
Foreword

“On the Silver Jubilee of ‘Intellectual Property and Information Markets: Preliminaries to a New Conservation Policy’”

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Imagining alternatives is innately human: What if I had married my childhood sweetheart? What if I had chosen a different career? What if I had migrated? What if I had stayed? Such musings evoke a range of emotions and the possibilities are endless. A few remind us of our vulnerability. “What if I had been at that very spot a minute sooner?”

Although the above questions are self-centered, the template is not ego-bound. “What if” radiates out and can be scaled up. On the lecture circuit, paleontologist Stephen Jay Gould would imagine the boundary of the Cretaceous and Tertiary Periods, 65 million years ago. “What if the asteroid struck a few seconds later?” Traveling at a velocity of 20 km/second, the Gulf of Mexico would have absorbed the kinetic energy rather than the coastline of the Yucatán. The Age of Reptiles might not have ended, nor the Age of Mammals begun. Imagining the alternative is instructive. In the Age of The Bomb, something slightly different may trigger nuclear war and end in nuclear winter. Disarmament makes sense.

Far less dramatic than an asteroid or The Bomb are the synergistic reasons for mass extinction in the Age of Man: Habitat destruction, Invasive species, Pollution, Population and Over-harvesting rendering the acronym HIPPO (Wilson 2002: p. 50). The 1992 United Nations Convention on Biological Diversity (CBD) grappled with the variables H, I and O of HIPPO but left the P of Pollution for another convention and the P of population for another time. Three broad objectives were established in Article 1 of the CBD: “the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.” Because the third objective enables the first two, the order was reversed *de facto* in the Conference of the Parties (COP). Yet, despite twenty years and twelve COPs, “the fair and equitable sharing of the benefits” remains elusive. Imagining a different trajectory of the CBD is the subject of this foreword; imagining the alternative outcomes, the subject of the Case Studies. The policy implications of a slightly different language – genetic resources as natural information – constitutes the body of the book.

Before musing over what if natural information had been the object of utilization in Article 1, one must understand how a foundational mistake – genetic resources as “material” – entered Article 2. Françoise Burhenne-Guilmin

reflected on the events that culminated in the CBD in “Introduction to The Guide to the Convention on Biological Diversity,” co-authored with Susan Casey-Lefkowitz (1994). Her first-hand observations are worthy of quoting at length:

The UNEP Secretariat, assisted by a small group of legal experts, then prepared a first draft of the convention based on all the “elements” that had been produced so far. The formal negotiating process started in February 1991, when the group was renamed the Intergovernmental Negotiating Committee for a Convention on Biological Diversity (INC).

The main issues were divided between two working groups ... Working Group II dealt with issues of access to genetic resources and relevant technologies, technology transfer, technical assistance, financial mechanisms and international cooperation. Progress was slow and negotiation difficult, especially during the final negotiating sessions. As time passed, the self-imposed deadline for signature of the Convention – the UNCED Conference in June 1992 – was approaching with alarming speed.

The negotiations were often close to breaking down. Even on 22 May, the final day of the final negotiating session in Nairobi, it was not clear until the last moment whether the Convention would be adopted. Had the UNCED deadline not been present it is unlikely that a convention would have been adopted on that date. Yet in spite of this fact, and in spite of the tensions in negotiation, the number of signatures to the Convention in Rio on 5 June was unprecedented. The entry into force of the Convention, only 18 months after it was adopted was equally stunning.

(Glowka *et al.* 1994: pp. 2–3)

The narrative reads like a cliff-hanger and returns us to my template. What if the negotiations had broken down? The imagination fires. Five sessions of the INC were held from February 1991 to May 1992. What if the UNCED deadline had not been present? Burhenne-Guilmin and Casey-Lefkowitz leave no doubt about what would not have happened: The Nairobi Final Act of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity on May 22, 1992. Désirée Marielle McGraw draws the same conclusion in “The Story of the Biodiversity Convention: Origins, Characteristics and Implications for Implementation.” She relates: “[T]he momentum created by a multiplicity of meetings, the completion of the climate change negotiations and the pending and highly public Rio Earth Summit served as incentives for concluding a biodiversity convention” (McGraw 2000: p. 17).

