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Governing the management and use of pooled microbial genetic resources: lessons from the global crop commons

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Abstract: The paper highlights lessons learned over the last 30 years establishing a governance structure for the global crop commons that are of relevance to current champions of the microbial commons. It argues that the political, legal and biophysical situation in which microbial genetic resources (and their users) are located today is similar to the situation of plant genetic resources in the mid-1990s, before the International Treaty on Plant Genetic Resources was negotiated. Consequently, the paper suggests that it may be useful to look to the model of global network of *ex situ* plant genetic resources collections as a precedent to follow – even if only loosely – in developing an intergovernmentally endorsed legal substructure and governance framework for the microbial commons.

Keywords: Access and benefit sharing, global crop commons, International agricultural research

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1. Introduction

One of the most appealing aspects of recent commons scholarship is its determination to transcend the oversimplified dichotomy of exclusively private versus exclusively public forms of control over pooled resources – a dichotomy that

has predominated earlier literature in the field (National Research Council 2002; Hess and Ostrom 2007). This article argues that governance of a global microbial genetic resources commons is indeed one of those 'commons cases' that involves a complex variety of rules derived from: customary practices of communities of users; new, voluntarily followed protocols and contractual agreements adopted by the same users; private, public (and in some cases, an absence of clearly articulated) property rights; and national and international public laws. In addition – and this is likely the biggest departure from other papers in this special issue (e.g. Fritze 2009) – this article argues that some form of recognition by an intergovernmental organization of the global microbial commons *per se* is an indispensable element of the overall governance of the microbial commons.

Champions of a microbial commons are in a privileged position, having the recently 'perfected' governance structure for the global crop commons to look to for inspiration and lessons learned. In sections 2 and 3 of this article, I engage in such an exercise, highlighting some of the most relevant lessons learned during the last 30 years from experiences creating the global crop commons and drawing conclusions from them for the governance of the microbial commons. I will work backwards chronologically, first reviewing the current, generally positive state of affairs, with the recent coming into force of the International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty).[1] This treaty provides a solid legal and administrative framework for the crop commons. I will then delve further into the past to a period of considerable political and legal uncertainty concerning the management and use of plant genetic resources on a global scale. In this context, I will highlight an interim solution that was felt to be necessary at the time in order to preserve the commons characteristics of critically important *ex situ* collections of crops and forages hosted by the International Agricultural Research Centres of the Consultative Group on International Agricultural Research (CGIAR Centres). Ultimately, it is this interim solution that may be most interesting for champions of the global microbial commons, since it arose out of a combined set of political, legal, and biophysical circumstances that share significant similarities to the circumstances in which microbial genetic resources (and their users) find themselves today.

In section 4, I compare the commons characteristics of plant genetic resources for food and agriculture and microbial genetic resources. I consider the similarities and differences between these two groups of resources and their various policy implications. In this context, I consider the possibility of subdividing the scope of the microbial commons with a focus on agricultural microbial genetic resources in particular. I also consider which intergovernmental body would be the most appropriate to attempt to engage in considering, recognizing and ultimately, providing policy guidance for microbial commons.

[1] International Treaty on Plant Genetic Resources for Food and Agriculture, Report on the Conference of the Food and Agriculture Organization, Thirty-first session, Rome, 2–13 November, 2001, c. 2001/REP, Appendix D.

2. The current state of affairs: the crop commons secured through the International Treaty

2.1. The multilateral system of access and benefit sharing

The Treaty creates a framework that addresses the collection, management, conservation, and use of all plant genetic resources for food and agriculture (PGRFA). It goes a long way to resolving decades of political and legal uncertainty concerning access to PGRFA and benefits associated with their use. In this section, I set out the most significant aspects of the scope, content, and functioning of the multilateral system of access and benefit sharing created by the Treaty, highlighting the manner in which it responds to, and is supportive of, the commons characteristics of PGRFA. I will address the political and legal conditions that created the need for the Treaty in the following sections.

In 2001, the Food and Agricultural Organization's (FAO) conference adopted the text of the Treaty. It came into force in 2004, and, at the time of writing, 120 countries and the European Community have ratified it. The Treaty creates the multilateral system of access and benefit sharing (multilateral system). One of the objectives of the multilateral system is to facilitate rapid, regular, and low-cost exchanges of plant genetic materials for use in training, research, and breeding for food and agriculture. To minimize transaction costs, all contracting parties to the Treaty adopted, in 2006, the standard material transfer agreement (SMTA), which sets out the legal conditions that govern all transfers of materials in the multilateral system.[2] The SMTA is a private contract between the providers and recipients of materials in the multilateral system. On principle, the SMTA does not leave room for any additional negotiations. All of the legal issues that needed to be, and could be, addressed were agreed to by the contracting parties in the Governing Body when they adopted the SMTA. The only exception is for 'PGRFA under Development', a term that refers to materials derived from materials accessed from the multilateral system that are still under development. Providers may request additional terms to those included in the SMTA for PGRFA under Development, as long as those terms are consistent with the Treaty and the SMTA.

Another objective of the multilateral system is to ensure the sharing of benefits that are derived from the commercialization of new products that incorporate multilateral system material. According to the SMTA, recipients who develop and commercialize new products that incorporate material accessed from the multilateral system must pay 1.1% of gross sales to the multilateral system if they simultaneously prohibit others, through legal or technical means, from using the product for research or breeding.[3] Not surprisingly, the conditions for mandatory

[2] The full texts of the standard material transfer agreement in all six official United Nations languages are posted on the Treaty's website at <http://www.planttreaty.org/smta_en.htm>.

[3] Pursant to SMTA clause 6.11, recipients can opt to pay a lower rate (0.5%) for all sales of related PGRFA products, not just those which they prohibit others from using for research and breeding.

financial benefit sharing were the most hotly debated issues during the negotiations of the Treaty and, later, the SMTA (the negotiations of the SMTA took four years to complete, starting in 2002, and ending in 2006 (Lim 2008). There was disagreement about what physical conditions should trigger benefit sharing. Some felt that there should be no mandatory benefit sharing if the final commercialized product contained less than 25 percent, by pedigree, of materials accessed from the multilateral system. Others argued that instead of minimum percentage thresholds, the 'trigger' should be whether the commercialized product contained traits of value (for example, drought tolerance, higher micronutrient production) obtained from multilateral system materials. Still others argued that there should be no minimum threshold, and that any incorporation of material accessed from the multilateral system should trigger payments, as long as the other conditions were met. (SGRP 2006b). Ultimately, the latter position prevailed and is included in the SMTA. There also was disagreement about whether commercialization alone should trigger benefit sharing or whether it should be triggered by commercialization in combination with legal or technical restrictions on further use for research and breeding. Ultimately, the latter formulation prevailed. Part of the justification for this decision was that it complemented the form of intellectual property protection already established in the 1978 and 1991 versions of the International Convention for the Protection of New Varieties of Plants (UPOV Convention), which includes exemptions for the unrestricted use of protected plant varieties for the purposes of research and breeding.[4] In this way, the benefit-sharing formulation of the SMTA underscored the importance of always keeping materials available for research and breeding. The adopted formula penalizes companies that seek stronger forms of protection, such as patents or some form of genetic use restriction technology, which prohibit the use of products for downstream research and breeding. Multinational life science companies who rely proportionately more on patents than smaller seed companies (that still exploit protections based on national laws implementing the UPOV Conventions) would prefer to have the benefit-sharing provisions triggered by any commercialization (Halewood and Nnadozie 2008). In this matter, the multinational life science companies and civil society groups, which are usually antagonists in matters concerning genetic resources policy making, find themselves making very similar criticisms, though for different reasons. The high threshold for mandatory benefit sharing established in the SMTA negotiations has also been strongly criticized by legal academics (Reichmann et al. 2008).

