1 Common pools of genetic resources and related traditional and modern knowledge

An overview

Gerd Winter

Setting the theoretical stage

This book is about the use of genetic resources (GR) and traditional knowledge (TK) associated with GR. Besides TK, it also addresses scientific or 'modern' knowledge (MK) related to GR. The use of GR and TK/MK for research and development (R&D) is socio-legally organized in many forms. The most common are 'free appropriation and use', 'property and market' and 'common pools'.

'Free appropriation and use' allows for access without prior consent of the resource holder and for unlimited use.[1] The concept has been used widely for many resources and in many regions. This was possible, because regulation by states and communities hosting the resources was either lacking or not adhered to. The Convention on Biological Diversity (CBD) and the Nagoya Protocol (NP) elaborated and encouraged the concept of 'property and market', which was a clear acknowledgement of states' sovereign rights over their GR and of local and indigenous communities' ownership over their TK, as specified by their domestic legal frameworks. This gives states and communities the right to regulate access to GR/TK and receive benefits drawn from them ('access regulation and benefit sharing' – ABS). This implies that 'free appropriation and use' is confined to national territories in which no state or customary law establishing ABS exists, as well as to the ocean areas beyond national jurisdiction. It is assumed that 'property and market' will foster research and development of GR and TK and stimulate states and communities providing them to conserve biodiversity. The major tool for achieving ABS is envisaged in the exchange between providers allowing access to GR or TK and users having to share benefits that arise from their use.

However, this bilateral exchange, 'genetic resource for benefit sharing', may have disappointing results that miss the initial vision of equity and have adverse effects on the other two goals, that is, to enable research and

development of GR/TK and conserve biodiversity. Equity may be prejudiced in two regards, which can be called 'horizontal' and 'vertical'. In the 'horizontal' dimension of equity, that is, among states hosting the same resource and indigenous and local communities holding the same TK, the provider of the resource or TK is entitled to take all benefit shares, thus excluding the others which may be prompted to lower their access conditions in a competitive race to the bottom. In the 'vertical' dimension, that is, between providers and users, providers may forego benefit shares because of difficulties in monitoring the process of research, development and commercialization, if the process is – as is often the case – intertwined and lengthy.[2] This may lead them to constrict the allowable uses, thus hindering the emergence of the very benefits that they wish to attract, and jeopardizing both sustainable uses of GR/TK and biodiversity protection (Winter 2009; Chapter 15).

These deficiencies might be alleviated in the third socio-legal form of GR and TK/MK use: common pools.[3] A common pool may very generally be defined as resources that are provided by resource holders for common use by a group of people. The common use of resources in our context means that resource holders cooperate in the preservation of their resources, and that providers and users of GR and TK/MK enter into cooperative R&D, allowing enhancement of their own capacity and sharing in the resulting non-monetary and monetary benefits. This means that providers of resources become users when participating in the R&D process, and users become providers by feeding their R&D results into the pool. In this way equity can be achieved in both the horizontal and vertical dimensions, research and development of GR and TK is enabled, and resources and incentives to preserve biodiversity are provided.

Common pools of this kind are not new inventions but have existed for a long time. Examples include seed exchange systems, networks of botanical and zoological gardens, networks of microbial collections and biological databanks.

However, commons – ideal as they appear to attain equity and free R&D for sustainable use and protection of biodiversity – are exposed to problems of construction. These problems are caused by the dilemma that commons must persist in individualist societies. The nature of this dilemma, however, differs under the so-called old and new commons. The major dilemma of old commons (such as in livestock grazing and marine fisheries) is the tragedy of overuse, that is, that free use may lead to overexploitation of the resource by free-riders. This effect is less important in new commons, that is, the exchange of GR and TK/MK, because, as for GR, natural resources are impaired hardly at all if small samples are taken for research and development, and, as for TK/MK, information cannot be exhausted (Hess and Ostrom 2007). New commons suffer from a different dilemma: that free use may prevent participants from supplying their own GR, knowledge and gain to the commons, thus impoverishing its stock

(Halewood *et al.* 2012: 14ff.). This dilemma can be called a tragedy of under-supply for the commons. It is reinforced by the ABS system because resource holders are affirmed as proprietors and encouraged to make individual use of their rights,[4] which means that they would opt for the 'property and market' concept. The dilemma could be solved by placing a duty on users to feed their own material, knowledge and gain into the pool, and by enhancing the participatory rights and opportunities of providers within the pool. In that way it may be possible to avoid the problem of under-supply for the new commons. As with the old commons, there is no tragedy (in the old sense of inescapable fate) for the new commons but the choice to establish appropriate rules.