I have one degree of separation from the heady events that transpired in Nairobi in the spring of 1992. In February of that year, I attended the 4th World Congress on National Parks and Protected Areas held in Caracas, Venezuela. Cyril de Klemm chaired a session on the progress of the CBD or, better said, the lack thereof. A more suitable chair could not have been found. Ten years earlier de Klemm had

presented “Protecting Wild Genetic Resources for the Future: The Need for a World Treaty” at the 3rd World Congress. In the intervening decade, his life-long vision had taken shape and he assumed center stage. Sporting a slightly crooked tie, the wispy 75-year-old seemed straight out of central casting. The role: the righteous legal scholar who hails from the Continent.

Attendance at the session was low, embarrassingly so. Reminiscent of the teacher who chastises the students present for those absent, de Klemm bemoaned the lack of interest by the attendees to the 4th World Congress. Meanwhile the session across the hall was packed to overflow. Its topic? How to build footpaths and hand-rails in the bush. The *mise-en-scène* is engraved in my memory and dredges up a strange mix of metaphors. Only years later would I realize that the text emerging out of Nairobi could never have been anything more than jerry-built. Time did not permit it. The Spring of 1992 must have been a roller coaster of emotions for de Klemm. As McGraw relates: “Going into the final meeting on 22 May 1992, delegates had agreed on less than half of the Draft Convention: 27 out of 42 articles contained square brackets” (McGraw 2000: p. 15).

WAS FAUST LURKING?

What if the Convention had not been adopted at the Earth Summit, Rio '92? The cynic in me wants to agree with Melinda Chandler, the legal advisor to the US negotiating team and convenient villain in the narrative:

It is regrettable that a legal instrument as ambitious as the Biodiversity Convention should suffer from basic conceptual and drafting deficiencies. The structure of the negotiations, the haphazard way in which crucial issues were considered, and the pressures of time contributed to a legal instrument which should cause distress for international lawyers and policy-makers.

(Chandler 1993: p. 174)

But the optimist in me cannot agree. A reason existed for hope and still exists: the CBD is a framework treaty which evolves through the decisions of the COPs. Alas, twenty years have now lapsed and all the issues surrounding “fair and equitable sharing of the benefits arising out of the utilization of genetic resources” remain contentious despite the Nagoya Protocol on the Fair and Equitable Sharing of Benefits Arising from the Utilization of Genetic Resources (Kamau *et al.* 2010). Even worse, new issues have been injected through the Protocol (West 2012), which also “suffers from basic conceptual and drafting deficiencies” precisely for the same reason: participants have to show something for all the time, effort *and* money expended. Faust re-surfaced and so, I oscillate. Perhaps the villain in Nairobi was a hero after all when she argued that “we as governments, lawyers, and policymakers can do better – much

better – in crafting legal instruments that will advance environmental conservation” (Chandler 1993: p. 175).

Sometime in the early years of the CBD, “access to genetic resources” and the “fair and equitable sharing of the benefits arising out of the utilization of genetic resources” were conjoined and simplified. The acronym “ABS” emerged. It stands for a phrase that appears nowhere in the CBD: “access and benefit-sharing.” To the ear of an economist, ABS sounds a lot like selling and buying, especially when the adjectives “fair and equitable” no longer modify “the sharing of benefits.” So, why the euphemism? Why not an expression more amenable to “mankind in the ordinary business of life”? (Marshall 1890: p. 1). Why not “buy” or “sell”? Such directness leads to the heart of the matter: Who holds title?

The observations of Burhenne-Guilmin and Casey-Lefkowitz (1994) are again worthy of close examination:

Since the early 1980s, several countries restricted access to the genetic resources under their jurisdiction, and the calls of developing nations for national controls over genetic resources have become increasingly louder. During the negotiation of the Convention on Biological Diversity, this point prevailed. As a result, article 15 recognizes that the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.