It is important to underscore the fact that the monetary benefits do not go back to individual suppliers or countries of origin of the material. Instead, they go back to the multilateral system to be spent on helping farmers, particularly those in developing countries, who conserve and sustainably use PGRFA, following

[4] International Convention for the Protection of New Varieties of Plants, 23 October 1978 (revised 10 November 1972, and 23 October 1978, and entered into force 8 November 1981) U.K.T.S. 11 (1984).

guidelines developed by the Governing Body. One issue that arose during the negotiations of the SMTA was that, since the financial benefits flow back to the system as a whole, there would not be incentives for suppliers to expend resources to enforce recipients' compliance. To address this situation, negotiators agreed to include a provision in the SMTA for a legal entity representing the third party beneficiary interests of the Multilateral System as a whole. This entity is able to initiate dispute settlement procedures against recipients who fail to comply with the benefit-sharing provisions (CGRFA 2006; Moore 2008). FAO has been requested to perform the role of the Third Party Beneficiary. The Governing Body recently decided upon the procedures that the third-party beneficiary representative should follow to initiate legal actions, and the kinds of information that suppliers need to be made available concerning transactions using the SMTA to facilitate the third-party beneficiary's work (GB/ITPGRFA 2009).

The scope of the multilateral system extends to 64 crops and forage genera, which are listed in Annex 1 of the Treaty. All contracting parties agree to 'pool' the reproductive materials of the Annex 1 crops and forages that are 'under the management and control of the Contracting Parties and in the public domain.'[5] As long as the materials satisfy these conditions, it does not matter if they are in *ex situ* collections in gene banks or in *in situ* conditions (for example, in fields and protected areas[6]) in the country concerned. The content of the Annex 1 list was one of the last things the Treaty's negotiators struggled over. In the lead up to the adoption of the text, countries made last minute deals about the inclusion of some species and unilaterally withdrew their consent concerning the inclusion of others. Over the course of the negotiations, the potential scope of the list expanded and contracted dramatically, from possibly including all agricultural plants to a narrow list of just 12 species or genera (Lim and Halewood 2008). Conspicuously absent from the current list of 64 crops and forages are soybean, groundnut, fonio, okra, and a wide range of tropical forages. Of course, it is open to the Governing Body to decide to increase or decrease the number of species/genera included in the list: any changes to the list require the consensus of all Contracting Parties.

Pursuant to the Treaty (Article 11.3), "Contracting Parties also agree to take appropriate measures to encourage natural and legal persons within their jurisdiction" to include Annex 1 PGRFA in the multilateral system. In addition, the Treaty invites the CGIAR Centres to sign agreements with the Governing Body of the Treaty, to place the collections they host (both Annex 1 and non-Annex 1 materials) under the Treaty's framework, and to subject the management of those collections to the overall policy guidance of the Governing Body. In 2006,

[5] Treaty, *supra* note 1, Article 11.2.

[6] It is anticipated in Article 12 (3) (h) of the Treaty that contracting parties may adopt national legislation setting out requirements to be fulfilled by collecting missions or other such conditions governing access to PGRFA found in *in situ* conditions, but any such legislation must be consistent with the other conditions of the Treaty and the SMTA (Moore and Tymowski 2005).

the eleven CGIAR Centres with plant genetic resources collections signed agreements with the Governing Body, formally placing ~ 700,000 unique accessions of crops and forages under the Treaty's framework.[7] During the first 20 months of operation under the Treaty, from January 1, 2007 to July 31, 2008, the centres distributed over 525,000 samples of PGRFA using the SMTA (SGRP 2009).

At its second meeting in 2007, the Governing Body decided that the CGIAR Centres should use the same SMTA when distributing the non-Annex 1 materials in their collections, with an additional explanatory footnote (SGRP 2007a).

Contracting parties are free to use whatever MTAs they wish for the transfer of non-Annex 1 materials. In exercise of this freedom, some countries have decided to use the SMTA with an explanatory footnote to distribute non-Annex 1 PGRFA (provided of course that those materials are not subject to other legal conditions that would preclude such use). The Netherlands' Centre for Genetic Resources was perhaps the first national organization to adopt such a policy. More recently, in the context of developing A European Genebank Integrated System (AEGIS), European countries have decided in principle that they would also make selected non-Annex 1 materials (categorized as European Accessions) available under the SMTA with explanatory footnotes (ECPGR 2009). While these materials are not included within the multilateral system created by the Treaty, in fact, they will be distributed using the SMTA, creating the same nexus of legal rights and obligations that applies to Annex 1 materials. Of course, since the decision to use the SMTA for non-Annex 1 materials lies outside the Treaty and within the sovereign rights of the individual States, it will be open for the Netherlands and the European Genebank Integrated System (AEGIS) to decide, on their own, to reverse their policies to use the SMTA for non-Annex 1 materials without seeking any guidance from the Governing Body.

As more countries start implementing the Treaty, the overall proportion of transfers within the multilateral system from countries (as providers) will increase. The Secretariat of the Treaty sent a letter to state parties in mid-2008, asking them to confirm which of their collections would be included in the multilateral system. A number of countries have responded positively, and the collections they identify are posted on the Treaty website.[8] In this context, it is important to note, as far as contracting parties are concerned, Annex 1 materials within their borders, that are under their management and control and in the public domain are *already, automatically,* in the multilateral system. It is not formally necessary for countries to make lists of included material (and they cannot exclude materials that otherwise fit those conditions simply by not listing them). However, for the multilateral system to actually work, potential recipients have to know what is

[7] The full text of agreements made under Article 15 of the Treaty, *supra* note 1, between international organizations and the governing body of the treaty are posted on the Treaty's website at <http://www.planttreaty.org/art15_en.htm>.

[8] See 'Information on Collections in the Multilateral System', at <http://www.planttreaty.org/inclus_en.htm>.

available in the pool, and the only way for them to know is for suppliers to publish lists of what they have.

Indeed, the drafters of the Treaty fully appreciated the importance of a global information system to make the multilateral system functional. It is for this reason that Article 17 of the Treaty, which is entitled 'The Global Information System on Plant Genetic Resources for Food and Agriculture,' states that contracting parties will cooperate to develop just such a system. Here again, the Governing Body still has decisions to make about the best way to harmonize existing information systems. There is a strong contingent of participants in the multilateral system who would like one day to see a globally accessible 'one-stop shop,' which would list all of the accessions available through the multilateral system (no matter where they are housed) and provide all non-confidential information about those accessions, including passport, characterization, and evaluation data; links to all published articles; and information on where such accessions have been transferred within the multilateral system. Whether or not it will ever be possible to actually construct such a one-stop shop remains to be seen.

As I shall highlight in the subsequent section, the Treaty did not invent the notion of globally pooled PGRFA. PGRFA have been pooled and exploited by farmers, breeders, researchers, and conservationists on international bases for a very long time. However, the Treaty is extremely significant because it effectively puts to rest so many of the struggles of the preceding 20 years about how the PGRFA commons should be managed.

2.2. Outside the multilateral system, what rules apply?

All plants not listed in Annex 1, and all uses of all PGRFA other than those specified in the Treaty and the SMTA, are outside the Treaty's multilateral system. Some argue that rules for access and benefit sharing for non-Annex 1 PGRFA should be nonetheless decided by the Governing Body of the Treaty. Others argue that the Convention on Biological Diversity (CBD) should apply to all plant genetic resources that are not explicitly listed in Annex 1.

The difficulty with the CBD, as far as the governance of a commons is concerned, is that most countries tend to implement the CBD with relatively rigid, process-heavy access and benefit-sharing regulations that can lead to significant delays or total frustration of research, conservation, and economic development programs. This problem was very clearly identified by ~ 200 Latin American scientists assembled by the Brazilian government in preparation for the eighth Conference of the Parties to the CBD in 2006. They stated '[b]asic biological research is seriously hampered by many of the current national ABS regimes,' and '[d]istrust, rather than trust, is presently dominating the situation in many countries, hampering biological research.' (UNEP 2006).

Such procedurally related problems are antithetical to the spirit and functioning of a commons. Of course, the CBD does not have to be implemented in a restrictive, bilaterally-oriented way. The Treaty proves that countries can exercise

their sovereignty to develop multilateral systems of access and benefit sharing that are consistent with the CBD. That said, quite understandably, in the absence of internationally coordinated efforts to support the exploration of multilateral approaches, countries tend to fall back on more protectionist themes, seeking to defend or fence off resources under their control.