In conclusion, two perspectives of study appear to have emerged, one looking from ABS to pools and one from pools to ABS: The ABS epistemic community, grounded on the paradigm of 'property and market', is interested in pools as a means to solve some of the equity deficiencies. On the other hand, the commons epistemic community starts with the *de facto* communality of GR and TK/MK and its beneficial function for R&D. In that view, pools should rather be defended against ABS claims of individual providers in order to preserve their useful performance. But the community, of course, accepts the need to pay tribute to ABS requirements.

While the contributions in this book can be grouped into those which tend to take the first perspective, and those which favour the second,[5] the book as a whole brings both views together considering that the CBD and NP, while opening themselves up to common pools, also insist that this should be consistent with the CBD/NP objectives, including the sovereign right of provider states to regulate access and ask for benefit sharing. Taking an inductive approach, the book strives to portray a variety of pools in order to understand under which conditions they develop and how they contribute to the equitable sharing of benefits, innovative sustainable uses of GR and, finally, to the conservation of biodiversity.

Structure and content of the book

There are different ways of structuring a book on common pools of GR, TK and MK. One important dimension is the kind of resource included in the pool:

- The GR may be 'wild', as, for instance, the forest produce of an indigenous and local community or state, or 'cultivated', for example, by farmers' collectives or transnational breeders' exchange networks.
- The pool may comprise collections of biological material or databases of GR-related information.
- The knowledge recorded in databases or other media may be 'traditional' or 'modern'.

- The pooled GR or related TK/MK may be concerned with plants, animals, microorganisms or biological agents.

All these differences of content will influence the choice of the basic organizational concept and, if that is a pool, they will shape the structure and rules of the pools. Just to give a few examples: certain highly developed crops have been pooled in the formalized multilateral system of the ITPGRFA and many less developed landraces in informal seed exchange systems (Chapters 5 and 17). In contrast, fish for aquaculture is still very much organized in settings of 'free appropriation and use' or 'property and market' (Chapters 9 and 10). TK is largely pooled by oral tradition while MK is rather saved in databases and print media (Chapter 13).

According to another dimension, pools can be structured by the level and nature of law regulating the pool:

- Many pools are local and subject to customary law, such as traditional holders of medicinal knowledge in Africa and Brazil (Chapters 2, 3 and 4) and local farmers' collectives in Peru (Chapter 5).
- Others have been – or it is proposed that they be – organized by states as in Brazil, Malaysia, China and Norway (Chapters 6, 7, 8 and 9).
- Many common pools of GR are transnationally organized, with transnational meaning that management is self-regulated by participants rather than governments and spans national borders.[6] Two subcategories of transnational pools can be distinguished here: collections of GR and related knowledge which invite material and open use by anyone on the globe, such as botanical gardens, microbial collections and biological and genomics databases (see examples in Chapters 10 and 11) and networks or metastructures of collaborating collections (Chapters 12, 13, 14 and 16).
- Only very few pools of GR have been given an international law framework like the multilateral system of the ITPGRFA mentioned above (Chapters 15 and 17), or may emerge, such as a regional system for East Africa and a global system for GR in the marine areas beyond national jurisdiction (Chapters 18 and 19).

As the organizational dimension is somewhat less complex than the content-related dimension, we have chosen it for the structure of the book. This will be reiterated when the individual contributions are summarized.