This evolution is based on the view that there is no *legal* reason to exempt genetic resources from the principle of national sovereignty over natural resources. But it is also grounded in practical reasoning: control over access to genetic resources gives the providing Party the opportunity to negotiate the mutually agreed terms for fair and equitable sharing of benefits required by article 15(7).

(Italics added)

A legal reason to exempt genetic resources might have occurred to the negotiators had they first pondered the economic reason. When sovereignty is understood narrowly as bilateralism, the (mis)interpretation enables competition in genetic resources as long as the attribute of interest is diffused over jurisdictions. The asteroid whizzes and the former sentence requires unpacking. Users are interested in the “natural information” teased out of the biological sample through research and development (R&D) and will obtain the input from the cheapest Provider. To what extent Nature obliges, with many Providers, is an empirical question. Some bits of natural information are found in all life forms, e.g. ATP synthase, while others are ephemeral to a few individuals at a moment of time (see Case Study 1). Although one does not know the diffusion *a priori*, natural product chemistry documents enough redundancy to expect competition.

A cautionary note: ever since Adam Smith, the enlightened State accepts competition as a good thing – the invisible hand – bringing material bliss. That thinking is generally correct. The outstanding exception is information. Without *de jure* protection of information, the creator of (artificial) information or steward of (natural)

information lacks incentives to create or to steward. So, limited-in-time intellectual property rights make sense for artificial information as do *sui generis* rights for natural information.

Did anyone express such thinking during the negotiations of the convention in Nairobi?

All degrees of separation now vanish. I had the good fortune to put the question to Burhenne-Guilmin at COP 6, held in the Slovak Republic in 1998. The Convention Hall was perched on a hilltop outside Bratislava and the building looked like a bunker. We were waiting for the elevator when I introduced myself and posed the question. Burhenne-Guilmin responded with mild astonishment. Didn't I know? They had indeed tried hard to establish a General Fund but the developing countries would have none of it! She half smiled, looked up and off to the side. She shrugged her shoulders in a gesture that is probably a human universal. The answer left me nonplussed. Although I do not doubt the accuracy of her impressions, I have nevertheless obsessed over the response. What she said meant that the negotiators from the developing countries acted against their own interests. That age-old advice "don't be your own worst enemy" rings in my head. Like the "what if's" about the asteroid, the homily radiates out and can be scaled up. The Global South had acted against themselves, decisively. Didn't anyone see the disaster coming?

Anniversaries are a time of reflection. Jeff McNeely, former director of the IUCN, said on the occasion of the 10th Anniversary of the CBD, which also coincided with the twentieth anniversary of the 3rd World Congress of the IUCN:

Cyril de Klemm called for a convention on genetic resources. He saw this as a means of securing free and open access, while also charging for international trade in such resources with the income earned going into an international fund that would support conservation activities in the developing world. The IUCN Environmental Law Centre continued to develop articles for inclusion in such a convention and when Mostafa Tolba convened a small group in his office in 1988, we were ready with some reasonably well fleshed-out ideas. Once negotiations began in earnest, some of our ideas were overtaken by other considerations.

(CBD News Special Edition 2002: p. 5)

In other words, the small group converged on the implications of the economics of information without recognizing genes as information. What if they had recognized genes as information? Would they still have let the Global Fund be "overtaken by other considerations?"

McNeely's quote invites revision. The openness of "bounded openness" can be interpreted as the "free" in de Klemm's call for "free and open access"; the bounds, as "charging for international trade." My memory of the bunker returns; the elevator door opens. I cannot remember the exact words said but I do recall that Burhenne-Guilmin implied that the opposition from the developing world was due to the "Global" in "Global Fund". We get on the elevator and my memory

fades. What if de Klemm had advocated a convention on natural information? The small group which met with Tolba were trained to think abstractly; surely, the *economic* reason would have resonated and been communicated in Nairobi. The Global Fund could have become isomorphic with “bounded openness”, thereby meeting the dual criteria for any successful ABS scheme that the legal scholar Charles R. McManis would spell out years later: “theoretically sound foundations and [the capability] of relatively low cost implementation” (McManis 2004: p. 427).