3. Uncertainties prior to the Treaty about the governance of the crop commons and the 1994 FAO-CGIAR in-trust agreements

3.1. The lead up to, and signing of, the in-trust agreements

In this section, I look back to the period before the Treaty was in place. I further elaborate on the political climate and legal uncertainties of the times and how they affected the management of *ex situ* collections hosted by the CGIAR Centres in particular. I also focus on the solution that was eventually adopted by the centres, whereby agreements with the FAO were signed, formally placing the collections they held in trust for the global community and submitting the management of these collections to the high-level policy oversight of the Commission on Genetic Resources for Food and Agriculture (CGRFA).

Throughout this section, I highlight four interrelated themes: (1) the degree to which intergovernmental oversight was necessary to provide the requisite political, legal, and administrative 'cover' for the centres to continue operating as primary 'pumps' in global systems of conservation and use of PGRFA; (2) the degree to which the centres proactively engaged with the CGRFA (and its working groups) and the FAO to forge these agreements; and (3) the positive impact of the agreements on the longer term negotiations of the Treaty and the multilateral system of access and benefit sharing in particular. I also highlight (4) the way the designers of the in-trust agreements took into consideration how the CBD affects the legal status of genetic resources. I include this additional focus on the CBD as a response to the fact that so much of the writing about the microbial commons appears to 'gloss over,' or ignore, the impact of the CBD on international genetic resources pooling. Reading through this section, champions of the global microbial commons will no doubt recognize some similarities, and some differences, between the situation of the microbial commons today and the PGRFA commons in this period before the Treaty.

Most accounts of efforts to formalize the existence of PGRFA as internationally pooled resources start in 1983, with the FAO Conference's adoption of the non-binding International Undertaking on Plant Genetic Resources for Food and Agriculture (IU),[9] and the creation of the CGRFA. One of the Commission's responsibilities was to oversee the implementation of the IU. The IU called for the creation of an 'internationally coordinated network of national, regional and

[9] International Undertaking on Plant Genetic Resources for Food and Agriculture, UN Food and Agriculture Organization, 22nd Sess., Conf. Res. 8/83 (1983) at article 1 [hereinafter *International Undertaking*].

international centres including the international network of base collections in gene banks, under the auspices or the jurisdiction of FAO, that have assumed the responsibility to hold, for the benefit of the international community and on the principle of unrestricted exchange, base or active collections of PGR' (Article 7)[10].

The IU also proclaimed 'the universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction.' (Article 7). However, this important principle was not actually universally accepted; eight countries abstained from adopting the IU on the basis that, among other things, it did not recognize the primacy of plant breeders' rights over the need to provide unrestricted availability (Mekouar 2002). Efforts to accommodate the abstaining countries, and to mollify those who did not like the compromises necessary to do so, lead to the adoption, in 1989, of one resolution allowing for the recognition of plant breeders rights within the IU framework, and another resolution recognizing the concept for farmers' rights. Most significantly, as far as norms affecting the pooling of PGRFA is concerned, in 1991, the Commission adopted a third resolution which recognized the sovereign rights of countries to regulate access to PGRFA within their borders. This resolution is hard to reconcile with the 'universally accepted principle' of 'availability without restriction'. The friction between these two principles never really got to be 'played out' as events at the Commission concerning the IU were overtaken, in 1992, by the adoption of the Convention on Biological Diversity.

Since 1989, the negotiations of the Convention on Biological Diversity had been under way under the aegis of the United Nations Environment Programme. In 1992, the text of the Convention was adopted, '[r]ecognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.'[11] Between the 1991 resolution by the Commission, and the CBD, the concept of an international legal framework designed to support international pooling of PGRFA was almost entirely eradicated. However, in the very last moments of the Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity in 1992, a resolution was adopted which preserved the possibility of formalizing such a structure in the future. Nairobi Final Act, Resolution 3, entitled 'The Interrelationship between the Convention on Biological Diversity and the Promotion of Sustainable Agriculture' stated that contracting parties needed to 'seek solutions to outstanding matters concerning plant genetic resources within the Global System, in particular access to *ex situ* collections not acquired in accordance with the CBD, and farmers' rights.'

[10] Engels and Visser (2003) define base collections as those comprised of accessions in long-term storage that are only used for regeneration. Active collections are comprised of the same accessions, but they are kept under less stringent storage conditions and are more easily accessible.

[11] CBD, *supra* note 7, Article 15.1.

Resolution 3 was a very positive development in as much as it preserved the possibility of developing a more appropriate system of pooled access and benefit sharing for PGRFA – one that would build upon what Charlotte Hess and Elinor Ostrom refer to as the biophysical-technical characteristics of the resource in question, the attributes of the communities of users, and the existing rules in use (Hess and Ostrom 2007). This opportunity was seized upon very quickly in 1993 by the FAO Conference, which requested the FAO to provide the CGRFA to host intergovernmental negotiations to: revise the IU in harmony with the CBD; consider the issue of access to plant genetic resources, including *ex situ* collections that are not addressed by the CBD; and look at the issue of farmers' rights. These negotiations took longer than anyone imagined they would. After seven long years, they led to the adoption of the text of the Treaty.

Not everyone, however, was enamored with the Resolution 3 at the time. For example, one civil society organization, GRAIN, opined that the CBD was 'disturbingly limited' by virtue of the fact that it did not extend to *ex situ* collections held by the CGIAR Centres (GRAIN 1992).

Resolution 3 was also somewhat disconcerting in as much as it suggested, in an attention-attracting way during a period of high political tension concerning genetic resources generally, that the enormous *ex situ* collections of crop and forage materials held by the CGIAR Centres were in an international legal vacuum. Some organizations that were not content with Resolution 3, picked-up on, and amplified this uncertainty. For example, GRAIN published a statement that, '[a]ccording to the CGIAR, these seeds were collected in the name of the international community and are being held "in trust" for humanity. Yet there is no legal footing to back these polite assurances.' (GRAIN 1992). The fact is, however, the legal footing for the collections was not as insecure as some commentary at the time suggested. The centres had acquired the materials in their collections over many years, through international collecting missions coordinated, usually, by the International Board for Plant Genetic Resources, with the agreement of the countries concerned (Esquinas-Alcázar and Hilmi 2008). The collections were maintained by the CGIAR Centres with the express intent of making the materials globally, publicly available. To underscore this point, and to help ease tensions that were permeating the international community and the meetings of the CGRFA, the CGIAR Centres published in 1989 a statement confirming that they considered themselves to be holding the materials in trust for the global community. There was nothing in international law to prevent the centres from holding the collections for this purpose, and there were no legal suits from countries asserting that the materials had been obtained without compliance with their own national laws. The fact that no one's actual legal ownership of the materials was clearly established is not, in itself, a problem. Indeed, currently, under the Treaty's framework, no 'owners' of the materials hosted by CGIAR Centres are identified. The Treaty refers to materials 'held in trust' by the Centres; as shown below, pursuant to the 1994 In Trust Agreements, the Centres were not the owners of those materials, despite the fact that they held them in trust for the

international community. Nevertheless there was a good deal of discussion in and around CGRFA meetings highlighting concerns about the legal status of the CGIAR collections.

As a result of the increased concern about the legal status of the CGIAR Centre-hosted *ex situ* collections brought on by the Nairobi Final Act, and the fact that the revision of the IU was clearly going to take a long time, political tensions continued to rise. There was always the possibility – in the minds of critics outside the CGIAR Centres – that the centres could simply change their policies and cut off, or restrict, access to 'their' collections. This line of critique was embedded in a longer-running, more general criticism – which was most frequently made by civil society organizations and a few developing countries – that the CGIAR Centres were too autonomous in their activities and that they should be subjected to more participatory forms of governance (Fowler and Mooney 1990; ETC 2009). In addition, there were fears and rumours that forces from outside the CGIAR Centres – for example, the World Bank or countries hosting the Centres holding the collections – could try to take over the collections and convert them to private or national uses. There was also concern that some countries would make demands for the return of the materials that were originally acquired from them, that were being held by the Centres.

