# Governing Global Scientific Research Commons under the Nagoya Protocol


Tom Dedeurwaerdere (FRS-FNRS/UCL) – E-mail: Tom.dedeurwaerdere@uclouvain.be
Arianna Broggiato (UCL)
Selim Louafi (CIRAD)
Eric W. Welch (University of Illinois)
Fulya Batur (UCL)



**Abstract**

Sharing of basic research assets in so-called scientific research commons has proven key to research contributing to the conservation and sustainable use of biodiversity, and in the life sciences more generally. As a result, in practice, many research assets are accessed and exchanged under public domain-like conditions. This chapter aimed to show that it is possible to build upon these practices in the implementation of the Nagoya Protocol, so as to ensure that this implementation is supportive both of the scientific research commons and the objective of fair and equitable access and benefit-sharing. In particular, we showed that this is possible by further building upon the standard contracts for the access of public research assets that are currently in use in many areas of the scientific research commons, by adopting a broad interpretation of the notion of non-commercial research under the Protocol in combination with appropriate benefit-sharing conditions for capacity building and technical services with basic research assets in the provider countries. In addition, to take this vision forward, this chapter discussed three institutional options for building standardised ABS approaches in global research commons.



**Bibliographical reference**

Dedeurwaerdere T., 2012. Design Principles for Successful Genetic-Resource Commons for Food and Agriculture. *International Journal for Ecological Economics and Statistics*, Volume 26, Issue no. 3, pp. 31-46.





ISSN 2213-493X; ISBN 978-90-04-21719-5 (hardback); ISBN 978-90-04-21720-1 (e-book)

# Chapter 13. Governing Global Scientific Research Commons under the Nagoya Protocol

*Tom Dedeurwaerdere,* Arianna Broggiato,** Selim Louafi,****
*Eric W. Welch,**** and Fulya Batur******

In the twentieth century, there has been a tremendous increase both in the quantities of biological resources that are exchanged for research purposes and in the global interdependencies of these exchanges.[1] For example, in the field of microbial resources only, over 1,2 million samples are exchanged on a yearly basis between collections of samples of microorganisms, that are members of the World Federation of Culture Collections, situated both in developed and developing economies. Further, over 200,000 new samples are still deposited each year in these collections and used in research laboratories, collected in countries from all geographical regions of the world.[2] Similar patterns can be observed in other sectors of biodiversity-related research and innovation, whether with microbial, plant or animal genetic resources.[3]

The positive impact of these changes on biodiversity-based innovation has, however, been attenuated by a set of counterbalancing factors. Major

* Research Associate at the National Foundation for Scientific Research, Belgium (F.R.S.-FNRS), and Professor at the Université catholique de Louvain.

** Post-Doctoral fellow at the Université catholique de Louvain.

*** Senior Researcher at CIRAD-Agricultural Research for Development.

**** Professor at University of Illinois at Chicago.

***** PhD Research Fellow at the Université catholique de Louvain.

[1] Browyn Parry, *Trading the Genome* (New York: Columbia University Press, 2004).

[2] Tom Dedeurwaerdere *et al.*, *The Use and Exchange of Microbial Genetic Resources Relevant for Food and Agriculture* (Rome: CGRFA Background Study Paper no. 46, October 2009).

[3] Devin M. Bartley *et al.*, *The Use and Exchange of Animal Genetic Resources for Food and Agriculture* (Rome: CGRFA Background Study Paper no. 43, July 2009); Jarkko Koskela *et al.*, *The Use and Exchange of Forest Genetic Resources for Food and Agriculture* (Rome: CGRFA Background Study Paper no. 44, January 2010); Devin M. Bartley *et al.*, *The Use and Exchange of Aquatic Genetic Resources for Food and Agriculture* (Rome: CGRFA Background Study Paper no. 45, September 2009); Ximena Flores Palacios, *Contribution to the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources* (Rome: CGRFA Background Study Paper no. 7, rev.1, December 1997).

obstacles in this regard are, first, the lack of sufficient incentives for promoting research into sustainable use and conservation of biodiversity, which have no direct high commercial value output,[4] and the hampering of international cooperation by an overly strong focus on direct monetary benefits at the expense of non-monetary benefits, in the discussion on access and benefit sharing (ABS).[5] In recognition of these obstacles, policy-makers have increasingly focused on alternative methods for promoting science and innovation, based on the networking of research infrastructures into global scientific research commons.

In this chapter, we aim to show in what respect these scientific research commons have become an essential tool for promoting scientific research and innovation based on biodiversity. In particular, this chapter aims to highlight the social motivations that play a role in the complex non-monetary incentive mechanisms that drive science and innovation in the research commons (such as reputational benefits, intrinsic values and reciprocity relationships) and analyse under what conditions these can be taken into account in a more effective way in the implementation of the Nagoya Protocol, with a view to improving the production and use of public research resources in a global context.

Through this analysis, the main goal of the chapter is to contribute to better global regulation of the scientific research commons in the specific context of the obligations under the Nagoya Protocol on Access and Benefit-sharing. We will first present survey results on access and use patterns in some major examples of global science commons, and analyse some of the main non-monetary benefits that are provided. Then we will apply the insights resulting from these surveys to evaluate possible scenarios for the implementation of key articles of the Nagoya Protocol that will have an impact on future regulation and governance of the scientific research commons. For this purpose, we will more specifically analyse the Nagoya Protocol provisions on simplified access measures for biodiversity-related research,[6] a multilateral

[4] Tom Dedeurwaerdere *et al.*, "An Evolutionary Institutional Approach to the Economics of Bioprospecting," in *Biodiversity Economics: Principles, Methods, and Applications*, ed. Andreas Kontoleon and Unai Pascual (Cambridge: Cambridge University Press, 2007): 417; Jerome H. Reichman *et al.*, *Intellectual Property and Alternatives: Strategies for Green Innovation* (Chatham House Energy, Environment and Development Programme Paper No. 08/03, 2008).

[5] Sikina Jinnah and Stefan Jungcurt, "Could Access Requirements Stifle Your Research?" *Science* 323:5913 (2009): 464.

[6] Nagoya Protocol Article 8.a.

benefit-sharing mechanism,[7] transboundary cooperation,[8] and best practices, standardisation and guidelines.[9]

The chapter is organised as follows. The first section will explain the concept of the commons and its application to the specific case of scientific research commons. The second section will present the survey on access and use patterns in the global scientific research commons, by focusing on the particular case of globally networked public collections of genetic resources. The third and fourth sections will analyse, on this basis, how to create the best possible institutional fit with the access and use patterns highlighted through the surveys, by discussing respectively a set of institutional and legal options for implementing the Nagoya Protocol in the scientific research commons.

## I. *Theoretical Models of Global Scientific Research Commons*

Much thought has been given over the last two decades to the positive role of non-State collective action for the provision of commons in modern economies. The provision of commons by non-State collective actors is increasingly seen as a necessary complement to the traditional institutional toolkit, in response to the insufficiencies of a unilateral focus on market mechanisms or government only. Such solutions have been especially prominent in policies that aim to address global environmental challenges, but have recently gained additional momentum in the context of digital knowledge resources and organisation of scientific research. This growing interest in the commons has led to broaden the concept of the historical commons, originally mainly related to natural resources, to new types of goods, such as knowledge goods and urban infrastructure.

Two basic features characterise both the historical and the newly emerging commons. The first is related to the physical and socially constructed characteristics of the commons as non-private goods. The second is related to the mechanisms of non-State collective decision-making, which is an important institutional modality for managing these goods.

First, commons can be characterised as non-private goods; that is, goods that are not easily subjected to exclusive control over access and use.[10] From a technical perspective, within political economy, the designation of commons as non-private goods covers goods that are both non-excludable and

[7] Nagoya Protocol Article 10.

[8] Nagoya Protocol Article 11.

[9] Nagoya Protocol Article 20.

[10] Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (New Haven: Yale University Press, 2006).

non-depletable, and goods which have only one of these two characteristics.[11] In this broad understanding, the concept of commons includes pure public goods, such as sunlight, which is both non-excludable and non-depletable upon joint consumption, and impure public goods, which only have one of these features. Examples of impure public goods that are non-exclusive and depletable are environmental goods such as the living resources in the open seas, where it is difficult or costly to exclude users, but which are exhaustible. Examples of impure public goods that are non-depletable, but nevertheless exclusive are digital knowledge pools, where it is easy to exclude users through digital fences, even though the knowledge resources are non-exhaustible upon joint consumption. From an empirical perspective, however, the possibility to exercise exclusive control over access and use is not only based on the physical nature of the goods. Indeed, it is important to recognise that the characteristics of the commons are both physically and socially constructed. An important case in point is the knowledge commons, where the cost and difficulty of exclusion will vary according to the institutional frameworks for intellectual property protection that have been put into place.