Looking at the overall results of the contributions, one of the first impressions is the great variety of pool design, which in a way justifies the bottom-up approach of the book. The variety concerns many issues, such as:

- the kind of resource that is the object of the pool;
- the overall goal of the participants;

- who is allowed, invited or even required to submit material and knowledge to the pool;
- the quality criteria the material and knowledge must fulfil;
- how the material and knowledge are maintained;
- whether the traceability of the material and the knowledge of their source material is ensured;
- who has access to the pool and under which conditions;
- the obligations that are imposed concerning the utilization of material and knowledge, and the sharing of benefits;
- how benefits flowing into the pool are allocated.

Individual contributions to the book

As indicated, the book is structured according to the levels of law that provide a framework for common pools. These can be local customary law, national legislation, transnational rules and international law.

Local approaches

The section on local approaches encompasses studies on the pooling or other organization of traditional medicinal knowledge and local seed breeding. The local communities holding and fostering the GR and TK understand their resources to be socially embedded. They all face problems of competition with the modern commodified sector and with the possibility that the product of their experience and work will be used by the modern sector without benefit sharing. They strive to strengthen their organizational framework in order to cope with those challenges.

In their chapter on 'Common pools of traditional knowledge: the story of the Kukula traditional health practitioners of Bushbuckridge, Kruger to Canyons (K2C) Biosphere Reserve, South Africa', Gino Cocchiaro and Britta Rutert present a case study that shows how the scattered and endangered knowledge of traditional healers has won new strength through the formation of a knowledge pool. The authors first describe the many challenges that the healers living in the K2C Biosphere Reserve have experienced, including the exploitation of their knowledge by researchers without being informed about its use and sharing of benefits, as well as difficulties of access to wild plants due to restrictive rules in nature reserves and competing unsustainable harvesting. With the assistance of UNESCO, the healers gradually formed an association that provided the framework for developing rules and practices on the mutual sharing of healing knowledge, training programmes, the compilation of a community protocol and the allocation of funds from monetary contributions. The customary law they practise concerning third party access to their knowledge is of particular interest. In principle, the healers share their knowledge on a reciprocal basis, expecting that those who receive it will

also provide their knowledge or, if they are students, will commit themselves to become healers. Academic researchers are nevertheless allowed access, provided they disclose the nature of the research, ask for consent if the intent changes, and engage in sharing benefits in case of commercialization. These customary rules are supported by the South African legislation, which is, however, still waiting for more specific regulation, the Bushbuckridge case being regarded as a learning example. The authors illustrate the access practices by summarizing the negotiations between the association and a local cosmetics company concerning knowledge about medicinal plants for hair and skin nourishment. One agreement, among other clauses, prevents the transfer of any knowledge to third persons. A benefit-sharing agreement was postponed until such time that bioprospecting had led to a viable product. The authors conclude their chapter by highlighting the two major goals of the TK pool, that is, to maintain the sanctity of culture inherent in the knowledge, and to organize the transfer of the knowledge for benefits that secure the livelihood of their communities.

In his chapter on 'Common pools of traditional knowledge and related genetic resources: a case study of San-Hoodia', Evanson Chege Kamau sheds new light on the often-told story of the southern African people of the San and their knowledge about the Hoodia plant and its use, highlighting the common pool aspects of the case. The author starts by explaining that ethnic San now live scattered over several states but that knowledge about the properties of the Hoodia plant, and notably its capacity to suppress appetite, is traditional and common to all of them. He describes the various steps taken by the San to claim a share in the monetary benefit from the use of Hoodia. This claim was furthered by the fact that the San gradually organized themselves transnationally, thus forming a kind of pool of stakes in the use of their TK. A major achievement was the conclusion of two agreements providing the payment of royalties, one with the South African Council for Scientific and Industrial Research (CSIR) which holds a patent on a biochemical compound of the plant, and the other with the Southern African Hoodia Growers Association (SAHGA). As of now, no other agreement has been reached with holders of patents on Hoodia except the one with CSIR. Based on this, Kamau evaluates the pool and its activities. Looking at 'horizontal' equity, he points to the successful endeavour of the San to include all scattered groups across state boundaries and to distribute funds for projects helping all of them. In regard to 'vertical' equity, Kamau acknowledges the organizational basis the San created in order to defend their interests, but also sees flaws, such as its failure to include more holders of intellectual property rights in Hoodia genes or derivatives. Finally, in terms of the conservation of biodiversity, he points to the commitment within the agreements to ensure sustainable use of the plant. This may trigger measures of conservation of the Hoodia plant, which has become endangered due to overexploitation.