Worries about the World Bank, (which provides the Chair for the CGIAR), reached a fever pitch in 1994, as reflected in an article in the *Financial Times* (UK) entitled 'World Bank Accused of Attempting Raid on Gene Reserves,' which recounted accusations by 'major environmental and development NGOs' accusing 'the World Bank of attempting a coup to take over control of the 500,000 samples held in the genebanks of the [CG Centres]' (Tansey 1994). The second session of the Intergovernmental Committee on the Convention on Biological Diversity, in June 1994, was dramatically overtaken by this issue as numerous delegates and observers made interventions about the dangers of privatization of the collections, World Bank control, and the necessity of developing standards on benefit sharing with countries of origin for the Centres to require when distributing materials from the collections they held (GRAIN 1994; UNEP 1994).[12]

These events had significance beyond the question of how the CGIAR Centre-hosted collections would eventually be managed. These events also contributed to an atmosphere of distrust during the negotiations for the revision of the IU, which were encountering more challenges than anyone had previously imagined. They may also have contributed to the declining rates of acquisition of materials by the CGIAR gene banks, as countries became concerned that they could not be certain where the material would eventually end up and how it would be managed (Halewood and Sood forthcoming).

[12] Calls were also made by delegates and civil society organizations (CSO) organizations for some form of benefit-sharing arrangements to be made, inspired by the CBD, with respect to the collections assembled by the CGIAR Centres before the CBD (UNEP 1994). This is, of course, what the renegotiations of the IU, in conformity with the CBD, were meant to achieve.

It was in this context, that the CGIAR Centres accelerated their efforts to develop agreements with the FAO to provide a secure legal status for the collections while preserving the ability of the centres to manage and distribute them globally, without restriction.[13] As part of its work in support of the creation of an 'internationally coordinated network of national, regional and international centres … that have assumed the responsibility to hold, for the benefit of the international community … collections of PGR,' the CGRFA had, over the course of a few meetings, developed four alternative draft agreements to be signed between the FAO and national public, private, and international organizations participating in the network. Pursuant to one model (model B), the organization or government concerned would transfer 'unconditionally to FAO the designated germplasm' and 'renounces the right to subject the designated germplasm to national legislation'. FAO would then 'determine all policies in respect of activities related to the designated germplasm.' Not surprisingly, this model enjoyed very little support. Pursuant to other models (C and D), the organization or country concerned undertook to place 'designated germplasm' 'under the auspices of FAO within the international network of base collections …'. The country or organization would 'retain ownership of the resources of the designated germplasm', and would make it 'available when necessary for the purpose of scientific research, plant breeding or genetic resource conservation, without restriction, either directly to users or though FAO, either on mutually agreed terms or free of cost' (CPGR 1991). As of 1991, 32 countries indicated to the Commission that they would be willing to sign variants of models C and D (CPGR 1991). That said, the drafts were not yet finalized and ready for adoption at that time. Clearly considerable additional work would have been necessary for countries and or organizations to decide out how they would practically implement such vague and arguably inconsistent standards as 'without restriction, either on mutually agreed terms or free of cost'.

For a variety of reasons, none of these agreements was ever signed by a country. One reason, as stated above, was that considerable 'heavy lifting' was still necessary to work through some of the more controversial terms. Another reason may be that some countries were not motivated to sign such agreements when it was not clear what immediate benefits would flow back to them. Furthermore, as time progressed, it was clear that what got included in the agreements would ultimately be affected by the ongoing negotiations of the CBD and the revised IU. So it made sense to wait until those negotiations were completed before finalizing the agreements. As one Commission meeting report from 1997 stated, continued work developing draft agreements with countries was, "to some extent on hold, pending the outcome of the negotiations for the revision of the International Undertaking," as they would "have a bearing on the final form and content of future agreements" (CGRFA 1997). Ultimately, of course, the Treaty rendered the

[13] It was understood that such agreements would be time-limited, based on the assumption that they would not be necessary once the negotiations for the revision of the IU were completed.

model agreements redundant, with its own formulae for determining what PGRFA are included in its multilateral system of access and benefit sharing.

Despite the fact that these agreements had never been signed, they nonetheless provided a very useful basis upon which the Centres could build the In Trust Agreements (CPGR 1993).

Representatives for the CGIAR Centres worked with FAO and the Secretariat of the CGRFA to develop a first draft of an agreement, based most directly on model C, but introducing the concepts of both holding the collections 'in trust' for the international community, but without asserting ownership of them. This draft was submitted for consideration to the eighth session of the Working Group on Genetic Resources, which reported to the fifth session of the CGRFA in April 1993. The commission 'welcomed the offer made by the CGIAR Centres to place their base and active collections under the auspices of FAO' and accepted the proposed draft agreement as a basis for negotiations between the FAO and the CGIAR Centres. The CGRFA also decided that 'as the only permanent intergovernmental forum dealing with plant genetic resources for food and agriculture, it should play a role in the development of the policy related to the collections' (CPGR 1993).

Thereafter, the CGIAR Centres ran into some highly publicized, short-term, uncertainties in terms of getting the agreements informally endorsed within the CGIAR hierarchy. At an annual meeting of the CGIAR, the chair of the CGIAR and vice-president of the World Bank stated decisions concerning the In Trust Agreements should be postponed for further consultations concerning intellectual property and trade related issues. When challenged on his position by a civil society organization, he wrote in a letter to the head of a civil society organization, that 'it would be foolhardy to lock' the centres' collections into such agreements (GRAIN 1994). The Bank appears not to have held this position very firmly; a few weeks later, at the meeting of the Intergovernmental Committee Meeting on the CBD mentioned above, the Director General of the International Plant Genetic Resources Institute (IPGRI), one of the CGIAR Centres, affirmed his expectation that the agreements would be signed within a few months. He also reasserted the centres' preferred position saying: 'The international community has long recognised the need to establish a legal and political identity for the ex-situ collections managed by the CGIAR by placing them under the auspices of an intergovernmental authority' (GRAIN 1994). Numerous delegates at that meeting expressed deep concern about ongoing uncertainties and called upon the FAO and the CGIAR Centres to finalize the agreements. These recommendations were echoed by the Crucible Group, an international think tank comprised of high-level stakeholder representatives, participating in their personal capacity. The Crucible Group recommended that the CGIAR Centres 'conclude an agreement with the member nations of FAO placing the *ex situ* germplasm collections they hold in trust under the auspices of that intergovernmental body' (Crucible Group 1994).

In March 1994, at a meeting of the Centre Directors Committee, the Director Generals of the 12 affected Centres confirmed that they were content with the

text of the generic Agreements between the CGIAR Centres and the FAO of the United Nations Placing Collections of Plant Germplasm under the Auspices of the FAO (In-Trust Agreements).[14] They also decided to send a letter to FAO outlining their interpretation of some of the clauses of the agreement.

Meanwhile additional changes were introduced into the draft agreement to meet the concerns expressed by the Commission, and the revised draft was submitted for approval by the Ninth Session of the Working Group on Genetic Resources. The Working Group approved the changes and the proposal that the FAO Secretariat and the CGIAR would issue a joint statement indicating their understanding of certain provisions of the in trust agreements.

Thereafter, each centre's Board of Trustees approved the agreements for their particular centre. Finally, in October 1994, the Chair of the CGIAR signed agreements on behalf of the twelve CGIAR Centres with *ex situ* collections.

The signature of the agreements was reported to the First Extraordinary Session of the CGRFA in November 1994, which warmly congratulated FAO and IPGRI (CPGR 1994).

Pursuant to the In-Trust Agreements, the CGIAR Centres were to place 'designated germplasm' under the auspices of the FAO in an international network of *ex situ* collections. At the time of signing, the CGIAR Centres reported including 450,000 accessions under the In-Trust Agreements. They provided updated reports on designated materials every two years to the CGRFA. By 2006, this number had increased to 650,000 accessions. The In-Trust Agreements stated that the CGIAR Centres held the material 'in trust for the benefit of the international community' and that the centres would make them available 'without restriction' for 'scientific research, plant breeding, or genetic resources conservation' along with any other available 'related information.' The CGIAR Centres would not claim ownership over the germplasm; nor would they seek intellectual property rights on designated germplasm or related information. The centres would pass on these same obligations to recipients. Furthermore, the centres recognized the authority of the CGRFA to set policies for the international network. The centres could designate as 'in trust' materials that were included in their collections before the CBD came into force and any materials that they obtained thereafter with the consent of the country of origin or other providers who obtained the materials in accordance with the CBD (SGRP 2003).