Second, many of the commons - especially those belonging to the impure public goods category – are not only provided by the State. Rather, commons are increasingly provided by a wide variety of non-State collective actors or by hybrid forms of collective decision-making, combining non-State collective actors with State actors and/or individual market actors. For example, the seminal work of Elinor Ostrom and her colleagues focused on community-based management of natural resources, as regulated by a clearly defined group of local users.[12] Ostrom's work accordingly sought to establish the possibility of a sustainable intermediate economic alternative for managing natural resource commons, situated midway between market-regulated exchanges of private goods, on the one hand, and pure public goods that typically depend on State-based governance of resources, on the other hand. In a similar way, recent scholarship on the commons has shown the importance of collective decision-making in social networks for providing knowledge goods on a non-exclusive basis,[13] or of mixed economies in open access communities on the Internet.[14] Empirically, the focus in all these cases is on the mechanisms of decision-making for managing goods on a non-exclusive basis and not on

[11] Elinor Ostrom, *Understanding Institutional Diversity* (Princeton: Princeton University Press, 2005).

[12] Elinor Ostrom, *Governing the Commons – The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990).

[13] Benkler, Yochai, *The Wealth of Networks*.

[14] Lawrence Lessig, *Remix: Making Art and Commerce Thrive in the Hybrid Economy* (New York: Penguin Press, 2008).

the formal ownership scheme underlying the administration of such goods, which varies in practice from a purely private property regime to various forms of collective ownership, including direct State ownership.

Many essential knowledge assets for scientific research can be characterised as commons, whether these are biological research materials conserved in *in-situ* environments, which are depletable, but from which it is difficult to exclude users, or research results, which are pure public goods. Moreover, non-State collective action potentially can play an important role in the provision of these assets, as the field of the knowledge commons faces many similar governance challenges as the natural resource commons, such as access restrictions resulting from privatisation of knowledge assets (such as databases or scholarly literature) or free riding by opportunistic players that benefit from the research commons without contributing in a fair and equitable manner.

In the past, it was difficult to imagine commons-based management and production of goods on a global scale, due to such factors as the costs of exchange and the lack of global institutional frameworks.[15] Arguably, the first major instance of formally managed commons on a transnational scale was the organisation of modern scientific research during the seventeenth century in Europe, through the organisation of science academies and associations operating on an international scale.[16] In recent decades, however, digital networks have dramatically expanded the opportunities for building and sustaining different kinds of research commons on a global scale.

In the life sciences, in particular, the genomics revolution and the development of new techniques for the handling and long-term maintenance of living biological samples[17] have led to a tremendous increase of initiatives for networking collections of biological materials on the global scale,[18] and for digitally integrating the associated genomic databases. Nonetheless, overall these initiatives remain poorly integrated, with the risk that they may succumb to adverse economic and political pressures over time. Therefore, new

[15] Robert O. Keohane and Elinor Ostrom, *Local Commons and Global Interdependence* (London: Sage, 1995).

[16] Paul A. David, "The Historical Origins of 'Open Science': An Essay on Patronage, Reputation and Common Agency Contracting in the Scientific Revolution," *Capitalism and Society* 3 (2008): 67–69.

[17] Rita Colwell, "The future of microbial diversity research," in *Biodiversity of Microbial Life*, eds. James Staley and Anna-Louise Reysenbach (New York: Wiley, 2002): 521; Raymond Cypess, *Biological Resource Centres: Their Impact on the Scientific Community and the Global Economy* (Manassas: American Type Culture Collection, 2003).

[18] Parry, Bronwyn, *Trading the Genome*; Kerry T. Kate and Sarah A. Laird, *The Commercial Use of Biodiversity* (London: Earthscan, 2002).

governance institutions are needed for organising the collections of biological samples on the global scale.[19]

Systematic research on generic design principles of governance of knowledge commons has identified a set of design principles of successful governance arrangements.[20] First, this research has shown that in knowledge commons participants are driven more by social motivations (especially reputational and social identity-related motivations) and intrinsic motivations (such as the science ethos or personal values related to biodiversity conservation) than by the prospect of direct monetary rewards. As a result, global scientific research commons will be governed by a set of mixed incentive schemes, which include both self-interested behavioural incentives (such as direct reciprocity or monetary rewards) and other-regarding behaviour incentives (such as the community norms and personal values).

The adoption of distributed modular architectures based on a division of labour amongst geographically distributed components, each specialising in different sub-tasks, but sharing the common norms of the network organisation, is a second major institutional feature bearing on the success of commons-based knowledge production in digital networks.[21] Distributed modular architectures enable many participants to effectively pool their efforts and contributions, notwithstanding the fact that these contributions may vary in quality, focus, timing, and geographical location.[22] The latter is typically the case for the genetic resource collections of microbial, plant and animal samples where, due to the high costs of long-term preservation and documentation of the genetic-resources, and the maintenance of the associated information databases, no single centralised collection can hold all, or even an important subset, of the resources.

[19] Robert Cook-Deegan and Tom Dedeurwaerdere, "The Science Commons in Life Science Research: Structure, Function, and Value of Access to Genetic Diversity," *International Social Science Journal* 188 (2006): 313.

[20] Benkler, Yochai, *The Wealth of Networks*; James Boyle, *The Public Domain: Enclosing the Commons of the Mind* (New Haven: Yale University Press, 2008); Charlotte Hess and Elinor Ostrom, *Understanding Knowledge as a Commons: From Theory to Practice* (Cambridge: MIT Press, 2007); Lawrence Lessig, *The Future of Ideas: The Fate of the Commons in a Connected World* (New York: Random House, 2001).

[21] Benkler, *The Wealth of Networks*; Lessig, *The Future of Ideas*.

[22] Yochai Benkler, "Coase's Penguin, or, Linux and The Nature of the Firm," *The Yale Law Journal* 112 (2002): 406.

## II. *Access and Use Patterns in Global Scientific Research Commons*

### 1. *Survey on Sharing Arrangements with Genetic Resources for Food and Agriculture amongst Researchers in the US and Europe*

The Nagoya Protocol contains a wide variety of provisions, which could potentially contribute to the further institutional development of the global scientific research commons, as will be discussed further below, whether it is in relation to specific science-related provisions in the Protocol or more general provisions related to codes of conduct or transboundary cooperation.

The main question addressed in this chapter, in this context, is how to create a better institutional fit between future institutional developments of scientific research commons under the Nagoya Protocol and the complex governance features of science commons that contribute to research into conservation and sustainable use of biodiversity. To address this question, a better understanding is needed, in particular, of the role of social networks and community norms in shaping the motivations of the participating scientists, in addition to the analysis of specific features of the genetic resources that play a role in the selection of the institutional frameworks.[23]

In 2011, a survey was administered to researchers that use genetic resources for food and agriculture (GRFA) in the US and Europe, with the view to collecting data to understand access and use patterns, to identify the determinants of use, and to investigate existing benefit-sharing practices and arrangements. In the US, the survey was administered to government and university researchers that work with eight different aquatic, microbial, livestock, and insect GRFA. The European data were collected from researchers in one single European government-sponsored organisation. The resulting data includes 126 usable responses (55% response rate) from European researchers and 385 usable responses from the US (38.8% response rate). In addition to individual-level data, the surveys also collected project-level data on GRFA exchange practices for 237 projects undertaken by the European respondents and 731 by the US respondents.[24]

[23] See above footnote 3 and also Marie Schloen, Selim Louafi and Tom Dedeurwaerdere, "Access and benefit-sharing for genetic resources for food and agriculture. Current use and exchange practices, commonalities, differences and user community needs. Report from a multi-stakeholder expert dialogue" (Rome: FAO, Commission on Genetic Resources for Food and Agriculture. Background Study Paper No. 59, 2011). However, the analysis of the particular characteristics and properties does not allow specifying what are the existing community norms and social networks to build upon in effectively implementing a certain institutional regime.

[24] Although the same survey instrument has been administered in the two countries, the sample selection for each is markedly different. In particular, the European study is a single case

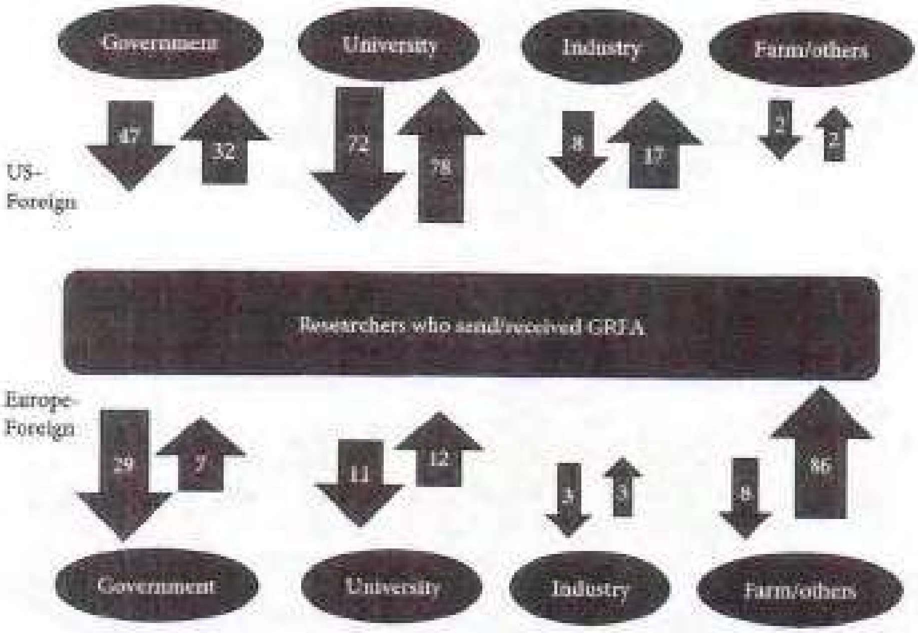


Figure 2: Percentage of respondents who send/received GRFA (Source: original survey data from USDA CIRAD funded research on the exchange and use of GRFA).