I have long thought: what a pity! Reductionism – genetic resources as natural information – would have triumphed had it only been heard in Nairobi. It would have been a small step to suggest a distribution of the royalties based on the geography of the natural information utilized in any intellectual property. Twenty years and as many refereed publications later, I realize just how wrong I was. Logic and evidence do not necessarily persuade, especially as any small group expands to include those who are not persuaded by the power of logic and evidence. Only recently do I perceive how a “tragedy of unpersuasive power” (Vogel 2013) penetrates all of the letters of HIPPO and becomes more destructive than any one of them. The tragedy lends itself to a derivative mnemonic which I will call THIPPO.

No metaphor is exact and the asteroid is no exception. Asteroids make sudden impact, attested by the well-defined boundary of the Cretaceous and Tertiary. In contrast, THIPPO gnaws relentlessly in human time. But time is relative. E.O. Wilson imagines its passing at speeds which range from the fastest (biochemical) to the slowest (geological) (Wilson 1984: p. 42). To rescue my asteroid, I must deploy another metaphor, also from Wilson: the movie projector. Let us see the twelve COPs in geological time. We ramp up the projector. Twenty years are compressed into what Wilson would describe as “less than an eye blink in the starry message of the cosmos” (Wilson 2014: p. 54). The asteroid is once again an apt metaphor: its trajectory tracks THIPPO but full impact is still several seconds away. When did the asteroid start to veer off course? When did people start thinking along the lines of bounded openness rather than bilateral negotiations over genetic material?

The answers are not easy to ascertain. Because many ways exist to express the same idea, one must search a variety of expressions to determine the date of its debut. To complicate matters, “bounded openness” is not a single idea but a set of interrelated ideas. What is the critical mass to affect the solution of ABS? When were the ideas published? And what really constitutes publication?

The question of the date of debut is central to aligning incentives and thereby achieving conservation and sustainable use, the first two objectives of the CBD. Showing a lack of due diligence by either the negotiators in Nairobi or the delegates to the COPs will help future delegates rethink the object of utilization in Article 1 and correct the foundational flaw of Article 2. The earlier the debut, the weaker is any invocation of *stare decisis* (stand by the decision) for bilateralism. Did the critical mass for “bounded openness” appear before the presentation of the CBD for signature at the Earth Summit, Rio '92? Before COP 1 in 1994? Before COP 2 in 1995? Before COP 12 in 2014? The asteroid can only veer with the elimination of the “T” of THIPPO.

But I am getting ahead of myself. The elements for “bounded openness” can be ordered into sequential steps. The first ten constitute the critical mass sufficient for the solution and the order approximates their relative importance:

1. Recognition of the utilization of genetic resources as the utilization of natural information, which invites the application of the economics of information and the justification of rents;
2. Incentives through the extension of property rights over natural information in a multilateral system;
3. Disclosure of utilization in the transmittal of applications for intellectual property;
4. Establishment of a Global Fund to hold royalties in escrow;
5. Imposition of a royalty rate with revenues destined to the Global Fund;
6. Recognition of redundancy of natural information at different taxa as an empirical question;
7. Recognition of the determination of the diffusion of natural information across taxa as a transaction cost subject to change, decaying with technological advances;
8. Recognition of the determination of the geographic distribution of the information dispersed across taxa as a transaction cost subject to change, also decaying with technological advances;
9. Dispersal of royalties to the countries of origin, proportional to the relative holdings of the natural information, when the costs of determinations (7) and (8) are inferior to the sum in escrow for the natural information utilized;
10. Dispersal of the sum collected in the Global Fund to the infrastructure required to make the determinations whenever the costs of so doing are superior to the sum collected at the moment the intellectual property right expires on the utilization.

Beyond the ten essential elements lie another five which facilitate the acceptance and efficiency of “bounded openness”. Unlike the previous ten elements, the order of the additional five does not indicate relative importance:

11. Determination of the geographic diffusion of the natural information among landowners in a country of origin with dispersal whenever the sum is superior to the cost of the determination of geographic share;
12. Recognition of public domain for all natural information already commercialized when the system begins;
13. A design of penalties for non-disclosure of the use of natural information to align incentives;
14. Recognition that the solution does not generate a market value to be integrated into any quixotic calculation of Total Value of Biodiversity but instead creates a Galbraithian “countervailing power” against HIPPO;

15. A negotiation of royalty rates between User and Provider countries based on a matrix of relevant characteristics of utilization.