Pursuant to the agreements, materials were designated at the discretion of the CGIAR Centres. In 1998, the centres published their own Guidelines for Designation of Accessions under the FAO Agreements (SGRP 2003). According to these guidelines, the centres would only designate materials for which they had a long-term conservation commitment and for which they could distribute without restriction. Concerning accessions acquired by the centres after the coming into force of the CBD, the guidelines stated that it was "understood that acquisition

[14] Cf. <http://www.bioversityinternational.org/fileadmin/bioversity/publications/pdfs/1178.pdf> for the full text of the agreements.

of materials should be based on the express written permission of the relevant government authority. Centres should seek to determine which institute or agency has this legal authority" (SGRP 2003).

At the time of signing, the FAO and the CGIAR Centres issued a joint interpretive statement indicating, among other things, that the centres could use a material transfer agreement (MTA) when distributing designated materials. It took almost four years to develop the MTA. Interim drafts developed by the CGIAR Centres and Secretariat of the Commission were presented to the CGRFA as they were being developed (CPGR 1995a). In 1998, the centres adopted a simple, one-page material transfer agreement to be used whenever distributing designated germplasm (CPGR 1999). Like the designation guidelines, the material transfer agreement explicitly addressed the status of the material vis-à-vis the CBD, stating that if it "was acquired after the entering into force of the Convention on Biological Diversity, it was obtained with the understanding that it could be made freely available for any agricultural research or breeding purposes" (SGRP 2001).

Between 1994 and 2006 when the centres signed the agreements with the Governing Body of the Treaty, the CGIAR Centres distributed over a million samples of PGRFA under the framework of the In-Trust Agreements (CGIAR-SINGER 2009).

3.2. What did the 1994 In-Trust Agreements achieve?

It is difficult to say with certainty what the 1994 In-Trust Agreements achieved. Perhaps the best 'yardstick' for their success is what did not happen. The CGIAR Centres' collections were not nationalized, privatized, or subjected to fee-for-service charges that might have put them out of reach of poorer recipients. If any of these things had occurred, it is reasonable to believe that they would have resulted in significant, if not total, disruption of the distribution of materials from the CGIAR Centres, and by extension, of the research, conservation and development efforts they were distributed to support. In fact, under the In-Trust Agreements, the centres' rates of distribution stayed more or less constant from the period prior to 1994 and thereafter.[15] Thus, the In-Trust Agreements provide continued legal and administrative security for the CGIAR Centres to continue in their role as the 'pumps' in a relatively open, global system of innovation and conservation. Elisabetta Gotor (2009) points out that around 1989, and leading up to the establishment of the In Trust Agreements, a large number of requests for restoration of germplasm back to countries of origin and a reduction in acquisitions was recorded by the International Rice Research Institute genebank

[15] The numbers of samples distributed per year dipped slightly after 1994, up to 10% in some years, but this can be accounted for by other factors, such as better information about the materials in the collection, which allows the gene bank to better 'target' what materials to send and they therefore can send fewer samples per request. Better informed requesters/recipients also contribute to the same phenomenon.

database. As a result the number of accessions held by IRRI reached a low point around 1994. The number of accessions might not have been built back up without the establishment of the stable policy environment that was provided by the In Trust Agreements.

Furthermore, the signing of the In-Trust Agreements sent a positive signal to the ongoing negotiations for the revision of the IU. The twelve In-Trust Agreements with the CGIAR Centres were the first agreements to formally place material in the network of *ex situ* collections. Given that those collections were among the largest and most diverse in the world, it was extremely important to have them 'in'. The In Trust Agreements had important symbolic importance to those who were critical of the centres' autonomy. Voluntarily submitting to the policy guidance of an intergovernmental body acted as a salve on political tensions. As such, at the time, the In-Trust Agreements represented a high water mark for the development of the global system. Once the controversy of the CGIAR Centre-hosted collections was resolved through the mechanism of the agreements with the FAO it became easier for countries to imagine themselves as being part of a system following similar rules. When the CGRFA was informed of the signature of the In-Trust Agreements, it "warmly congratulated FAO and […] the CGIAR Centres, for taking this important step, that will strengthen the Global System". The Commission noted that agreements constituted "an important contribution to the process of revising the International Undertaking," representing "the beginning of a new era of cooperation between FAO, the CGIAR Centres and national institutions." (CPGR 1994).

Ultimately, no countries signed agreements to put their collection in the international network; they did not need to. Instead, they ratified the Treaty, which automatically included in the multilateral system both *in situ* and *ex situ* PGRFA that are under their management and control and in the public domain.

4. A comparison of the commons characteristics of microbial genetic resources and PGRFA

4.1. Commons characteristics of PGRFA

Perhaps the two most important commons characteristics of PGRFA is that they are crucial to global food security, and that countries are interdependent in their reliance upon them. PGRFA are critical to food security because they are the basic building blocks of crop and forage research, and by extension, all agricultural production. They are the source of traits needed to overcome biotic and abiotic stresses; they are used by farmers and breeders in all forms of plant variety improvement and breeding. Interdependence refers to the fact that all countries rely on PGRFA that originated from other countries. This interdependence is a function of the history of crop domestication and the global movement of crops and associated agricultural technologies around the globe as a result of exploration, colonialism, free trade, economic development, and the 'globalization' of a

number of foods. It is estimated that today, 60% of calories consumed by humans worldwide come from just four crops: rice, wheat, maize and sugar (Palacios 1997). Interdependence on PGRFA can be seen in the pedigrees of modern varieties that are grown all over the world, with 'end point progenitors' from tens of different countries from two or more continents (Gollin 1998). Interdependence is also demonstrated by the high number of international exchanges of PGRFA. Each year, the CGIAR Centres alone distribute more than four hundred thousand PGRFA samples all around the world in support of plant breeding, research, and conservation. More than 90% of those samples go to public sector organizations; 85% to developing countries (SGRP 2009).

The importance of a) PGRFA's contribution to food security, and b) countries' interdependence on them, is embraced by the Treaty: interdependence and food security are the two criteria explicitly cited in the Treaty for including crops and forage genera in Annex 1 and the multilateral system.[16]

Other commons characteristics of PGRFA flow from these two fundamental characteristics. For example, PGRFA have (with a few notable exceptions) traditionally been subject to open exchanges from farmers-to-farmers and from breeders-to-breeders as well as among conservationists on a local, national, and international basis. The users of internationally pooled PGRFA are globally dispersed and potentially limitless.

As a result of the way PGRFA have developed and been used, it is often difficult to determine their country of origin. The CBD defines 'country of origin' as "the country which possesses those genetic resources in *in situ* conditions." The CBD defines '*in situ* conditions' as the "conditions where genetic resources exist within ecosystems and natural habitats and, in the case of domesticated or cultivated species, in the surrounding where they have developed their distinctive properties". Ultimately, as far as crops are concerned, the CBD "requires the identification of the county of origin of the distinctive properties of a crop". The international ancestry of most PGRFA makes it extremely difficult to know in which countries particular traits may have developed (Frison and Halewood 2006).

There are extensive *ex situ* collections of PGRFA hosted by national and international public organizations. It is estimated that currently more than 1300 gene banks around the world hold 1.5 million unique accessions of PGRFA (Fowler and Hodgkin 2004). Most of those accessions were acquired prior to the coming into force of the CBD, which means that they are beyond the reach of national sovereign rights of control. So even if it was possible to discern their country of origin, it would be legally irrelevant. A sizeable proportion of those accessions – approximately 13% of the total number of accessions – are hosted by the CGIAR Centres, which have historically provided/facilitated open, global, access to them. Because the centre-hosted collections contain a considerably higher proportion of traditional varieties and wild relatives than many other

[16] Treaty, *supra* note 1, Article 11.1.

ex situ collections, it is reasonable to conclude that the overall percentage of genetic diversity represented in the centre-hosted collections is considerably higher than 13%.