In his chapter, 'Reinventing traditional medicine: Pacari and its struggle towards health, environmental protection and benefit sharing', John Bernhard Kleba starts by emphasizing the high relevance of traditional medicinal practices (TMPs) for complementary healthcare, especially for the poor and for the development of drugs. Kleba asks about the patterns of self-reproduction of TMPs, focusing empirically on Pacari, an association of indigenous and local communities in the Brazilian Cerrado struggling for the right to exercise and protect their customary practices. One of the findings is that TMPs are introducing modern concepts in a very selective way, maintaining their heritage of social institutions and a traditional health ethos. However, TMPs are threatened in three major policy areas: the health surveillance regulation has drifted them into illegality; the erosion of the biodiversity hotspot Cerrado and the enclosure of lands are subtracting the pool of medicinal plants; and the regulatory adjudication of ABS rights is failing to protect new uses of traditional knowledge. These pressures are counteracted by Pacari, with good bottom-up medicinal practices developed by the association (Pacari), sustainable extractivism and the publication of its common property knowledge. Outstanding achievements are the establishment of *pharmacia vivas* (living pharmacies) which serve local and poor communities, the conclusion of agreements with landowners to allow sustainable harvesting of medicinal plants, and the publication of medicinal knowledge, which was not only meant as an improvement of common knowledge but also as a defensive strategy of prepublication against claims for intellectual property. According to Kleba, the association can also serve to actively ask for benefit sharing concerning new uses of knowledge and plants that were obtained before the CBD came into force. In conclusion, Kleba highlights the fact that the Pacari association treats traditional knowledge not as something static but as permanently developing. He warns, however, that in spite of its relative success, all efforts remain fragile and thus depend upon strong partnerships and favourable changes in policy and law.

In their chapter 'Guardians of the seed: the role of Andean farmers in the caring and sharing of agrobiodiversity', Mario Tapia and Brendan Tobin emphasize that, like wild biodiversity, agrodiversity is a fundamental source of human life, and that breeding by local farmers is crucial as a basis for *ex situ* collections and industrial seed production. Vital for the preservation and development of agrodiversity is the exchange of seeds among local farmers. The authors present three case studies of such exchange systems. One case is local markets and seed fairs in the Peruvian Andes. The transactions are characterized by a complex mixture of sales, barter, social reciprocity and redistribution. The local markets and seed fairs maintain the diversity of the products, though the authors warn that given the competition of high-yield seeds, the seed fairs would not survive without external assistance from NGOs and the state. The second case is what the authors call participatory plant breeding. Its location is Bolivia

and the crop at stake is potatoes. The Bolivian National Institute for Agricultural Technology started a programme of collecting, selecting and improving local varieties in order to combat plant diseases and increase yield. This was implemented through cooperation between scientists and local farmers. Evaluating the case, the authors see positive effects because commercial interest in diverse varieties exists, thus contributing to their preservation. On the other hand, the breeding effect has not yet been as successful as needed in order to compete with high-yield varieties on the global market. The third case is an association of six communities in the high Peruvian Andes called ANDES, which concentrates on potatoes, having the dual aim of conserving their agrodiversity and ensuring local food security. The Potato Park, as the initiative is called, operates on the basis of customary law principles such as reciprocity and equilibrium. It has collected and partly repatriated more than 1500 varieties. It collaborates with the International Potato Center and is one of the first examples of a private organization including its PGRFA in the multilateral system of the ITPGRFA. From presenting the cases, the authors proceed to a more systematic analysis of how the local initiatives could be supported by national and international law, which commonly puts stress on them. One supportive way has been that Peru and Bolivia have relaxed the standards for certification of seeds, thus allowing local varieties to be admitted to the market. In addition, the services of local farmers will be rewarded by requiring that access is subject to their prior informed consent. Farmers' rights could be a third mechanism, but the authors feel they would be too narrowly constructed if only securing monetary benefit sharing. Rather, they should be understood as empowering farmers to regulate their own ecosystem and use seeds in accordance with traditional practice. Such empowerment could be supported by establishing agrobiodiversity zones, a category of protection not yet provided in the IUCN list of protected areas. Peru is presently preparing a law to that effect. As Juliana Santilli explains in Chapter 6, similar measures are being discussed in Brazil.