To determine the date of the debut of any element, one must also establish what constitutes publication. E.O. Wilson provides a clue: “Science grows in a manner not well appreciated by non-scientists: it is guided as much by peer approval as by the truth of its claims” (Wilson 2012: p. 276). Not surprisingly, the Harvard professor emeritus sets a high bar for scientific growth through publication. Let’s define “The Platinum Standard” as publications which are peer reviewed by experts in the field. A notch below is “The Gold Standard” constituting scholarship from think tanks in the form of bulletins, newsletters and discussion papers. Continuing downward, newspapers and magazines would constitute “The Silver Standard”. At the bottom is Straw, which are the instantaneous uploads on the web.

A Google search of the words “benefit”, “sharing” and “genetic resources” yields, as of the date of this writing, 529,000 hits. No one can be accused of lack of due diligence for not sifting through all that straw. However, if we consider only those publications which are peer reviewed – a contraction by about three orders of magnitude – we hazard misattribution of ideas which may have earlier taken root by standards more accessible to the stakeholders of the COPs. To complicate matters, testing a publication will generate results shy of the critical mass, no matter what standard we choose. For example, the core idea of “incentives” (Element 2) can be inferred in *Biophilia*, when Wilson writes “The only way to make a conservation ethic work is to ground it in ultimately selfish reasoning ... An essential component of this formula is the principle that people will conserve land and species fiercely if they foresee a material gain for themselves, their kin, and their tribe” (1984: pp. 131–132). However, the intrigued reader will not so easily infer any of the other nine elements from *Biophilia*. The learned reader will also balk at the originality of “ultimately selfish reasoning” and think of Adam Smith’s *The Wealth of Nations* (2007 [1776]) which is also “not a wholly original book” (Heilbroner 1979: p. 49). Indeed, ascertaining the originality of any one idea could conceivably take us back to the Greek Philosophers. Nevertheless, ascertaining the originality of the critical mass – all ten elements together – is within our lens of resolution.

Coming closer to “bounded openness” and the presentation of the CBD at Rio ’92 is “Property Rights for Plants” by Roger A. Sedjo, an economist with the think tank Resources for the Future. The four-page article appears in the in-house news journal *Resources*. One immediately infers Elements 2 and 11 in the following excerpt:

Under a system in which the concept of property rights was extended to include species not now known or utilized, newly discovered natural genetic resources would become the property of the political state in which the resource resides. In principle, the state would be free to declare all such resources as the property of the state, or it could grant private property rights to individuals or to corporations that discover the genetic resources. Having

ownership of the resources, the owners – public or private – could be expected to have an interest in their long-term preservation and development.

(Sedjo 1989: pp. 2–3)

Albeit suggestive of the critical mass for bounded openness and at the cusp of the negotiations in Nairobi, Sedjo missed the economic meaning of genetic resources as information and even inveighs against its overarching implication – a biodiversity cartel:

The country where the resource resides could negotiate an exclusive agreement with a firm, or allow a number of firms to utilize the resource under a set of mutually agreed-upon conditions. Agreement might be reached as part of bilateral negotiations or as the result of a competitive bidding process. Should a particular germplasm be discovered in several countries simultaneously, the potential users would be free to negotiate the best deal possible with the country of their choice ... [T]he longer a monopolist withholds the germplasm from the market, the greater is the possibility that events will compromise the favorable initial bargaining situation. Where several countries have the same unique germplasm resource, the possibility for collusion and the formation of a cartel exists. However, cartels have been historically unstable, and the possibilities for finding alternative germplasm resources are likely to be substantial.

