involves what intellectual property lawyers call “traditional knowledge.” Modern systems for protecting intellectual property are organized to protect discrete innovations that occur at a moment in time by specified persons; they are generally unable to protect innovations that reflect the slow accumulation of novel concepts by many (unknown) members of a community.⁵³ This fact has led advocates for indigenous peoples to fear that traditional knowledge will be incorporated into discrete innovations and patented—with the stewards of such knowledge not rewarded for their long efforts and, perhaps, even forced to pay for the innovation constructed on their work. This movement spawned the effort to create and assert “farmers rights”—as a counterpart to plant breeder rights—that would recognize and reward traditional farmers for their improvements to crops. That effort has not yielded much practical change—mainly because key advanced industrialized countries are opposed but also because the decentralized “learning through implementation” process never produced a viable solution. Opponents of strong intellectual property rights rail about the failures to reward traditional knowledge, but have generally failed to develop viable rules with which to do so. Now WIPO, which has been a peripheral actor in this story, has convened a new working group to generate property rights rules and benefits sharing schemes that will recognize traditional knowledge. WIPO’s entry is part of the decentralized adjustment process that has occurred in the PGR regime complex as legal inconsistencies and broad rule conflicts are revealed.

Legal Consistency

⁵³ See generally Boyle, seeds, shamans and spleens.

One of the signal attributes of the PGR regime complex is a concern on the part of actors [diplomats] with legal consistency within each elemental regime and among the various elemental regimes. Assuring legal consistency, by which we mean a lack of overt legal conflict among overlapping rules, is a recurring and difficult problem because the international legal system has no formal hierarchy of treaty rules. While the WTO may be more politically significant than the CBD, for instance, as a legal matter the two are on an equal plane. Nor are there are clear super-mechanisms or principles for resolving inconsistencies among legal rules.⁵⁴ The PGR case suggests that legal consistency matters because areas of persistent inconsistency serve as a focal point for efforts at reconciliation—through attempts at inventing ways to implement or interpret international norms such that inconsistencies would be resolved and, if such efforts fail, through formal renegotiations. Efforts to resolve inconsistencies are focused, initially, within each elemental regime; as these are sorted out, inconsistencies at the “joints” between the elemental regimes pose more persistent challenges.

The concern with achieving or increasing legal consistency in the PGR regime complex is illustrated in several conflicts. One is the evolution of the FAO Undertaking. The original 1983 Undertaking declared all PGR to be common heritage, but as attitudes shifted during the 1980s and developing countries favored a new approach based on sovereign rights the inconsistencies between the Undertaking and shifting norms of international law became apparent and were enshrined in the 1992 CBD. Those inconsistencies then set the scene for the major battles over intellectual property rules concerning PGR. The Undertaking itself was renegotiated—and through that negotiation process diplomats were forced to elaborate how the new scheme of sovereign rights over PGR could be applied in detail, such as in the gene banks that housed raw PGR. Similarly, when diplomats took up the task of negotiating a protocol to the CBD—the Biosafety Protocol—the did so against the backdrop of TRIPs, which required countries to impose stricter systems for protecting intellectual property in worked PGR. The result was extensive debate over so-called “savings clauses”: clauses

⁵⁴ Note importance of temporality (later in time principle) and *lex specialis*. In practice, however, these rules are not that powerful and as a result substantial controversy exists over the result when international treaties conflict.

in the Biosafety Protocol that purport to immunize TRIPs from any inconsistency with the Biosafety Protocol's provisions. (Whether the text achieves this or merely highlights the intractability of legal consistency is a debated proposition).⁵⁵