The poolers, managers and users of PGRFA are globally dispersed, and potentially limitless in number.

Human intervention is a critical variable, along with environmental conditions and plant reproductive systems, in the selection of distinct traits within species and the generation of crop biological diversity. In the absence of human intervention, many of these traits and varieties will cease to exist (Halewood et al. 2006). Put another way, human use is a prerequisite for the conservation of PGRFA, which is not at all the case for wild plants, for example.

4.2. Commons characteristics of MiGR

I start this subsection by noting that it is not entirely fair to compare *all* microbial genetic resources to the subset of plant genetic resources that are useful for food and agriculture. The PGRFA commons is defined by a discrete subset of plant genetic resources and a community (or communities) of users with similar enough interests/practices that it was possible, in the context of the International Treaty, to agree upon standard access and benefit-sharing conditions, dispute resolution, and so on. If the Treaty applied to *all* plant genetic resources, including wild endemic species with potential pharmaceutical, cosmetic, and other industrial purposes, it seems unlikely that the international community has been able to come to such an agreement. Likewise, it seems to be expecting 'rather a lot' that the same kind of cohesion and commonality of purpose that permitted the creation of the Treaty's multilateral system could be found across the entire range of microbial genetic resources and their users.

On the other hand, as shall be reviewed below, there are already substantial efforts on the parts of a number of organizations to promote internationally-harmonized quality management and access and benefit sharing policies across culture collections. So one should not dismiss the possibility of the development of a unified set of rules for a microbial genetic resources commons that includes all sectoral uses of microbial genetic resources. To that end, it is worthwhile to start with consideration of the commons characteristics of all microbial genetic resources, and only afterwards, focus in on microbial genetic resources of relevance to agriculture (i.e. the counterpart of plant genetic resources used for food and agriculture).

Dedeurwaerdere et al. (2009) conclude that countries are interdependent upon microbial genetic resources, based on evidence of a) the need to collect a wide range of geographically dispersed species and or strains in the service of microbial-related research, and b) the actual high rate of international exchanges of microbial genetic resources that already occur in service of that research.

As in the case of PGRFA, the international character of microbial genetic resources has been promoted through human uses, pooling and conserving

culture collections in service of research programmes. There are currently 553 culture collections, in 68 countries, holding over 1,420,000 microbials, registered with the World Data Centre for Microbials (WDCM 2009). And there are many more collections that are not included in the WDCM list. Probably more than 50% of the strains held world-wide were acquired before the CBD came into force (Dedeurwaerdere et al. 2009). So, like the pre-1993 crop collections, they are beyond national sovereignty-based claims for control rooted in the CBD, at least those strains that were transferred out countries of origin prior to their implementing article 15 of the CBD. Many of the culture collections – certainly the larger ones located in developed countries – have long-established traditions of providing/facilitating open, global access to their collections. That tradition has apparently continued, even since the CBD has come into force. Dedeurwaerdere et al. (2009) report that out of 19 genebanks studied around the world, on average, ~ 90% of new deposits in 1995, 1996 and 1997 were made without any restrictions on the collection's ability to further distribute that material. As in the case of PGRFA, the 'poolers' and users of microbial genetic resources are globally dispersed, and potentially limitless in number. On the other hand, it is noteworthy that there is no equivalent in the microbial culture collections world of the international CG Centres and their international *ex situ* collections of PGRFA. Almost all of the culture collections in the world are held by national organizations, and most (perhaps all of them) do not have international public purposes inscribed in their constitutions. While a number of these collections have clearly adopted 'internationalist' approaches to the management of their collections, they are still, potentially, subject to nationally motivated shifts in policy, including adopting restrictive approaches to access and supply of their collections.

It is estimated that the public culture collections alone distribute more than 500,000 single isolates annually (Dedeurwaerdere et al. 2009). The vast majority of those transfers – 77% – are to public sector recipients (Stromberg et al. 2006). At least as much, and probably considerably more, is distributed through informal networks between researchers with 'working collections' (Dedeurwaerdere et al. 2009).

It is estimated that only ~ 1% of bacterial and archeal species, 1% of viruses, and 5 to 10 % of all fungal species have been described (Staley and Reysenbach 2002). Many of the species identified are internationally ubiquitous. At the species level at least, these microbes are already commonly pooled and available.

4.3. An agricultural microbial genetic resources commons?

In this section, as anticipated above, I focus on the commons-characteristics of agricultural microbial genetic resources, that is, a subset of microbial genetic resources identified on the basis of their function assisting "in the production of plants or animals, either directly or indirectly, in agricultural settings" (CGRFA

2007a). The possibility of taking such an approach was highlighted in a submission by the Genetic Resources Policy Committee of the CGIAR – a committee established to provide policy advice to the Chair of CGIAR Chair – to the CGRFA in 2007. The paper submitted by the Genetic Resources Policy Committee to the CGRFA, written by John Howieson, considers that agricultural microbial genetic resources would include the following:

- plant microsymbionts;
- associative organisms (that is, eliciting or enhancing a positive reaction or effect when in intimate proximity to a plant or animal);
- rumen organisms;
- biocontrol agents (pathogens of weeds, fungi, insects, or nematodes);
- pathogens of plants or animals;
- agents for nutrient solubilization, bioremediation, or biodegradation;
- agents for production of biofuels; or
- agents facilitating DNA or gene transfer (CGRFA 2007a),

in as much as they are used to assist in the production of plants or animals either directly or indirectly in agricultural settings.

Of course, some of the same microorganisms could also be used for purposes in pharmaceutical, industrial, or cosmetics-related research or applications. The GRPC urged that such taxonomical uncertainties need not be problematic. They can be overcome through focusing on the function for which the organism in question is used.

The GRPC noted that the microbes used in agriculture 'were extremely important for the sustainable improvement of productivity in developing countries.' The committee also noted that agricultural microbial genetic resources are subject to 'extremely fast rates of reproduction and variation' and 'historical patterns of use and distribution', including being deployed in open fields without any containment, that render them difficult to subject to legal forms of control and appropriation (CGRFA 2007a).

Finally, as in the case of PGRFA, it is argued that considerable potential advantage can be gained through agricultural microbial research, and the direct deployment of microbial genetic resources in production systems is being lost due to political and legal uncertainties. To this end, the GRPC has suggested that

> [o]ne possible way to increase the availability to, and use of AMiGRs by, developing countries would be to develop a 'virtual' core collection of screened materials currently held by public organizations around the world that wanted to participate. A critical aspect of this enterprise would be to agree upon harmonized terms and conditions for the distribution of those materials, in conformity with international law. The process for considering the establishment of such a base collection and the terms and conditions for

> its use would need to be highly participatory, with costs, legal status, partners, administrative responsibilities and other issues identified and exhaustively considered (CGRFA 2007a).

Perhaps most importantly, the GRPC noted that agricultural microbial genetic resources are critical to food security, i.e. the second of the two fundamental commons characteristics of PGRFA. This characteristic is important for two reasons: it embodies a common concern of people all around the world, and it is a compelling justification for the intergovernmental community to expend energy developing norms to support the functioning of a global agricultural microbial genetic resources commons. It is hard to imagine mounting a campaign in support of similar efforts on behalf of microbials-based cosmetics research … although, in fact, recently, there have been muted attempts to do so (Oliva 2009).

Interestingly, as it turns out, during its eleventh session in 2007, the CGRFA adopted a multi-year program of work, which includes consideration of access and benefit sharing for all genetic resources for food and agriculture, including microbial genetic resources (CGRFA 2007b). Since that time, the CGRFA secretariat has coordinated the development of a growing body of technical literature, including a number of background papers analyzing patterns of use and exchange of genetic resources in different food and agriculture subsectors, including papers on plant, animal, acquatic, forest, biocontrol, and microbial genetic resources – all useful inputs which demonstrate the value of having a specialist body looking at access and benefit sharing issues (CGRFA 2009). The 12th Session of the CGRFA adopted Resolution 1/2009 'Policies and Arrangements for Access and Benefit-sharing for Genetic Resources for Food and Agriculture' which stressed the importance of genetic resources for food and agriculture for food security, recognized countries' interdependence upon them, and called upon the Conference of the Parties of the Convention on Biological Diversity (COP/CBD) to take the special nature of genetic resources for food and agriculture when developing access and benefit-sharing norms. The Resolution also invited the COP/CBD to work closely with both the Commission and the Governing Body of the Treaty in future access and benefit sharing related work (CGRFA 2009). Future meetings of the CGRFA, therefore, appear to be tailor-made for advanced, intergovernmental consideration of policy and institutional support for an agricultural (and possibly food) related microbial genetic resources commons.