National approaches

The pools or pool ideas assembled in this part are all framed or are under discussion to be framed by national law. The thrust of the issues raised in these chapters is how such frameworks could be used to improve the utilization of the GR and TK and ensure that benefits, including commercial benefits, are shared with the pool and with the provider of the resource.

In her chapter on 'Genetic resources common pools in Brazil', Juliana Santilli first introduces a network of *ex situ* collections of plants including a Base Collection, the National Genetic Platform. Concerning *in situ* and on-farm cultivated resources, she observes that there are artisanal as well

as scientific networks exchanging seeds and animals, but that neither the legal status of wild nor cultivated GR is clear. This means that in most cases private landowners end up receiving the benefits of the genetic potential. Santilli considers how existing networks and market systems for seeds and farm animals could be transformed into common pools of *ex situ* and *in situ*/on-farm resources at national or regional levels. Looking at existing legal frameworks, she points to the multilateral system of the ITPGRFA, which, however, covers only a limited number of GR in the public domain. For pools of other GR, she recommends the creation of appropriate legislation on participation, cooperative governance and the sharing of benefits via the introduction of a tax on seed sales. Highlighting the need to protect centres of agrodiversity, the author looks further for an appropriate international legal basis. She proposes that these centres should be understood not only as hosts of GR but as cultural and social complexes. She suggests the use of the UNESCO Convention on World Cultural and Natural Heritage as a basis, mentioning that traditional foodways have already been accepted as a new category of protection. In addition, she recommends, like Mario Tapia and Brendan Tobin in Chapter 5, that a new category of agrodiversity landscape should be added to the IUCN list of nature protection areas. Brazil has already started to designate such areas by providing a specific seal, the so-called *chancela.*

In his chapter on 'Developing a common pools strategy for genetic resources for food and agriculture: a case study of Malaysia', Gurdial Singh Nijar starts with the observation that the unimpeded use and exchange of GRFA is crucial for food security. Such practices deserve also to be respected in the context of the access and benefit-sharing concept of the CBD and NP. Nijar outlines the recent Malaysian draft law that will transform the NP into national law and highlights those clauses, which, by waiving the PIC requirement, open the bilateral model up for common pools of traditional farmers, research communities, and regional and global exchange systems. Focusing on the latter, he describes how the multilateral system of the ITPGRFA is implemented in national practice. Currently, there is a lack of specific national rules. Based on the assumption that the ITPGRFA is directly applicable in Malaysian law, Nijar discusses in detail the scope of the ITPGRFA provision which states that GR that are under the management and control of contracting states are included in the multilateral system. He recommends looking at the supervisory competences of the central state, which implies that the government-based Malaysian Agricultural Research and Development Institute (MARDI) is covered, but not, however, the highly autonomous universities or the plant collections of the federal states. He proposes that the national legislator should further specify what exchange systems should be included. Nijar goes on to show that, in addition to the ITPGRFA, Malaysian collections and R&D centres participate in a large number of regional networks, each focusing on specific GRFA. He

discusses the International Coconut Genetic Resources Network (COGENT) in some detail and its problems in keeping the collection of germplasm and related knowledge up to date. He concludes by pointing to the fact that ASEAN is developing a common framework for ABS, which also includes common pool concepts. ASEAN may join forces by establishing its own regional clearing-house mechanism as well as a common fund for biodiversity conservation.