The PGR case illustrates that states also attempt to create what we term strategic inconsistency—to force change in rules by explicitly crafting rules in one elemental regime that are inconsistent with those in another. They do this because they know that inconsistencies focus diplomatic and implementation effort. Developing countries led the establishment of the original 1983 FAO Undertaking in an attempt to refocus the agenda—away from established principles that awarded property rights to plant breeders, such as in the UPOV Convention, and toward a broad common heritage principle for all PGR. The CBD rules on intellectual property rights are another example—the CBE included language that made intellectual property rights subservient to environmental protection and development objectives, which appeared to contravene the content of TRIPs, which was already taking shape in the Uruguay Round. Indeed, this conflicting language was part of the reason the US refused to sign the CBD.⁵⁶ These examples contrast sharply with the single-issue nature of the ozone regime, where the issue of legal consistency with other regimes did not arise until several years after the Montreal Protocol was first negotiated—when compatibility between environmental regimes and trade regimes was the subject of intense debate. (Even then, the debate over compatibility between trade and environment regimes was mostly hypothetical.) In the one area that initially might have revealed interactions between regimes—the fact that some ODS are global warming gases as well—explicit language was added in the UN Framework Convention on Climate Change to exempt the ODS gases from its reach.⁵⁷

The concern with legal consistency in the PGR story is emblematic of a more general trend toward legalization in world politics.⁵⁸ International relations are increasingly legalized; legal arguments and legal concepts play a greater role in international cooperation.

⁵⁵ safrin article in *ajil*.

⁵⁶ Raustiala, *World Politics* 1997.

⁵⁷ cite to the language in the UNFCCC.

Conclusion

Genetic resources are increasingly an arena of global conflict in world politics. The struggle over the control of plant genetic resources is at the core of this battle. Over the last century, the international rules for PGR protection shifted—quite dramatically—from a common heritage, open access system to a system of sovereign resource rights and private intellectual property rights. We have argued that this transition, was driven by the perception—and the reality—of the rising value of PGR, in particular as new techniques of genetic manipulation permitted innovators to add substantial value to plants. Propertization, initially resisted by the plant-rich developing world, has triumphed over common heritage.

This transition to an international property rights system did not occur smoothly. Rule evolution in the PGR case involved several distinct but overlapping international regimes interacting with each other as well as the domestic practices of key states. Whereas existing studies of international regimes have generally focused on regimes as single, self-contained entities, often built around a single treaty, the hallmark of the regime complex in PGR is the lack of any central, hierarchical international institution. The principles, norms, rules and decision-making procedures that govern plant genetic resources have not arisen or changed in ways that are fully consistent with the existing body of theory about international regimes. Consequently, the PGR case is best characterized as a regime complex rather than a regime. The horizontal, overlapping structure and the presence of divergent rules and norms are the defining characteristics of a regime complex.

The regime complex for plant genetic resources is unlikely to be the first or the last such institution in world politics. Indeed, there are good reasons to believe that regime complexes will become much more common in coming decades as international institutions proliferate and inevitably bump against one another. We have advanced several hypotheses about the dynamics of a regime complex in order to highlight how the process of rule evolution in a regime complex differs from the processes identified by mainstream regime theory. In a regime complex rules evolve against a thick

⁵⁸ IO volume

backdrop of existing rules: there is no clean institutional slate upon which actors pursue interests or wield power. This backdrop defines the regime complex but also generates its distinctive dynamics. In an increasingly legalized world, the lack of legal consistency that flows from differing and overlapping rules pushes states to seek resolutions and to negotiate broad rules. At times, states also create strategic inconsistency as they seek to move the rules in one or another direction.

In all these circumstances the primary locus of action is not formal negotiations but instead more complicated processes of implementation and interpretation, which in turn feed back at times to formal negotiations. We hypothesize that as the scope of the regime complex grows, the style of rule change shifts ever more to this “bottom-up” style and away from the top-down system that is implicitly assumed in the dominant approach to the study of regimes. While regime theory has advanced significantly since its start in the early 1980s, more research on regime complexes and their evolution will, we believe, both reflect a growing empirical reality and contribute to the increasing number of studies on the relevance of law, legalization and institutions to world politics.