Meanwhile, in the hope of jarring forward the stalled negotiations of an international regime on access and benefit sharing under the framework of the CBD, the ninth Conference of the Parties to the CBD, in 2008, decided to create an expert group on, among other things, sectoral approaches to access and benefit sharing. The group met in early December 2008. Certainly a strong case was made among the expert group participants for recognizing food and agriculture as a sector worth treating separately as far as access and benefit sharing is concerned. And within the discussion of food and agriculture by the expert group, what I

have referred to as the commons-characteristics of agricultural microbial genetic resources were noted (UNEP 2008). On the other hand, there appears to be continued intransigence or inability on the part of most delegations – including those purportedly in favour of sectoral approaches – to get into discussions about particular sectors and how they could possibly be treated differently. The text of the international regime is supposed to be ready for adoption by the tenth meeting of COP/CBD in October 2010. Ultimately, as far as the agricultural microbial commons is concerned, it would be very useful if some combination of a) the section on scope, b) the preamble and c) the decision of COP/CBD adopting the text of the international regime, anticipated (or even expressed the need for) future international access and benefit-sharing norm-setting processes concerning genetic resources for food and agriculture, possibly even mentioning the CGRFA as candidate fora for such processes.

In the meantime, it is still too early to be able to predict with any accuracy how these activities under the aegis of CGRFA and the CBD will influence one another and what their outcomes will be.

4.4. An international network of agricultural microbial collections?

If indeed the CGRFA and/or the CBD concludes that there are sufficient grounds for investigating a set of access and benefit sharing norms to support the global pooling and management of microbial genetic resources used in food and agriculture, it will have a number of precedents to examine from its past work in support of the global crop commons.

The positive correlation between the commons characteristics of agricultural microbial genetic resources and PGRFA cited earlier suggest that some of the lessons learned in formalizing and governing the crop commons are highly relevant. Perhaps the most obvious parallel (though not the easiest course of action) would be to consider negotiating a legally binding international convention, like the Treaty, with a carbon-copied multilateral system of access and benefit sharing for agricultural microbial genetic resources. The Treaty, however, took seven years to negotiate, and requires the support of some fairly complex administrative machinery, for example, the Governing Body of the Treaty, comprised of all members states, and its own secretariat. Another, lighter-weight possibility would be to investigate the possibility of a series of standardized bilateral agreements between an appropriate intergovernmental body and the holders of microbial collections, in the spirit of the agreements that were being developed by the CGRFA for the global network of *ex situ* collections of PGRFA (before they were rendered redundant by the Treaty). These agreements could establish minimum quality standards and harmonized terms for distribution from those collections. They could also subject the management of the collections concerned to high-level intergovernmental policy guidance. International and private organizations could make such agreements on their own, and public organizations could do so through their national governments or at least with their approval. The network would not need all, or even most, of the collections of microbial genetic resources

to be 'signed on.' In the start-up phase, it would be important to ensure that through those organizations that do 'sign on,' the most immediately useful strains for agricultural uses would be effectively conserved and made globally available. More collections and materials could be added later. Flexibility could (indeed, would have to be) maintained to allow signatories to not include some materials, for example, those which they are convinced have high market value.

In this context, however, it is important to note that a much higher proportion of the world's *ex situ* collections of microbial genetic resources are held in nationally controlled collections than in the case of PGRFA. In the agricultural microbial genetic resources world, there are no international organizations that occupy the equivalent central role of the CGIAR Centres, with the same extensive range of *ex situ* collections and an established role as a global collector and supplier. One of the reasons the CGIAR Centres attracted so much attention throughout the 1990s was that they were international organizations, coupled with the fact that there was dissatisfaction, in some camps, with the way the centres were governed. National organizations are seldom subject to the same level of international scrutiny or political pressures. It was partially for this reason that there was not the same pressure to finalize and sign the model agreements for countries vis-à-vis the global network of *ex situ* collections under the CGRFA, as there was on the CGIAR Centres.

That said, it is worth underscoring that throughout the 1980s and up the mid-1990s, until the negotiations of the Treaty had substantially advanced, the CGRFA continued its work in developing draft model agreements for countries to sign to bring their collections into the global network of *ex situ* collections. Furthermore, as noted above, at least 32 countries had indicated their willingness to sign such agreements before they were rendered redundant by the International Treaty (CPGR 1991, 1995b, 1995c).

Part of the reason it took so long for the international community to finally agree on international rules governing the global crop commons was that, within the realm of genetic resources, there were no precedents to look to. Perhaps now, with the Treaty's multilateral system of access and benefit sharing in place, the idea of formalizing governance structures for other international genetic resources commons will not seem so difficult. Furthermore, in this context, perhaps the international community will be more comfortable with exploring less weighty alternatives to full-blown treaties as means to establish those governance structures, for example, something like the series of agreements that would have been used to populate the global network of ex situ PGRFA collections under the CGRFA.[17]

[17] Of course, even 'lighter' options exist, such as endorsement, by an intergovernmental body of a microbial genetic resources users' code of conduct. Another possibility would be for an intergovernmental body to endorse a material transfer agreement that could be used (on a voluntary basis) by organizations when distributing microbial genetic resources for proscribed purposes. At the same time, the intergovernmental body concerned could endorse a deposit agreement that competent authorities

In this context however, it is important to note that there are significant differences between the ways in which PGRFA and microbial genetic resources are used in the development of commercialized products, and this has important implications for how benefit sharing should be approached or 'triggered' in a microbial commons. Traditional plant breeding involves making crosses between (PGRFA) parents leading to the incorporation (in various degrees, depending upon the breeding method) of the parents' genetic information in downstream products. Likewise, crop improvement through biotechnological manipulation also often involves introducing DNA (PGRFA) into the genomes of new plants which is, presumably, reproduced by their progeny. It is for this reason that mandatory financial benefit sharing under the International Treaty is triggered (in part) by the incorporation of PGRFA accessed from the multilateral system of access and benefit sharing into new commercialized PGRFA products. There is considerable horizontal transfer of genetic material between bacteria, for example; however, microbes are not cross-bred to make new strains in the manner that crop plants are. Incorporation, as it is meant under the Treaty and SMTA, is therefore a foreign concept to the world of microbial genetic resources users.[18] Microbial genetic resources in culture collections are most often used either for the purposes of identification or authentication of other microbes. Or they are often exploited, as they are, for the chemical compounds that they produce, either through directly harnessing microbes as the producers of those compounds, or by making synthetic copies of the compounds. In some cases, researchers purposefully allow, or encourage, mutation of microbes in the hopes of their developing useful properties. There is not direct crossing *per se*; if anything it is more akin to mass selection in the plant breeding world. Because of these differences in the uses of PGRFA and microbial genetic resources, it would not be possible to simply reproduce the benefit sharing model of the Treaty for a microbial commons. Perhaps this basic difference could be a pretext for exploring some other, simpler-to-administer form of benefit sharing, that did not turn on the necessity – as it does under the Treaty – of tracing the path of particular materials from the commons into a particular products, and then pay a proportion of sales of those particular products (assuming of course that the other threshold of restricted access has also been passed). Perhaps something more like what Norway has recently voluntarily adopted – a percentage of total

could use (again, on a voluntary basis) when depositing microbial genetic resources in culture collections, authorizing them to use the endorsed material transfer agreement. Such measures could be useful in terms of assuring reluctant would-be providers/competent authorities that they would be making the resources available under conditions approved by an intergovernmental body, and also, presumably, their own government, as a state member of the intergovernmental body concerned. Such an approach would help address problems associated with legal uncertainty in the supply of microbial genetic resources (Halewood forthcoming). It would not, of course, address concerns about unauthorized takings of microbial genetic resources that providers did not want to make available with the endorsed MTA.