Descriptive findings show that researchers in both countries exchange GRFA with partners in different sectors – government, university and industry (cf. figure 1). Among researchers who send and receive GRFA internationally, materials come from multiple sectors, indicating that there is a broad set of sources and exchange patterns among partners who do not necessarily share the same objectives. Project-level data also show that in many instances researchers obtain materials from a variety of sources from different sectors. Researchers likely identify a wide range of collaborators and partners that are able to effectively provide access to resources in ways that increase their chances of obtaining GRFA for undertaking their research. Overall, this points to the existence of a relatively distributed GRFA exchange network. Active exchange of GRFA appears to be beneficial both for the foreign and the national entities, in that there are substantial two-way flows in all sectors, illustrating a certain level of interdependence among the various stakeholders, where no single entity is a self-sufficient user of GRFA. In addition, the

study of a large publicly funded research organisation that has a broad array of international projects mainly dealing with plant genetic resources for food and agriculture, while the US survey covers a wider range of institutions and types of genetic resources. Hence, these two samples may generalize to somewhat different populations and care should be taken when using the results to make comparisons between the US and Europe.

Table 1: Restrictions on access and use, and expected reciprocity (Source: original survey data and from USDA CIRAD funded research on the exchange and use of GRFA).

| | Questions | France | | US | |
|---|---|---|---|---|---|
| | | Yes | No | Yes | No |
| Restrictions on Access | During the last two years, did a person or organisation in a foreign country request genetic resources from you that you did not supply? | 19% | 81% | 9% | 91% |
| | During the last two years, did you request [%Species%] genetic resources from a foreign-based source that you did not receive? | 15% | 85% | 2% | 98% |
| Restrictions on Use | For the genetic resources you obtained during the last two years on each of the project you named, which of the following are true? | | | | |
| | I agree not to provide the materials to others | 31% | 69% | 18% | 82% |
| | I agree not to use the materials for commercial purpose | 30% | 70% | 10% | 90% |
| Reciprocity | For the genetic resources you obtained during the last two years on each of the project you named, which of the following are you expected to provide in return? | | | | |
| | Expected to provide storage of the material | 28% | 72% | 16% | 84% |
| | Expected to provide research or technical services | 43% | 57% | 24% | 76% |
| | Expected to provide information on project results | 80% | 20% | 59% | 41% |
| | Expected to provide education or training | 32% | 68% | 15% | 85% |

existence of private partners shows also that the exchange network likely accommodates both commercial and non-commercial uses of material.

Table 1 shows that few researchers have denied GRFA access to a person or an organisation in a foreign country. More surprisingly, despite a context where access to GRFA appears to be more and more restrictive for major users, few researchers have eventually failed to receive material they requested from their foreign-country partners. In addition, the table shows that few restrictions are imposed on (or are accepted by) researchers regarding third-party transfer and commercial purpose.

These results tend to demonstrate that in order to access material, university and government researchers have the capacity to mobilise resources within the GRFA network that undoubtedly go beyond legal or market-based approaches. This capacity likely arises because users are embedded in trust-based collaborative relationships that also recognise non-monetary benefits that accompany these exchanges. Existence of non-monetary benefits is clearly confirmed by the survey results, which show that reciprocity explicitly plays a role in the exchange process. Most important, in accordance with the generally recognised research norm in which the exchange of materials and knowledge are part of the same process of inquiry, there is a high level of expected provision of information in return for receiving GRFA.

2. *Global Exchange in the Microbial Research Commons*

The *in-situ* conservation of microorganism is not sufficient for organising systematic research into microorganisms and their applications for a number of reasons, in particular because they replicate frequently and need special equipment for their study.[25] Microorganisms that are isolated from the environment are typically conserved and made available for systematic comparative research by public culture collections, which are formally organised to acquire, conserve and distribute microorganisms and information about them to foster research and education.

The main features of the exchange practices found in the survey of the plant genetic resource collections discussed above also characterise these international exchanges amongst the public culture collections. First, as illustrated in figure 2 below, the researchers and managers exchanging the resources come from various sectors, including both research organisations and gene banks, and commercial and non-commercial entities. The two-way flow of resources is also clearly present, as most entities are both providers and recipients of resources.

A vast amount of new microorganisms from *in-situ* sources are collected every year in various regions of the world by culture collection managers or affiliated researchers, characterised and deposited in culture collections for long-term conservation. A quantitative assessment conducted in 2009[26] of the entire accession databases of a representative set of nine collections (totalling more than 15,000 single accessions, covering the years 2005, 2006,

[25] Tom Dedeurwaerdere *et al.*, *The Use and Exchange of Microbial Genetic Resources Relevant for Food and Agriculture* (Rome: CGRFA Background Study Paper no. 46, October 2009): 28–29.

[26] *Ibid.*, 23–25.

and 2007) has shown that new deposits of resources from *in-situ* environments in the culture collections are mostly from national depositors, that is researchers working in a collection or in a research laboratory situated in the same country (between 45% and 100% of the new deposits) (see Table 1). However, a substantial proportion of the new deposits by these national depositors come from foreign countries (over 40% in five of the eight collections for which data was available, four of these being countries of the Organisation for Economic Cooperation and Development – OECD). This suggests that national depositors often collect in other countries and deposit the resulting material in their national collections. Direct deposits from foreign countries also represent an important subset. For instance, the survey showed that every year depositors from India, the Philippines, China, Brazil, Colombia and Uruguay, directly deposit strains from their countries in OECD collections.[27]

A remarkable fact that was found in this quantitative assessment is the lack of restrictions on the further distribution and use of the microorganisms which have been deposited and where the collections are using formal deposit forms. Eight of the nine collections used formal deposit forms for all new deposits in 2005, 2006 and 2007 and between 98% and 100% of these deposits came without any restrictions attached.[28]

This survey did not include questions on the expected public good benefits. However, some of these reciprocity features are also clearly present in the case of the microbial collections. Samples are deposited with the clear expectation that these samples will be stored in the long-term storage facilities and will be maintained under the very demanding quality assurance systems of the public culture collections.

Agreements for providing research and technical services, to provide information on project results, or to provide education and training, are mostly based on bilateral agreements, such as, for example, the agreements between the Belgian and the Moroccan collections for training in bio-information and management (BCCM – CCMM collaboration)[29] and the agreement for access to samples between the national Japanese and Thailand culture collections (NITE-BIOTEC agreement).[30]

---

[27] *Ibid.*, 28.

[28] *Ibid.*, 7.

[29] BCCM Newsletter, edition 13-03, May 2003, accessed 4 March 2012, http://www.bccm.belspo.be/newsletter/13-03/index.htm.

[30] BIOTEC News, 2005, accessed 4 March 2012, http://www.biotec.or.th/EN/index.php/info-center/news/news2005/104-biotec-signed-mou-with-dob-nite.

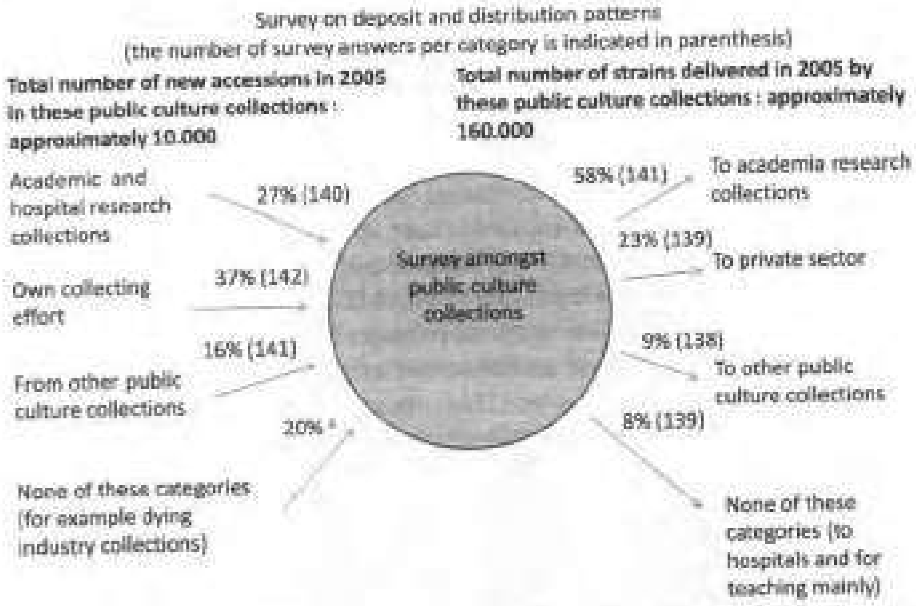


Figure 3: Exchange patterns amongst microbial collections in a sample of 240 culture collections that are members of the World Federation for Culture Collections. (Source: Tom Dedeurwaerdere, Per M. Stromberg and Unai Pascual, *Social Motivations and Incentives in ex-situ Conservation of Microbial Genetic Resources* (Cambridge: Open Book Publishers, 2012).