Tianbao Qin starts his chapter on 'Common pools of traditional Chinese medical knowledge in China' with the observation that China, like other developing countries, is rich in traditional medicinal knowledge (TMK) but has so far not benefited from access by industrial users. He explains the ways in which traditional and modern medicinal knowledge are different. Regarding the pool character of TMK, the author relates that TMK in China has various holders spanning from families through local communities to the public at large. Some of the TMK is collected in books and databases; some lives as an oral tradition. The law does not give TMK a specific legal status but provides a general framework. Thus, state and local governments are constitutionally empowered to manage and develop TMK. While the ABS system has not yet been fully introduced, some elements of it are already to be found, such as in the requirement that access to research results of TMK by foreigners is subject to administrative approval. The author presents two cases where foreign companies have utilized Chinese TMK to develop, patent and sell medicine. This leads him to suggest that legislation should be introduced to clarify ownership in TMK, ensure benefit sharing and provide legal certainty. This is not to suggest that the author argues in favour of strengthening individual ownership. Rather, he proposes the formation of common pools of TMK which then set the conditions for access and benefit sharing. Such pools already exist but could be further developed. Qin distinguishes two kinds of such pools and presents examples of each. The first category is state owned pools, of which the Traditional Chinese Medicine Database System is an example. The system can be accessed on payment of an upfront sum that is used mainly to finance the system. Further benefit sharing is not required. The providers of the knowledge are not remunerated. They are not even registered by the system. The second category is pools run by non-state actors. One major example is the Encyclopedia of Classics of Traditional Chinese Medicine, which consists of a database on ancient medicinal books and documents. The documents can be bought in the form of e-books. No further benefit sharing is foreseen, nor any tracing and remuneration of knowledge providers. Qin concludes his chapter by developing ideas for improvements that clarify the ownership in TMK, bring the providers of knowledge into play and require users to share benefits. He suggests the introduction of ownership by local communities rather than individuals and families. For the management of their rights he considers the state as not acting as a trustee,

but rather recommends the formation of a collective organization following the example of the Music Copyright Society of China.

In his chapter on 'Common pools in aquaculture: exploring patent law, ABS and *sui generis* options', Morten Walløe Tvedt discusses the legal frameworks for marine GR that should be developed for aquaculture. Using Norway as a case study, he shows that the present situation is such that free access for others to Norwegian raw genetic resources is allowed. Breeders, however, seek to control the further utilization of their breed by contractual agreement. But this is hampered because there is no *sui generis* intellectual property protection for marine animals; only the patenting of gene sequences is available. The author considers where to go in this situation, to more or less free access. He considers that the GR and knowledge about them, including inventions, could be pooled. For Norway to do this as a provider of wild GR, or breeders as providers of breed or inventions, a strong incentive would have to be built into the system unless the providers are considered to be altruistic players who are satisfied with fostering global innovation. The incentive could be the right to make use of the material and information contained in the pool alongside an obligation on all participants to feed their material and knowledge into it. A problem is, of course, how to deal with those who wish to commercialize the results of their research and development. The author discusses whether the example of the ITPGRFA could be used where, in the case of commercialization, benefits must be shared in certain ways with the pool. However, this would presuppose that an institutional framework is erected and a critical mass of GR and information is already available within the pool. Realistically, therefore, the author expects and even recommends that Norway should rather introduce a legal framework ensuring bilateral ABS.

Transnational approaches

'Transnational approaches' imply pools and other structures whose activities involve actors across national borders, which are not organized within a formal legal framework but by the actors themselves, be they private companies, public research institutions or governmental bodies. These can be collections of material and databases as well as networks or metastructures of such collections and databases. The thrust of most chapters in this part of the book is to start with existing pools of, in most cases, cultivated GR and advanced MK, and ask how they can be made compatible with ABS requirements, especially with the need to make users share benefits with the pool and the providers of pool resources.