[18] Excluding, for the time being, the thorny issue of incorporation of microbial genetic resources into plants, e.g. Bt cotton, Bt maize, etc.

sales of seeds in the country to be paid directly to the Treaty's benefit sharing fund – could be explored for a microbial commons. Before moving to the next section, it is worth noting that these considerations about benefit sharing would apply to all microbial genetic resources, and not just those used in agricultural contexts.

4.5. Microbial commons beyond agriculture

In the last two subsections, I have focused on comparing the situation of PGRFA to that of agricultural microbial genetic resources. Of course, this comparison is of little relevance (and possibly little interest) to users of microbial genetic resources outside agriculture. However, to move well beyond consideration of agricultural uses of microbes risks losing the advantage of gleaning what insights can be gained from comparing two similarly situated groups of resources and communities of users. That said, there are numerous potential ways to define communities of users and the related groups of organisms, and it would be a disservice to ignore them. One frequently sighted user community that potentially cuts across agricultural, pharmaceutical, cosmetic, and industrial sector divisions is up-stream, non-commercial researchers (Reichmann et al. 2008; UNEP 2008). Common practices among up-stream, non-commercial researchers using microbial genetic resources could potentially justify treating them as a distinct community of users. On one hand, I have cited the importance of agricultural microbial genetic resources to food security as a justification for intergovernmental interest in, and support for, an agricultural microbial commons; not all research is associated with such a fundamentally important objective. On the other hand, clearly, research associated with climate change or human health, as discussed briefly below, share much the same quality of socially important *gravitas*.

There has already been an impressive amount of activity on the part of international umbrella organizations for culture collections, to develop common quality standards and harmonized policies for access and benefit sharing, regardless of the ultimate use of the microbial genetic resources concerned. For example, the Board of the European Culture Collections Organization (ECCO) representing 65 member collections from 24 European countries holding over 350,000 strains adopted an the 'ECCO core Material Transfer Agreement for the supply of samples of biological material from the public collection' which establishes a set of common core conditions that will apply to all materials transferred from those collections (ECCO 2009). Earlier efforts coordinated by the Belgian Co-ordinated Collections of Micro-organisms, in partnership with the OECD, the World Federation of Culture Collections, and others led to the development, in 2000, of the voluntary Microorganisms Sustainable Use and Access regulation International Code of Conduct (MOSAICC), which provides guidance on basic, common clauses to be used in material transfer agreements to lower the transaction costs of complying

with the CBD (Desmeth 2000). Adoption and use of MOSAICC however, has been frustrated due to uncertainties within countries about their own standards and processes for regulating access (Smith 2003). In 2008, Catholic University of Louvain, with support from a number of organizations, including Bioversity International (one of the CG Centres) sponsored a meeting concerning the development of a microbial commons. In October 2009, the US National Academy of Science hosted a meeting on the same topic. These efforts have generally not been sector-specific.

In this context, it is also important to note another important difference between the historical development and current function of culture collections and *ex situ* collections of PGRFA. Most of the *ex situ* PGRFA collections hosted by the Centres started off as 'working collections' to support plant breeding efforts. Thereafter, they became more formally recognized collections with conservation mandates. Throughout their history however, their core purpose has been related to conservation and uses for food and agriculture. The same is not true of many culture collections, which also service research activities related to human health, pharmaceuticals, cosmetics and industrial uses. It is difficult to estimate what proportion of depositors to, and recipients of materials from, culture collections are from the food and agricultural sectors. One survey of a major European general purpose collection and a major Asian collection showed that the number of recipient /depositor organizations from food and agriculture sector was between 10 and 30% of the total (Dedeurwaerdere et al., unpublished survey data with the authors).

Another challenge facing champions of a commons that includes all uses of microbial genetic resources concerns intergovernmental forum shopping. As reviewed above, the CGRFA would provide an appropriate forum for the consideration of policies and administrative structures in support of an agricultural microbial commons. It is hard to imagine what intergovernmental body has the capacity to entertain negotiations (and later, provide oversight) for the creation of a commons for all uses of *all* microbial genetic resources. Once one moves beyond the context of food and agriculture, there are very few examples of intergovernmental bodies considering models for pooling resources other than for creating new ways to control or appropriate them. The one striking exception that confirms this rule is the ongoing consideration, under the aegis of the World Health Organization, in the context of support for bird flu-related research (WHO 2009). Another possibility for crafting a special set of combined intellectual property and access and benefit sharing rules for genetic resources has arisen in the context of the ongoing negotiations for a framework agreement to address climate change (UNFCC 2009). But it is still far too early to tell how those negotiations will end. Ultimately, it may be that simultaneous efforts at different intergovernmental bodies dealing with agriculture, health, environment will be necessary, with culture collections and other microbial commons champions promoting consistent, harmonized norms to be developed by those bodies.

5. Conclusion

The evolution of the governance of the crop commons provides useful insights for those engaged in efforts to formalize the structure of the microbial commons. During the 1980s and 1990s, issues related to the international movement and use of all genetic resources became highly politicized and subject to rancorous international debate, polarized between developed and developing countries. Most developing countries were deeply resentful of the extension of intellectual property protections for foreign technologies within their own borders, through the negotiations under the General Agreement on Tariffs and Trade and the World Trade Organization. The negotiations and coming into force of the CBD did little to resolve these tensions. In many ways, it exacerbated them by asserting that countries have the right to regulate access to genetic resources within their borders (which is fine in itself) but failed to provide any guidance as to how they should do so. The model that most countries have seized upon, in the absence of coordinated consideration of alternatives, is based on a reaction to the archetype 'bio-piracy' scenario of a compound, isolated from a wild plant with the help of traditional knowledge, that was accessed without permission from a developing country, leading to the development of a pharmaceutical worth millions in the global market. The regulatory 'solution' in such a case is to create processes for exhaustive screening of all applications for access to genetic resources in a country and require the consent of the government in each case. All but the most recent work of the Conference of the Parties of the CBD has tended to entrench this approach to implementing the CBD. Such regulations are appropriate to address some forms of exploitation of some genetic resources. However, it appears that, perhaps inadvertently, the baby has been thrown out with the bath water. The internationally encouraged preoccupation with sealing off unregulated access to any and all genetic resources has led to the mismanagement, disuse, and, in some cases, abandonment of valuable commons.

Volunteer efforts of individual (or groups of) organizations to maintain genetic resources commons are not powerful enough, on their own, to counter this trend. The CGIAR Centres' declaration in 1989 that they considered themselves to be holding their *ex situ* collections in trust for the global community did not create the necessary conditions for the secure management and use of those collections. Their good intentions did not insulate the collections from the (real, or equally damaging imagined) threats of being taken over by national host governments or the World Bank or from being disintegrated by demands for repatriation of accessions by countries of origin or subject to future changes of policy decided by the centres themselves. Ultimately, in order to secure the position of the collections as core resources for the global PGRFA commons, the CGIAR Centres had to sign agreements with the FAO, putting their collections in the global network of *ex situ* collections and subjecting them to being managed by the high level policy guidance of the CGRFA. The secure inclusion of nationally held material in the global crop commons was not achieved until governments'

ratified the Treaty. In a more positive political environment, a similar outcome could have been achieved through those same governments signing agreements to include their collections in the international network of *ex situ* collections of PGRFA.

Many of the same challenges face the management and use of the microbial genetic resources commons. Under these circumstances, it is unlikely that individual collection holders – individual, public, or private – will be able to reverse the 'Balkanization' of the microbial commons through their own voluntary efforts. Intergovernmental recognition and support for the microbial commons will be necessary for their long-term maintenance and efficiency. As time passes, the proportion of microbial collections that are acquired after 1993 will have to increase. Without the buy-in, and approval of, the governments of the countries from which this material is first accessed, it will be impossible to populate, and maintain, a global microbial commons. The best way of obtaining such support is to have the principles of the commons recognized, and supported, through an intergovernmental body.

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