## III. *Institutional Options for Standardised ABS Approaches in Global Research Commons*

The above-mentioned surveys on exchange practices in the scientific research commons highlight two important features of the research commons. First, in spite of general similarities, the agreements used in the exchange are tailor-made for the various sub-sectors of exchange. Therefore, any standard agreement that would be established on mutually agreed terms could only be based on a minimal set of common conditions, because the specific agreements will be different in their details. This reflects the heterogeneity of the research infrastructures, both in relation to the type of material that is conserved, their funding structures, and the requirements of their national policy frameworks. Second, the ongoing transformation from an informal exchange regime to a formal one is not necessarily leading to more restrictive access and use conditions, but can be managed in a way, which is supportive of the scientific research commons. As can be seen from the survey of the microbial collections, it is possible to design formal license conditions, such as deposit forms for the public *ex-situ* collections, that allow facilitating use and re-use of research resources along the innovation chain.

For the design of a worldwide scientific research commons, however, sufficient guarantees have to be provided for reciprocity in the exchanges, and for fair benefit-sharing based on mutually agreed terms. Therefore, to put the global research commons on a solid legal and institutional basis, a more systematic approach is needed, based on a better understanding of the costs and benefits of alternative institutional frameworks. The main issue that has to be addressed in this context is the creation of a better fit between the proposed formal institutional arrangements for building the scientific commons and the norms and goals of the scientific communities.[31] In particular, to foster wide acceptance of the envisioned system, and thereby accelerate scientific progress, any formal arrangements need to be committed to facilitate the exchange of materials, data and published research results, and need to be easy to implement by regulatory bodies, as well as by both parties involved in the exchange (providers and recipients). This raises a double set of problems. On the one hand, institutional frameworks that rely excessively on monetary incentives or formal control can 'crowd out' the social norms of communalism and the intrinsic values that drive scientific communities.[32] Crowding out occurs when internal motivations, such as social norms and personal values, are conflicting with external incentives, mainly monetary/economic incentives or formal sanctions. In those cases of conflicting incentives, individuals might stop to contribute to collective goods or decrease their cooperation with other individuals that contribute to such goods. This is especially relevant for the bulk of public domain resources, which are exchanged for public research purposes on the basis of the social norms of science. On the other hand, without a formal arrangement of some kind for regulating the exchanges, the benefits might be restricted to the researchers

[31] Arti K. Rai, "Regulating scientific research: intellectual property rights and the norms of science," *Northwest University Law Review* 94 (1999): 77; Tom Dedeurwaerdere, "The Role of Law, Institutions and Governance Processes in Facilitating Access to Genomics Research," in *Gene Patents and Clearing Models. From Concepts to Cases*, ed. Geertrui Van Overwalle (Cambridge: Cambridge University Press, 2009), 365; Paul David and Michael Spence, *Towards institutional infrastructures for e-Science: the scope of the challenge* (Oxford: University of Oxford – Oxford Internet Institute Research Report No. 2, 2003); Partha Dasgupta and Paul David, "Toward a New Economics of Science," *Research Policy* 23 (1994): 487.

[32] Bruno S. Frey and Reto Jegen, "Motivation crowding theory: a survey of empirical evidence," *Journal of Economics Surveys* 15 (2001): 589; Bruno S. Frey and Margit Osterloh, eds., *Successful Management by Motivation* (New York: Springer, 2002); Mark Lepper and David Greene, eds., *The Hidden Costs of Reward: New Perspectives on the Psychology of Human Motivation* (New York: Lawrence Erlbaum, 1978); David and Spence, *Towards institutional infrastructures*.

who have access to the networks of professional relationships. In the latter case, those benefits would not reach the scientific community beyond a club of most advanced researchers. Such crowding out has been clearly observed in the case of the implementation of the Convention on Biological Diversity, which has hampered international cooperation built on the norms of public science.[33] In contrast, patenting in academic life science research does not appear to have led to similar crowding-out effects.[34]

The goal of the further harmonisation of the institutional frameworks should therefore be to provide the broadest access possible to essential research materials – within the constraints set by biosecurity and quality management requirements, while maximising the reciprocity benefits of access and exchange which motivated the practice of exchange to start with.[35]

To examine the contribution of possible harmonisation frameworks to the implementation of the Nagoya Protocol in the specific area of scientific research, three main institutional options for building standardised ABS approaches for networks of public collections will be considered. The specific focus on public collections is related to the research interest of this chapter on the institutional design of the scientific research commons. In this context, we qualify a collection as public if the resources conserved in these collections are held in public domain-like conditions; that is, without exercising exclusive legal ownership rights over the resources. A typical example falling under this definition are the government-funded members of the World Federation of Culture Collections, who are holding the microbial materials 'in trust' for the global scientific research community. Similar cases of public availability of resources exist in many other cases of public sector or non-profit *ex-situ* collections of genetic resources, such as the plant genetic resources held by the collections of the Consultative Group on International Agricultural Research (CGIAR). The first option that will be considered is a full-fledged intergovernmental organisation based on a binding international treaty, much like the existing arrangement under the FAO's International Treaty on Plant Genetic Resources for Food and Agriculture

[33] Jinnah and Jungcurt, "Could Access Requirements Stifle Your Research?"

[34] Wesley Cohen and John Walsh, "Access – or not – in academic biomedical research," in *Working Within the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society*, eds. Rochelle Dreyfuss, Diane Zimmerman and Harry First (New York: Oxford University Press, 2010), 16.

[35] Cook-Deegan and Dedeurwaerdere, "The Science Commons"; Peter Dawyndt, Tom Dedeurwaerdere and Jean Swings, "Exploring and exploiting microbiological commons: contributions of bioinformatics and intellectual property rights in sharing biological information. Introduction to the special issue on the microbiological commons," *International Social Science Journal* 188 (2006): 249; Jerome Reichman, Paul Uhlir and Tom Dedeurwaerdere, *Global Intellectual Property Strategies for the Microbial Research Commons* (Cambridge MA: Cambridge University Press: forthcoming).

(International Treaty).[36] The second option, on the opposite, is a purely science-driven non-governmental organisation, building upon existing institutions such as the World Federation for Culture Collections, the International Union of Microbial Sciences and the relevant scientific societies in microbiology. Finally the third option, in between these two extremes, is a framework agreement between willing governments[37] that would contractually establish a common position, notwithstanding underlying differences of the various national laws. An example of this third option that will be analysed is the International Rice Genome Sequencing Project (IRGSP) (1998–2002).

### 1. *Example of a Treaty-based Global Research Commons: The Global Crop Commons Established under the International Treaty on Plant GRFA (2004)*

By far the most directly relevant international agreement affecting the common pooling and management of genetic resources is the International Treaty on Plant Genetic Resources for Food and Agriculture.[38] The Treaty establishes a multilateral ABS system that consists in pooling the genetic material listed in the Annex I of the Treaty and coming from various countries. This material is indeed included in the gene pool by the States that have ratified the Treaty and the institutions under their control. But these samples could also come into the gene pool from international institutions as well as from natural and legal persons within the jurisdiction of the Parties. These samples are pooled in that they are administered under a common set of rules that are contained in a contractual instrument, namely the Standard Material Transfer Agreement (SMTA). The rules apply for each and every individual transfer of material coming from this pool between two legal entities, called the provider and the recipient. The use of SMTA is, however, compulsory only if the material is used or conserved for research, breeding and training for food and agriculture. Finally, the rules regulate not only how to obtain access to the plant genetic material but also how to share the results of research and breeding on that material.[39]

---

[36] International Treaty on Plant Genetic Resources (Rome, 3 November 2001, in force 29 June 2004) 2400 *UNTS* 379. [See also contribution by Chiarolla, Louafi and Schloen in this volume (Chapter 3).]

[37] Reichman, Uhlir and Dedeurwaerdere, *Global Intellectual Property Strategies for the Microbial Research Commons*, where this idea was first developed in the specific context of the microbial research commons.

[38] Michael Halewood, Isabel Noriega and Sélim Louafi, eds., *Crop Genetic Resources as a Global Commons: Challenges in International Law and Governance* (London: Earthscan, 2012).

[39] Daniele Manzella, "The Design and Mechanics of the Multilateral System of Access and Benefit Sharing," in *Crop Genetic Resources as a Global Commons*. Edited by Halewood, Noriega and Louafi. Earthscane. Forthcoming.