(Sedjo 1989: p. 3)

The excerpt is remarkable inasmuch as Sedjo had written, just the previous year, about the value of species as “a repository of genetic information that someday may have direct commercial and/or social value.” The quote appeared in the highly visible anthology *Seeds and Sovereignty*, three years before Nairobi (Kloppenburg 1988: p. 296). Although Sedjo referred to genetic resources as information, he would proceed to treat them as if they were material. A pull-out quote in the *Resources* article projects the equivocation in large type: “Genetic material markets could function just as markets do for other resources” (Sedjo 1989: p. 3). The observation is true but problematic; the price in a competitive market will settle at the marginal cost of collecting samples, virtually nothing.

Speculation can be instructive. What if Sedjo had reflected on genes as information? I believe he could have deduced the critical mass of bounded openness for his chapter in *Seeds and Sovereignty*. Had that happened, I would not be writing this foreword now. The asteroid would have veered, sharply. On what basis do I speculate? Critics of intellectual property regimes have long disparaged patents with the epithet “monopoly”. Sedjo was undoubtedly aware of the defense for time-limited monopolies as a means to recoup the fixed costs of R&D. It would have been low-hanging fruit to justify some sort of “oligopoly property right” to conserve “repositories of genetic information” and explore the institutional exigencies. I speculate that Sedjo missed the obvious for a reason that is Skinnerian. Economists are reflexive with any reference to “oligopoly”, “cartel” or “rent-seeking behavior”. The conditioning

begins in the introductory course, more specifically, Chapter 9 in the classic textbook *Economics* (Samuelson and Nordhaus 2005). I count myself fortunate not to have been encumbered by an undergraduate education in economics; I studied chemistry.

In 1990, I published “Intellectual Property and Information Markets: Preliminaries to a New Conservation Policy” in the newsletter for the Centre for International Research on Communication and Information Technologies (CIRCIT), located in Melbourne, Australia. I was affiliated with CIRCIT as a summer research fellow. On the Silver Jubilee of “Intellectual Property” in 2015, a Google-Scholar search reveals not one single citation. But I am not disheartened. Rereading the piece, I am happily surprised at the prescience of the title. It is indeed preliminary and falls short of the critical mass needed to solve ABS. Nevertheless, “Intellectual Property” demonstrates more elements than any other publication as of that date (Elements 1, 2, 6–8 and 11). In just one page, I advocated “an extension of property rights to include genetic information” and concluded that

[h]abitats do not correspond to landownership patterns and therefore, genetic information, is likely to be owned jointly among landowners. The contractual relationships between these landowners and the industrial users of genetic information must be carefully considered. My work at CIRCIT will elaborate on these issues and outline incentive structures for landowners, corporate boards and systematists.

(Vogel 1990)

The following summer, I published “The Intellectual Property of Natural and Artificial Information” (Vogel 1991). Its major point was that intellectual property and genetic resources are homologous in information. Re-reading the article, I see that I had added Element 4 to the argument made the previous summer:

Protection of natural information requires unique institutions to deal with joint ownership. Whereas artificial information is the product of one inventor or one group of inventors, natural information is diffused over land owned by many individuals. The creation of a property right over natural information would be the creation of a right shared in common by all owners of the habitat. To establish claims to royalties, an international biological inventory would be required.

(Vogel 1991: p. 7)

The two articles were still too sketchy to be of any real use for the negotiators in Nairobi, even if miraculously they were somehow to have been read. Missing were four elements, 3, 5, 9 and 10, necessary for the solution. Nevertheless, the co-directors of CIRCIT, Don Lamberton and Bill Melody, must have sensed that I was on to something. They supported my efforts to flesh out the full argument. After the following summer fellowship in 1992, I stayed on at CIRCIT and worked feverishly on the manuscript, some 170 pages. At the AIC Conference on

Biodiversity held in Sydney on November 16–17, 1992, I launched the special limited edition *Privatisation as a Conservation Policy*. The softcover book was designed to look “in-house” and not foreclose the possibility of publishing the same text with an academic publisher. Oxford University Press of New York accepted the manuscript in 1993 and it appeared the following year as *Genes for Sale*.

And the four elements missing from the newsletter articles? Were they present in *Privatisation*?