The multilateral system might qualify as the most advanced expression of the need for cooperation in the management, conservation and distribution of plant GRFA. By managing globally, in a coordinated and coherent way, a distributed, but still common, pool of genetic resources, the International Treaty creates the global conditions for attenuating the effects of centrifugal forces (intellectual property, sovereignty and so on) and provides an enabling framework for different actors to cooperate across existing geographical, organisational and disciplinary boundaries. It is designed to address the specific features and needs of the agricultural sector when it comes to access to plant genetic resources for food addressing, in particular: i) the existence of important *ex-situ* collections; ii) the interdependence between countries in their use and exchange of PGRFA; and iii) the collective nature of the innovation process (plant improvement and breeding).[40]

Through the establishment of the multilateral system, Parties, 'in the exercise of their sovereign rights,'[41] have agreed to facilitate access to specific plant GRFA and to share the benefits arising from the utilisation of these resources, as laid down in the Treaty and as operationalised through the SMTA. In a highly politicised context about sovereignty over genetic resources, the Treaty has led to a new way of exerting this national sovereignty. Through the establishment of the multilateral system, Parties have agreed to defer a part of their responsibility for plant GRFA management from the national level to the international level. The underlying *rationale* is that they will all gain more by having access to all the resources of the multilateral system than they would have by restricting access to their own. Moreover, the SMTA is a very operational instrument that applies directly (that is, without the necessary involvement of State or administrative representatives) to the stakeholders involved in the exchange of plant GRFA. It does not necessarily require any administrative steps at the national level even in the case of reporting procedures. Hence, the direct link that is established between the stakeholders and the Governing Body of the Treaty (through its Secretariat) provides an opportunity to reinforce the global commons nature of the resource exchanged and the responsibilities attached to its management, beyond or next to the State. In addition, as a viral license agreement,[42]

[40] Marie Schloen, Selim Louafi and Tom Dedeurwaerdere, *Access and benefit-sharing for genetic resources for food and agriculture. Current use and exchange practices, commonalities, differences and user community needs. Report from a multi-stakeholder expert dialogue* (Rome: CGRFA Background Study Paper: 46, May 2011), accessed 3 March, 2012, http://www.fao.org/docrep/meeting/022/mb336e.pdf.

[41] As International Treaty Article 10.2 explicitly states.

[42] This notion has been coined in the software sector to describe a software made freely available through a license that permits modification and distribution as long as the modified

the SMTA allows for the monitoring and control of the flow and use of plant GRFA. Together with the Treaty's compliance mechanism, the SMTA functions as a certificate of compliance and generates the knowledge needed to operationalise the sharing of benefits.

Striking the proper balance between open availability and private enclosure was contentious during the Treaty negotiations, and continues to be to this date.[43] In a context of hyper-ownership,[44] the Treaty manages to ensure a wider circulation of plant GRFA worldwide by reducing dramatically the transaction costs associated with the exchange of genetic resources. By moving away from the bilateral and case-by-case approach, the Treaty indeed contractually reconstructs a common good.

Social value is underlined in the reciprocity aspects of the non-monetary benefit-sharing mechanisms. Capacity building, the exchange of information, and access and transfer of technology are very often catchwords in international texts. In the context of the Treaty, it is argued that these components are key for maintaining the overall political coherence of the Treaty by promoting other values than the monetary ones that will likely remain quite low. These components are indeed taking on their full meaning in the context of implementing the Multilateral System: they are the means and the vehicle through which a wider conception of benefits could be generated, a broader range of stakeholders could be encouraged and a wider range of concerns could be dealt with.[45] The use of GRFA indeed usually generates important external effects that go far beyond the individual provider and recipient of the respective genetic material, sometimes even independently of whether the product reaches the market place. These external effects may, for example, contribute to the creation of important public goods such as rural development and poverty alleviation, environmental protection, food security and cultural diversity. The fact that an important part of agricultural and food production relies on the use of species of exotic origin, and that

software is distributed under the same license through which the source code was originally obtained.

[43] Christine Frison, Tom Dedeurwaerdere and Michael Halewood, "Intellectual Property and Facilitated Access to Genetic Resources under the International Treaty on Plant Genetic Resources for Food and Agriculture," *European Intellectual Property Review* 32 (2010): 1.

[44] Safrin uses this term in her article to refer to the increased legal enclosure of genetic material (Sabrina Safrin, "Hyperownership in a time of biotechnological promise: the international conflict to control the building blocks of life," *American Journal of International Law* 98 (2004): 641.

[45] Selim Louafi, "Collective action challenges in the implementation of the Multilateral System of the International Treaty. What roles for the CG Centres?" in *Crop Genetic Resources as a Global Commons*, edited by Halewood, Noriega and Louafi. Earthscane, forthcoming.

countries are usually not self-sufficient with regard to GRFA, increases the relevance of these non-monetary spillover effects.[46]

The Multilateral System established with the International Treaty illustrates the option of an international treaty for a standardised ABS approach for research. However, the Multilateral System poses major challenges of implementation to governments at various levels – the global level as much as the national levels.

It should be indeed mentioned that, to date, there has not been more vigorous engagement in the Treaty's multilateral system by a number of key actors. The most relevant contributing factors are related to two underlying issues:[47]

- insufficient policy reinforcement of the plant GRFA commons – there are no boundaries and no direct reciprocity requirements (non-contributors can equally benefit from the system as contributors);
- the mandatory financial benefit-sharing provision suffers from a design situated somewhere between multilateralism and bilateralism that undermines some actors' enthusiasm for participating in the multilateral system as conservers, users, providers and recipients of germplasm and information. While mandatorily shared financial benefits are directed to the Multilateral System and decoupled from the countries, communities or legal individuals that actually provide the resources, the triggering mechanism (*i.e.*, the requirement to share benefits) remains linked to the use of a specific sample accessed from the Multilateral System.

### 2. *Example of a Self-regulatory Solution: The Global Microbial Commons Established under WFCC and ECCO*

A second model for standardised ABS approaches takes a bottom-up approach to some of these problems, by formalising science community driven practices through self-regulation. The self-regulatory solution developed within the World Federation for Culture Collections (WFCC) is an example of this second model. More than 80% of the WFCC collections belong to public sector entities (universities or governments). The remaining are semi-governmental

[46] Marie Schloen, Selim Louafi and Tom Dedeurwaerdere, "Access and benefit-sharing for genetic resources for food and agriculture. Current use and exchange practices, commonalities, differences and user community needs" (Rome: CGRFA Background Study Paper no. 59, July 2011).

[47] Halewood, Noriega and Louafi, eds., *Crop Genetic Resources as a Global Commons.*

(8%) and, in a few cases, private non-profit (4%) or private industry collections (1%).[48]

Historically, most microbial materials have been exchanged informally between the culture collections and between researchers in universities and public research institutions, *i.e.*, without formal written agreements on the moment of accessing such resources. Nevertheless, for resources exchanged between the culture collections, a minimal tracking system was put into place, mainly for scientific reasons, by attributing numerical identifiers to each single microbial sample which is recorded in the documentation on the exchange history of the sample.

The main advantage of these informal networks (clubs or loose networks of scientists) is to lower transaction costs compared to the use of formal material transfer agreements (*i.e.*, costs related to negotiations to be undertaken, contracts to be drawn up, inspections to be made, arrangements to be made to settle disputes, and so on),[49] while allowing the use of the research materials in the recipients' laboratory with few, if any, strings attached to them arising from concerns about potential future commercial applications.[50] At the same time, the tacitly recognised quality management standards observed by trusted members of the club guarantee the authenticity and integrity of the materials exchanged.

However, since the adoption of the CBD and the globalisation of intellectual property regimes under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), culture collections increasingly use formal Material Transfer Agreements (MTAs) for the distribution of microbial materials. In particular, to put the existing collaborative networks between the culture collections on a sound legal basis, some WFCC members have developed formal MTAs that formalise the basic norms and benefits of the informal club system, along with the new obligations and responsibilities that have arisen in the context of the CBD. These formal MTAs are, however, only a first step in the attempt to build a truly global microbial commons and are hampered by the wide variety of license conditions which are currently adopted, and the lack of transparency in access procedures in developing countries, involving sometimes lengthy delays in obtaining genetic materials.[51] Scientists from both developed and developing countries have

48 Scott Stern, *Biological Resource Centers: Knowledge Hubs for the Life Sciences* (Washington: The Brooking Institution, 2004), 15.

49 Ronald Coase, "The Problem of Social Cost," *Journal of Law and Economics* 3 (1960): 1.

50 Dedeurwaerdere *et al.*, *The Use and Exchange of Microbial Genetic Resources Relevant for Food and Agriculture*.

51 Carolina Roa-Rodriguez and Thom Van Dooren, "Shifting Common Spaces of Plant Genetic Resources in the International Regulation of Property," *The Journal of World Intellectual*

repeatedly expressed concern about the harm that such restrictive access regulations may have on basic scientific research.[52]

The main initiative for a more standardised approach to the formalisation of the distribution of samples by the culture collections is the standard MTA adopted by the regional culture collection network in Europe. In February 2009 the European Culture Collection (ECCO) adopted a core Material Transfer Agreement.[53] The main purpose of the agreement is to make biological material from ECCO collections available under the same core conditions, which are to be implemented by ECCO members either as such or integrated into their own more extended MTAs.

The common contracts contain a similar viral license clause to the clause included under the MLS of the ITPGRFA discussed above, which specifies that recipients can only distribute materials under the same conditions as the conditions under which they received the material. Indeed, recipients must not transfer the material to any others, except to those acting as intermediaries and those involved in legitimate exchanges, under the conditions that they use the same licensing conditions. Legitimate exchange is defined as the transfer of the material between scientists working in the same laboratory or between partners in different institutions collaborating on a defined joint project, for non-commercial purposes. This also includes the transfer of material between culture collections for accession purposes.[54]

The ECCO MTA requires the material to be used only for non-commercial purposes. If the recipient desires to use the material or modifications of the material for commercial purposes, it is the responsibility of the recipient, in advance of such use, to negotiate the terms of any benefit-sharing with the appropriate authority in the country of origin of the material (as indicated by

---

*Property* 11 (2008): 176; CBD Ad Hoc Open-Ended Working Group on Access and Benefit-Sharing, "Analysis of Gaps in existing national, regional and international legal and other instruments relating to access and benefit-sharing," (13 September 2007) UN Doc UNEP/CBD/WG-ABS/5/3.

52 S. Jinnah and S. Jungcurt, "Could Access Requirements Stifle Your Research?"; CBD Group of Legal and Technical Experts on Concepts, Terms, Working Definitions and Sectoral Approaches, "Concepts, Terms, Working Definitions and Sectoral Approaches Relating to the International Regime on Access And Benefit-Sharing – Submission from the international workshop on the topic of 'Access and Benefit-sharing in Non Commercial Biodiversity Research', Bonn, 17–19 November 2008," (29 November 2008) UN Doc UNEP/CBD/ABS/GTLE/1/INF/2.

53 Official website of the ECCO, accessed May 23, 2012, www.eccosite.org (text of the ECCO core Material Transfer Agreement for the supply of samples of biological material from the public collection, accessed May 23, 2012, http://www.eccosite.org/MTA_core.html).

54 ECCO core Material Transfer Agreement for the supply of samples of biological material from the public collection, 10 February 2009, Preamble, Definition, accessed 23 May 2012, http://www.eccosite.org/MTA_core.html.

the collection's documentation). In principle, the ECCO agreement does not require that the collection be involved in the benefit-sharing negotiations.[55]

The MTA adopted by the BIOTEC culture collection, at the National Centre for Genetic Engineering and Biotechnology in Thailand,[56] is an example of a science-friendly MTA used in a developing country, bearing many similarities to the ECCO standard MTA. BIOTEC uses two standard material transfer agreements, one for the general distribution of materials to customers (MTA1), and the other for the exchange of materials between biological research centres. This second MTA allows recipient collections to further distribute the materials to third parties (MTA2).

MTA1 requires the material to be used only for research and education. The material may be distributed to co-workers, as long as it remains under the recipient's direct supervision. Its release to colleagues in other institutions (or outside of the recipient's direct supervision) is only allowed with BIOTEC's written permission and after an MTA1 has been signed between the third party and BIOTEC. If the recipient wants to use the material for commercial purposes, BIOTEC will, in advance of such use, negotiate with the recipient to establish the terms of a commercial license. The MTA2 is quite similar, with the main difference relating to the part of the agreement covering other public collections. Thus, the MTA2 allows further distribution of the material by public collections that receive material from BIOTEC under the recipient's direct supervision or the recipient's explicit agreement. As with ECCO's core MTA, this second model facilitates the exchange and distribution of strains by the scientific community.

### 3. *Example of a Framework Agreement: The International Rice Genome Consortium*

The genesis and culmination of rice genome mapping is a prominent example of how science commons represent a prerequisite for further research and innovation within the world of high sunk cost bound specialised biotechnology research. From a governance perspective, the Rice Genome Consortium illustrates a hybrid solution in between the self-regulatory solution of the science communities and a full-fledged international treaty between contracting governments. In this example, science organisations, private

[55] ECCO core Material Transfer Agreement for the supply of samples of biological material from the public collection, 10 February 2009, Article 7, accessed 23 May 2012, http://www.eccosite.org/MTA_core.html.

[56] Official website of the National Centre for Genetic Engineering and Biotechnology (BIOTEC) in Thailand, accessed 23 May 2012: www.biotec.or.th; the text of the MTA, accessed 23 May 2012, http://www.biotec.or.th/germplasm/Forms/MTA%20Eng_TLO%20Rev%20v.3.pdf.

companies and governments join into a collaborative agreement for making research results available to the greatest extent possible to the global research community.

The example of the International Rice Genome Sequencing Project demonstrates that socially useful innovation may not always be sufficiently incentivised through public license conditions, but that it sometimes temporarily needs partially open mechanisms, where all parties recognise the role played by unpatented sequencing technology and the access to other research teams' provisional research results in achieving their final objective. Involved public actors included within their realm powerful nations who could invest in such a gargantuan project, while also having a great social interest in doing so. Igniting the race was Japan, with its Rice Genome Research Program dated as early as 1991, followed in its footsteps by the current Beijing Genomics Institute in 1993. Finally emerging from a recognised need for cooperation was a consortium of publicly funded laboratories regrouped within the International Rice Genome Sequencing Project, under Japanese leadership and a commitment on the final release of research results into openly accessible databases.[57] On the other side of the spectrum, two private agrobiotechnology giants initiated sequencing projects with a commitment for proprietary mapping, with even a prospect for the sale of resulting information to other biotech and seed companies. Interestingly, all private sponsored research results also winded up in the international public consortium databases, either because demand for proprietary information remained too low, or because collaborations were established with public institutes who shared their sequences on GenBank.[58] The complete rice genome sequence was made available on line through the National Centre for Biotechnology Information (NCBI) database in December 2004, leading to the completion of the full map-based sequences for all examined rice varieties in August 2005, exemplifying the instigating potential of partially open innovation systems in upstream research.

Based on this same model, and following in the footsteps of the 'Rosetta stone of all cereals', an international consortium was established in 2005 for the sequencing of wheat. This new cooperation includes members of the academic community and representatives of public research institutes, but also those of the private sector, all committed to ensuring that the sequence of

[57] Takuji Sasaki and Ben Burr, "International Rice Genome Sequencing Project: the effort to completely sequence the rice genome," *Current Opinion in Plant Biology* 3 (2000): 138.

[58] Carl Pray and Anwar Naseem, "Intellectual Property Rights on Research Tools: Incentives or Barriers to Innovation? Case Studies of Rice Genomics and Plant Transformation Technologies," *AgBioForum* 8 (2005): 108.

the wheat genome and the resulting DNA-based tools are available for all to use without restriction.

## IV. *Implications for the Implementation of the Nagoya Protocol in Scientific Research Commons*

The three options analysed above, the International Treaty on plant genetic resources, the self-regulating system of exchange of microbial resources, and the framework agreement for rice genome mapping are innovative and advanced solutions to manage commons of genetic resources. However, even if it fulfils the objective of ABS and provides for a strong reciprocity between the Parties, the International Treaty is limited in scope, as its Multilateral System applies only to plant genetic resources included in its Annex I.[77] On the other hand, the self-regulatory system of microbial commons needs to evolve in the future in order to comply with the Nagoya Protocol, by adapting the currently used deposit forms for newly deposited materials and the standard MTA's to the newly codified requirements under the Protocol (such as by explicitly mentioning the formal approval by the recognised national authorities on the deposit forms, or by integrating explicitly the obligation of benefit-sharing over modified materials as already envisioned in the ECCO standard MTA).

The objective of this chapter is to evaluate how and to what extent, in implementing the Nagoya Protocol, it is possible to safeguard the non-exclusive access and use conditions that govern much of the present relationships between biodiversity scientists both in developing and developed countries, by further building on formally codified MTAs used both in the self-regulatory regime of the microbial commons and in the International Treaty. The latter would not require, however, a negotiation of an ad hoc international legal instrument for research, which would be costly and of unpredictable result. Instead, it can be accomplished through the implementation of the science-friendly provisions of the Protocol in combination with a further standardisation of the diverse arrangements of the scientific research commons into a set of minimal conditions based on mutually agreed terms as specified below.

### 1. *Non-commercial Research*

The research community is arguably the stakeholder group most affected by access and benefit sharing under the CBD and the Nagoya Protocol: access

[77] International Treaty Article 11.1.

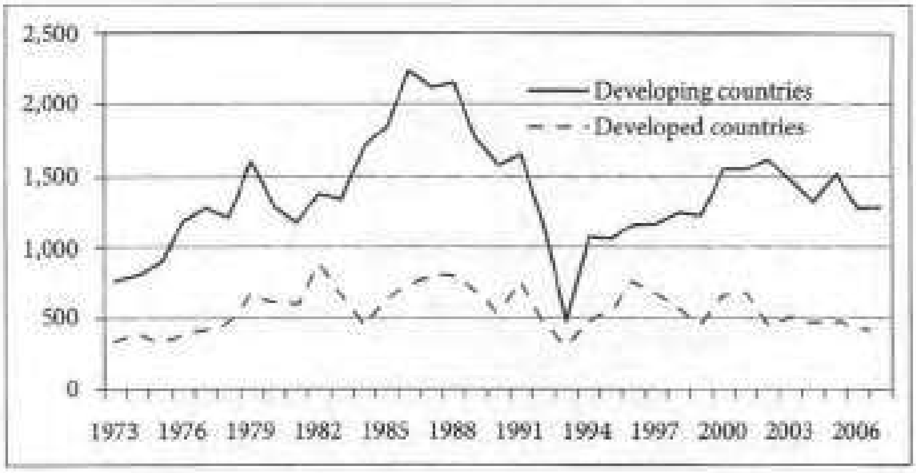


Figure 4: Global seed exchange network (Source: Derek Byerlee *et al.*, "Crop improvement in the CGIAR as a global success story of open access and international collaboration," *International Journal of the Commons* 4 (2010): 452).

in almost all cases is undertaken with no commercial intent at the time of access.[60] For example, it has been demonstrated that at the time when the entry into force of the CBD was approaching (end of 1993), the amount of exchange of plant genetic resources in food and agriculture for public research purposes, within the Consultative Group on International Agricultural Research, dropped considerably (see figure 3) as a result of the re-affirmation of national sovereignty over genetic resources under the CBD, in conjunction with the fear of legal uncertainty over intellectual property rights.[61] In reaction, in order to preserve the global seed exchange network established by the CGIAR, the FAO adopted in 1994 a set of 'in trust' agreements, which re-established the confidence between developing and developed countries over the global public nature of the CGIAR resources, in combination with a formal mandate to negotiate a specific international instrument to regulate plant genetic resources for food and agriculture.