They were present with differing degrees of elaboration. For example, Element 3 appears *en passant* when I write that “corporations reveal the genetic information used in their products to the inventory” (Vogel 1992: p. 39) whereas Elements 5 and 9 are somewhat detailed:

The delineation of a commons for genetic information is complex inasmuch as landowners may have valuable information in organisms on their parcel of land but not know who else has this same piece of information ... [T]hree types of transaction costs would be incurred: (1) the identification of the taxon at which the genetic information is distributed (2), the identification of other landowners who have that same piece of genetic information on their land and (3) the design and implementation of a scheme to exclude non-paying users from access to that information. Clearly, these transaction costs are enormous ... The only way to lower these costs is to capture economies of scale and reduce the average cost per landowner of establishing his share of the genetic information commons. Theoretically, this can be done by following some simple steps to reduce the aforementioned transaction costs (1)–(3). Although the sequence of steps may be simple, each step is a complex task: (1) the identification of the taxon at which the genetic information is distributed; this will require molecular analysis of the organism for which the GCF [genetically coded function] has been commercialized and then molecular analyses of organisms from the same race, species, genus, etc., to measure the distribution of that GCF across taxa, (2) the identification of the landowners who have that same piece of information on their land; this will require not only a database but also a biological inventory with records for each land title and (3) the design and implementation of a scheme to exclude non-paying users from that information; this will require that industries which use natural genetic information in new products identify that usage, declare its dollar value, and remit a royalty to the commoners.

(Vogel 1992: p. 56)

Element 10 was broached in Chapter 9 entitled “Who will finance the Gargantuan Database?” (Vogel 1992: p. 95). Because the costs of the system could be greater than the monies collected, I argued that the monies should, in such instances, “be used to diminish the fixed costs of the Gargantuan Database” (Vogel 1992: p. 96). Element 11 also has its own chapter, Chapter 6: “Genestealers.” In contrast, Element 12 only appears in a Footnote, number 8 of Chapter 5: “Like an

expired patent or copyright, genetic information that is already commercialised for a specific function would be in the public domain” (Vogel 1992: p. 38). Years later the last three additional elements for bounded openness would enter the research stream. Element 13 can be found in “Reflecting Financial and Other Incentives of the TMOIFGR: The Biodiversity Cartel” (Vogel 2007a) and Element 14, in “White Paper: The Successful Use of Economic Instruments to Foster the Sustainable Use of Biodiversity” (Vogel 1997). Element 15 is the most recent addition and was first discernible during the Online Discussion Group on Article 10 of the Nagoya Protocol, from April 8 to May 24, 2013, through the ABS Clearing House Mechanism.

Before the formal negotiations began in Nairobi in 1991, three other academics were converging on bounded openness, although under different nomenclatures. Whether the negotiators in Nairobi exercised due diligence turns on the publication date of the critical mass. Of the other three publications, the earliest is Timothy Swanson’s Discussion Paper “The Economics of the Biodiversity Convention” (Swanson 1992).

Unlike Sedjo, Swanson recognized the implications of genetic resources as information. The Discussion Paper satisfies Element 1 when he writes: “The presence of variation is information; uniformity is the absence of information. Therefore, the diversity inherent in biological resources contains information simply by definition” (Swanson 1992: p. 13). Element 2 is also easy to find as Swanson uses the same word, “incentive”. In Element 4, he deploys a synonym, “International Fund” for “Global Fund”. However, the presence of Elements 5 and 6 requires inference, and Elements 7–9, an even greater capaciousness in interpretation. Element 10 would be a stretch, as it requires that the reference to “World Heritage Convention” (Swanson 1992: p. 27) also includes possible modalities of the financial mechanism of the “World Heritage Fund”, not cited. Totally absent is “the disclosure of utilization in the transmittal of applications for intellectual property”, which is ranked third in the ten elements of the critical mass. Without it, “bounded openness” cannot work. In summary, applying the filter of Elements 1–10 to Swanson’s discussion paper, we find an absence of Element 3, extreme difficulty in discerning Element 10 and ambiguity in discerning of Elements 7–9. So, a convergence on the critical mass did not happen despite its publication in the same year as *Privatisation*. However, Swanson *et al.* added many of the missing elements soon thereafter, in a background study paper for the FAO, “The Appropriation of the Benefits of Plant Genetic Resources for Agriculture” (Swanson *et al.* 1994).