As stated above, scientists in other fields of research have also repeatedly expressed concerns about the harm that restrictive access regulations might have on research. These potential negative impacts of the CBD on science

[60] Matthias Buck and Claire Hamilton, "The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity," *Review of European Community & International Environmental Law* 20 (2011): 59.

[61] Michael Halewood, "Governing the management and use of pooled microbial genetic resources: Lessons from the global crop commons," *International Journal of the Commons* 4 (2010): 403.

made the scientific community push for a simplified procedure for scientists accessing genetic resources for non-commercial purposes under the international ABS regime, to avoid burdens and obstacles. At the same time many parties were concerned that special treatment for research could create loopholes in the system of ABS compliance to the detriment of countries providing genetic resources.[62] The result of these conflicting interests is the compromise reached in Article 8.a of the Nagoya Protocol.

The *rationale* of this provision is to create legislative conditions to promote and encourage research which contributes to conservation and sustainable use of biological diversity, *i.e.*, to the first and second objective of the CBD. To this end, Article 8.a of the Nagoya Protocol singles out the adoption of simplified measures to access genetic resources for non-commercial purposes as a tool to promote and encourage this research. Other tools are possible as well, but legislation in provider countries, if adopted, 'shall' provide for simplified measures to access genetic resources for non-commercial research that contribute to conservation and sustainable use of biological diversity. Moreover, when such simplified procedure is adopted in drafting national ABS legislation, it needs to take into account and define the issue of 'change of intent.' Nevertheless, some crucial concepts in this provision still need to be clarified through practice or further legislative development: where does the limit between commercial and non-commercial research lay? How to demonstrate that research is aimed at the conservation and sustainable development of biodiversity? And how to identify a change of intent?

In particular the definition of research activities pursuing non-commercial objectives at the point of access in provider countries and, therefore, falling under the simplified access procedure for non-commercial purpose in the Nagoya Protocol,[63] still needs to be clarified. Non-commercial research is usually understood as publicly available, determined by non-commercial intentions and not generating monetary benefits for profit or personal gain, while commercial research is intended as characterised by restrictive access, generating market products, benefiting the users and generating monetary benefits.[64] The problem is that, in most situations, when accessing the

[62] Buck and Hamilton, "The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity," 59; Evanson C. Kamau, Bevis Fedder and Gerd Winter, "The Nagoya Protocol on Access to Genetic Resources and Benefit Sharing: What is New and what are the Implications for Provider and User Countries and the Scientific Community?" *Law, Environment and Development Journal* 6 (2010): 256.

[63] Nagoya Protocol Article 8.a.

[64] CBD Group of Legal and Technical Experts on Concepts, Terms, Working Definitions and Sectoral Approaches, "Concepts, Terms, Working Definitions and Sectoral Approaches Relating to the International Regime on Access And Benefit-Sharing – Submission from

materials, there cannot be a clear-cut separation between commercial and non-commercial research activities with the same material, or with the genetic information derived from that same material, because this distinction might arise at a later stage. At the time of accession it is not possible to foresee any possible future commercial implication, therefore the materials is usually accessed with no commercial intent.

To analyse the regulation of the scientific research commons under the Nagoya Protocol, we contrast two options for defining utilisation for non-commercial research and discuss the implications of these two options for the scientific research commons.

A first option is to consider as non-commercial utilisation all research activities that are in the exploratory phase of research, which is defined here as all research activities that do not involve the sale of a genetic resource, its components or derivatives for profit-making purposes; and whose research results remain in the public domain. Both basic and applied research activities, research and development, and research on subsequent applications would fall under such a definition. Any exercise of exclusive ownership rights, such as intellectual property rights, would be considered as commercial utilisation under this first option, as this would take the research results out of the public domain. Therefore, under this option, non-commercial research would cover research with materials and their components, including the genetic components, only under the conditions that no exclusive ownership rights are claimed on these materials and components, as a way to foster unrestricted access, use and re-use of these materials during the exploratory phase of research.

An example of such an approach can be found in the national legislation of South Africa.[65] In 2009, the South African government amended its 2004 Biodiversity Act and introduced a distinction between the 'discovery phase' and the 'commercialisation phase' of bioprospecting. As such, this amendment acknowledges the unpredictability of the scientific process and allows for benefit-sharing agreements to be made at a later stage in the research process, once results are clearer and potential value is easier to evaluate. The 'discovery phase' now only requires a notification to be made to the relevant minister, while prospective 'commercial users' need to apply for a permit,

the international workshop on the topic of 'Access and Benefit-sharing in Non Commercial Biodiversity Research', Bonn, 17–19 November 2008," (29 November 2008) UN Doc UNEP/CBD/ABS/GTLE/1/INF/2; CBD Ad Hoc Open-Ended Working Group on Access and Benefit-Sharing, "Report of the Meeting of the Group of Legal and Technical Experts on Concepts, Terms, Working Definitions and Sectoral Approaches," (12 December 2008) UN Doc UNEP/CBD/WG-ABS/7/2.

[65] Brendan Coolsaet *et al.*, *Study for the Implementation in Belgium of the Nagoya Protocol* (unpublished, 2012).

linked to a benefit-sharing agreement, before entering in the 'commercialisation phase.'[66]

The public domain conditions considered in this first option are typically satisfied in the case of publicly accessible gene banks for plant, microbial or animal genetic resources, which are directly funded by the government or which are maintained as public research infrastructures for depositing materials or data related to the scholarly publication process. One example analysed in this chapter is the case of the public microbial culture collections that are members of the World Federation for Culture Collections, which are formally organised to acquire, conserve and distribute microorganisms and information about them to foster public research and education. Another example, in the field of data, is the International Nucleotide Sequence Database Collaboration, which stores, on a public database, all the genetic sequences that have to be deposited prior to any scholarly publication on that sequence.

A second option would be to consider as utilisation of genetic resources, for non-commercial research only, the research activities at the stage of basic research, which would generate no monetary benefits for profit or personal gain (such as through the sale of services, for example), and whose research results remain in the public domain. Activities at the research and development stage and activities leading to the development of subsequent applications are considered as commercial under this option. Basic research activities conducted in a private company would also be excluded from non-commercial utilisation.

Many of the options proposed or adopted for the implementation of the Nagoya Protocol provision on non-commercial research[67] are a variation or a combination of these two basic options.[68] For example, in Brazil, the Genetic Patrimony Management Council, responsible for granting access to the country's genetic resource, established a list of the types of research and scientific activities exempted from access requirements.[69] In Australia, access for non-commercial purposes such as taxonomy is free, while the permit fee

[66] South Africa, National Environment Laws Amendment Act No. 14 of 27 May 2009, Sections 29 and 38–39.

[67] Nagoya Protocol Article 8.a.

[68] Brendan Coolsaet *et al.*, *Study for the Implementation in Belgium of the Nagoya Protocol* (unpublished, 2012).

[69] Juliana Santilli, "Brazil's Experience in Implementing its ABS Regime – Suggestions for Reform and Relationship with the International Treaty on Plant Genetic Resources for Food and Agriculture," in *Genetic Resources, Traditional Knowledge & the Law. Solutions for Access & Benefit Sharing*, eds. Evanson Kamau and Gerd Winter (London: Earthscan, 2009), 187.

for commercial purposes is AUD $ 50.[70] In Costa Rica, biodiversity related research conducted in public universities has been left out of the ABS law's scope, except if it has commercial purposes.[71]

However, not all of these combinations of the options used for defining the notion of non-commercial would allow preserving the practices of the plant genetic resources for food and agriculture and microbial collections that were surveyed above. In particular, under the second option described above, any distribution for purposes other than basic research of material that was legally acquired from a provider country would not fall under non-commercial use and, therefore, require to re-negotiate the mutually agreed terms with the provider country, even if there is no intent of commercialisation of the genetic resource itself, its components or derivatives. This would also apply to the utilisation of genetic sequence data at the research and development stage even if it would have been deposited on a public database. In contrast, under the first option, such downstream uses under public domain-like conditions would be allowed and considered as part of the exploratory phase of research.

Some of the existing practices within the scientific research commons already share, on an informal basis, the rationale of the first option for defining the non-commercial use provision of the Nagoya Protocol. On the one hand, the above-described survey shows that under current circumstances, only a limited number of researchers from the provider countries ask for restrictions on the downstream uses of the deposited materials, and this is confirmed in the microbial sector also in cases of developing countries: about 80–100% of the acquisitions in the surveyed collections came without any conditions. On the other hand, they promote rapid and easy access to genetic resources for research purposes, while organising non-commercial benefit-sharing through promoting a global publicly accessible research infrastructure and a set of bilateral capacity-building efforts with developing country collections. For example, as we saw in the case of the microbial collections, the practice of the microbial sector is very much supportive of distributing genetic resources without impairments, thereby also contributing to uses of these resources by depositors from the countries of origin providing the resources that often do not have the capacity for long-term storage of these resources. However, as explained above, these benefit-sharing arrangements are often incomplete or based on informal arrangements between researchers

[70] Geoff Burton, "Australian ABS Law and Administration. A Model Law Approach?" in *Genetic Resources, Traditional Knowledge & the Law*, eds. Kamau and Winter, 271–310. [See also contribution by Burton to this volume (Chapter 10).]

[71] Costa Rica, Biodiversity Law No 7788 of 30 April 1998, Article 4. [See also contribution by Cabrera to this volume (Chapter 11).]

from the provider countries and culture collections. Therefore, a further formalisation of these initiatives is needed.

The main contribution, in this context, of the Nagoya Protocol's provision on simplified procedure to access materials for non-commercial purposes[72] is that it can potentially clarify, when further specified in national legislation, under what non-commercial use conditions facilitated access would be granted. However, to make the Nagoya Protocol and the scientific research commons mutually supportive, the implementation of a proper simplified access procedure for non-commercial research, though certainly an important building block, will not be sufficient if it only covers the set of activities contemplated under Nagoya Protocol Article 8.a – that is, the activities in the scientific research commons that contribute to biodiversity conservation and sustainable use.

An additional option for governing the research commons under the Nagoya Protocol would be, therefore, to implement the facilitated access procedure for all non-commercial research with genetic resource, not only limited to biodiversity research, in combination with a set of up-front non-monetary and monetary benefits, such as support for capacity building for research with the genetic resource in the provider country, preferential access to the research results and to the genetic material conserved in ex-situ collections, training for the use of the genetic sequence databases and the provision of technical services.

### 2. *Possible Future Research-related Developments of the Nagoya Protocol*

The Nagoya Protocol contains possible future scenarios[73] for collaboration on the management of genetic resources and for benefit-sharing, which might possibly also apply to some areas of activities of the research commons. The Protocol obliges parties to consider the need for, and modalities of, a global multilateral benefit-sharing mechanism to address the fair and equitable sharing of benefits derived from the utilisation of genetic resources and associated traditional knowledge that occur in transboundary situations, or for which it is not possible to grant or obtain prior informed consent.[74] Moreover, the Protocol prescribes an obligation to collaborate in cases where the same genetic resources are found *in situ* within the territory of more than one Party, with a view to implementing the Protocol.[75]

[72] Nagoya Protocol Article 8.a.
[73] Nagoya Protocol Articles 10 and 11.
[74] Nagoya Protocol Article 10.
[75] Nagoya Protocol Article 11.

### a. *Global Multilateral Benefit-sharing Mechanism*

The language of the Protocol, when referring to the global multilateral benefit-sharing mechanism, is very vague and the result of compromise:[76] it provides for a procedural obligation on Parties to 'consider the need for and modalities of a global multilateral benefit-sharing mechanism'[77] and not for a compulsory setting up of such mechanism. The eventual mechanism, therefore, would likely be only voluntary and complementary to the Nagoya Protocol. Moreover it would be multilateral, not bilateral.

The crucial issue of this provision is national sovereignty: it focuses on cases where sovereignty is not clear or difficult to be addressed. In order to avoid excessive costs of tracking, therefore, a global mechanism is to be established in the future. The scope of the provision can be interpreted narrowly or extensively. In the wider sense, it might re-open the issue of the temporal or geographical scope of the Protocol; whereas in the narrow sense, it could address genetic resources that are in user countries' jurisdiction but of unknown origin or legal status, or even to cover materials in *ex-situ* collections that were collected after the entry into force of the CBD but before the entry into force of the Nagoya Protocol.[78] It is important to underline that the benefits shared through this mechanism must be used to support the conservation of biodiversity and the sustainable use of its components globally. This means that the benefit-sharing is not going to the provider or providers. This could represent a disincentive for countries to build up such a mechanism.

The very first reflections on this mechanism in 2011[79] did not find any agreement on two basic questions: if the mechanism is needed and how it would be articulated. However, a consistent opinion was expressed in favour of a step-by-step approach to build up a flexible instrument. Agreement was expressed in recognising that the mechanism is meant to be complementary to the system based on prior informed consent and mutually agreed terms – not an alternative to it.[80]

It can be argued that the concept of transboundary situations applies to scientific research commons when accessed *in-situ*, but they have become *de facto* transboundary research resources based on the need to share resources amongst many researchers in transboundary situations. For example, in

[76] Buck and Hamilton, "The Nagoya Protocol," 59.

[77] Nagoya Protocol Article 10.

[78] Buck and Hamilton, "The Nagoya Protocol", 60.

[79] Morten W. Tvedt, *A Report from the First Reflection Meeting on the Global Multilateral Benefit-Sharing Mechanism* (Oslo: Fridtjof Nansen Institute, June 2011), accessed 4 March 2012, http://www.fni.no/abs/publication-47.html.

[80] *Ibid.*

case of microbial genetic resources, taxonomic type strains always have to be deposited in two different collections in two different countries upon publication.

b. *Transboundary Cooperation*

The Nagoya Protocol[81] prescribes collaboration in cases where the same genetic resources are found *in-situ* within the territory of more than one Party, with a view to implementing the Protocol. As in the case of the provision on the global multilateral benefit-sharing mechanism, the language is vague: there is no definition of what the 'same' genetic resources mean. In the context of scientific research commons, the case of the same genetic resource found in two countries would be the case of plants only (characterised by great genetic stability), and not of microbial strains (most strains within a same species are not exactly the same, and small genetic differences lead to different properties because of the relatively small size of the genome of a microbe) and animals (different individuals within a breed). Therefore the article probably also has a very restrictive scope for the design of access agreements for research purposes.

As opposed to the global multilateral benefit-sharing mechanism, where benefits do not go to the individual country, the issue is left open in the case of transboundary cooperation. If, however, a similar approach to that for the multilateral mechanism would be adopted through interpretation also for transboundary cooperation – that is, benefits from transboundary cooperation would only be devoted to conservation and sustainable use globally – this would probably decrease the incentive for countries to start negotiating further details on cooperation in transboundary situations of access to and utilisation of genetic resources.

c. *Best Practices, Guidelines and Standards in Relation to Access and Benefit Sharing Agreements for Research with Public Knowledge Assets*

The results of our analysis in this chapter demonstrate that a strict differentiation between commercial and non-commercial research intent does not correspond to how science commons are organised. Many research activities are conducted under public domain-like conditions (without any ownership claims that would restrict access and use of the research results and basic research materials) and it is often difficult to clearly separate uses of public resources with a commercial intent and uses with non-commercial intent. Therefore, as explained above, further work on the overall implementation of the Nagoya Protocol will be needed to build a regime that will be supportive of the scientific research commons that organises research under

81 Nagoya Protocol Article 11.1.

public domain-like conditions and underpins much of the contemporary biodiversity-related research in the public section organisations that were surveyed in this chapter.

A possible contribution would be to further strengthen our proposition of a broad interpretation of the notion of non-commercial research under the Protocol,[82] by exploiting the Nagoya Protocol provision calling on Parties to encourage, develop and use guidelines and best practices.[83] Such recognised best practices could crystallize agreement amongst stakeholders about standardised licence conditions for access to genetic resources for research purposes under mutually agreed terms, which could contribute to the periodical stock-taking by the Protocol governing body.[84] Best practices could, for example, specify a minimal set of clauses to be included in the contracts, while leaving sufficient flexibility to adapt a contract to the various research specific contexts.

## V. *Conclusion*

Sharing of basic research assets in so-called scientific research commons has proven key to research contributing to the conservation and sustainable use of biodiversity, and in the life sciences more generally. As a result, in practice, many research assets are accessed and exchanged under public domain-like conditions. This chapter aimed to show that it is possible to build upon these practices in the implementation the Nagoya Protocol, so as to ensure that this implementation is supportive both of the scientific research commons and the objective of fair and equitable access and benefit-sharing. In particular, we showed that this is possible by further building upon the standard contracts for the access of public research assets that are currently in use in many areas of the scientific research commons, by adopting a broad interpretation of the notion of non-commercial research under the Protocol[85] in combination with appropriate benefit-sharing conditions for capacity building and technical services with basic research assets in the provider countries. In addition, to take this vision forward, this chapter discussed three institutional options for building standardised ABS approaches in global research commons. In the current context of the development of national ABS legislation under the Nagoya Protocol, the most feasible institutional option, in the short term, is to build framework agreements between

[82] Nagoya Protocol Article 8.a.
[83] Nagoya Protocol Article 20.1.
[84] Nagoya Protocol Article 20.2.
[85] Nagoya Protocol Article 8.a.

willing governments that would establish such a common position,[36] based on mutually agreed terms, and thereby put the self-regulatory practices of the science communities on more solid legal and institutional ground.

[36] [See discussion of bilateral agreements in the context of the implementation of the Protocol in the contribution by Young in this volume (Chapter 15).]