Two other works stand out which suggest the broad outlines of “bounded openness”: Christopher Stone’s 42-page article, “What to Do about Biodiversity: Property Rights, Public Goods, and the Earth’s Biological Riches” (Stone 1995) and Barbara Laine Kagedan’s 176-page report “The Biodiversity Convention, Intellectual Property Rights, and the Ownership of Genetic Resources: International Developments”, prepared for the Intellectual Property Policy Directorate Industry Canada (Kagedan 1996). The former provides enough overarching statements to

infer the elements of the solution, and the latter, enough institutional detail to substantiate them.

As Swanson, Stone, Kagedan and I were imagining institutional arrangements for ABS, other economists were taking a different path. The divergence is reminiscent of the early history of economic thought: “For Malthus the issue was the immensely important one of ‘How Much Is There?’ For Ricardo it was the even more explosive question of ‘Who Gets What?’” (Heilbroner 1979: p. 99). Bruce A. Aylward (1993), R. David Simpson *et al.* (1996), Gordon C. Rausser and Arthur A Small (2000), and many others, have all grappled with “How Much Is There?”, in other words, “What are genetic resources worth for R&D?”. Their very different estimates reflect slightly different assumptions and again make the metaphor of the asteroid apt. In contrast, Swanson, Stone, Kadegan and I were asking the more explosive “Who Gets What?”, I believe that I have also gone further and answered “How Will They Get It?”. The reason for my follow-up question is simple: if the transaction costs in deciding “Who Gets What?” are greater than the answer to “How Much Is There?” then “What is the Point?”.

Nonetheless, the model builders were right to insist on some estimate of value. Ironically, an indicator was established about the same time the first model made its debut. The polymerase chain reaction (PCR) revolutionized biotechnology and its discoverers won the 1993 Nobel Prize in Chemistry. By 2005, the expired patent on PCR had earned US\$2 billion (Fore *et al.* 2006). That fact provokes reflection: Just one piece of natural information, an enzyme, from one species, *Thermus aquaticus*, could have generated US\$300 million for countries of origin at the royalty rate I suggested in 1992, a startling 15 percent. The sum is three times the six-year budget of International Barcode of Life (Genome Canada 2011: p. 8), which could help achieve Elements 6–8 needed for “bounded openness”. With 100 million or more species on the planet, the question “How Much Is There?” need not be answered with any precision.

The publication of the necessary and sufficient elements for “bounded openness” – all ten elements – occurred with the launch of *Privatisation* on November 17, 1992, five months after the submission of the final draft of the CBD (May 22, 1992). So, we cannot accuse the negotiators in Nairobi of a lack of due diligence. We cannot reach the same conclusion, however, regarding the delegations to the twelve COPs. Before COP 1 met in 1994, and ever since, various scholars have independently published the solution for ABS in increasingly fine detail through venues which meet the Gold and Platinum Standards. The legal concept of *laches* may be appropriate; it never set in. Sometime in the first decade of the COP discussions, the lack of due diligence morphed into studied ignorance (Oduardo-Sierra *et al.* 2012). From about COP 9 onward, one will hear stakeholders begrudgingly acknowledge the logic and evidence for “bounded openness” but, taking a deep breath, also dismiss it as a solution which has come too late. Somehow they say this with a straight face.

The book before us by Manuel Ruiz appears twenty-five years after the first elements of “bounded openness” surfaced in “Intellectual Property and Information

Markets: Preliminaries to a New Conservation Policy.” The asteroid has scorched Planet Earth badly but need not continue its course to full impact. The Case Studies are thought experiments which imagine the ABS that might have been, and still can be. Ruiz opens the book with a Turkish proverb that is both timely and timeless. As long as biodiversity is threatened with extinction through the misalignment of incentives, we must turn back.