The chapter on 'Practices of exchanging and utilizing genetic resources for food and agriculture and the access and benefit-sharing regime' by Sélim Louafi and Marie Schloen is based on empirical information from a multi-stakeholder expert dialogue. Most of the GRFA exchanged and

utilized have already been domesticated while some still need input from wild relatives. A market and a pool approach of practices can be distinguished. The market approach implies that GR are exchanged on the basis of individual contracts between actors who traditionally just transfer ownership in the material for some payment that reflects the market value of the material but not the value of its genetic potential. Sometimes, the kind of allowed utilization is restricted. This approach is most common in relation to animal, aquatic and forest genetic resources. The pool approach implies that the genetic resource is exchanged without restriction between actors and utilized by them. This approach is most often taken concerning plant GR, microbes and biological control agents. The authors proceed to explore how these practices will be influenced if the ABS requirements are implemented. The stakeholders expect that the whole process of research and development, in which the provider and user side often change places, will become very complicated and subject to high transaction costs. This may cause users to utilize *ex situ* rather than *in situ* GR. There is also a risk that those GR whose survival depends on their permanent use (such as landraces) may wither away. Small users will be more affected than large companies. On the other hand, stakeholders concede that a clear legal framework of ABS will help in many provider states whose ABS policy is not yet conclusive. In a third part, the authors discuss the possibilities for overcoming the general stalemate. One is to improve the ABS framework by streamlining procedures, another is the creation of research and development pools, and a third is the establishment of multilateral systems decoupling benefit sharing from the individual provider states.

In their chapter on 'Global scientific research commons under the Nagoya Protocol: governing pools of microbial genetic resources', Tom Dedeurwaerdere, Arianna Broggiato and Dimitra Manou discuss how current practices of sharing material and knowledge on microbes can be adjusted to the requirements of the ABS regime. The authors start with the observation that open sharing systems are in the interest of scientific progress, as well as biodiversity protection, but that they are dependent on conditions such as avoiding free-riding, quality assurance, etc. They distinguish between three models of how such conditions can be established: regulation by a central authority, market-like interactions and self-governance of the networks. Looking at the example of the World Federation of Microbial Collections, they show that self-governance can work, in particular by using MTAs with viral licences and come-back clauses for commercial utilization. They recommend that these clauses should be introduced by all other exchange systems in order to cope with the requirements of the NP. They also point to the fact that the NP is not exclusively committed to bilateral concepts but does encourage commons approaches. Notably, this is done by asking for non-commercial research to be facilitated. The authors suggest that this clause should be read

broadly to include research aiming beyond the protection of biodiversity and to encourage various kinds of sharing of non-monetary benefits, such as by joint ventures, training in bioinformatics, and preferential access to research results. The chapter closes by considering how the opening clauses on multilateral agreements can be used for the purposes of research commons.

In her chapter on 'Networks of *ex situ* collections in genetic resources' Christine Godt studies collections of GR and networks of such collections, asking whether they respect or even support the objectives of the CBD and the NP. Taking three examples of such GR pools, the multilateral system of the ITPGRFA, the International Plant Exchange Network (IPEN) and the German Collection of Microorganisms (DSZM) as part of the World Federation of Culture Collections (WFCC), she looks into and compares the constituencies and participants of the pools, their accession and access conditions, and their rules concerning commercialization of GR and related knowledge. The author finds a wide range of divergent rules and practices. What they have in common, however, is their self-perception and actual performance as intermediaries between providers and users of GR, that is, neither providers nor users. As intermediaries they serve the public interest of both sides by preserving GR and collecting taxonomic information. Confronting this role with the CBD and NP, Godt suggests that they should be seen as specialized instruments, which according to Article 4, NP, are allowed to follow their own logic but must be consistent and even support the objectives of the CBD and NP. She observes that while the service function of the pools is already a (non-monetary) benefit shared with all stakeholders, there are also loopholes allowing benefits to accrue without their sharing being ensured. For instance, although IPEN excludes commercial research, it does not do so if the user is a university. DSZM does not take responsibility for benefit sharing in cases of access with commercial intent, and the multilateral system of the ITPGRFA, although it requires benefit sharing in case of commercialization, does so too leniently. Godt therefore suggests that the host states of collections should introduce legislation extending the responsibility of intermediaries to ensure fairness between providers and users.

Gorch Detlef Bevis Fedder, in his chapter on 'Biological databases for marine organisms: what they contain and how they can be used in ABS contexts', highlights a crucial problem of the ABS concept, that is, traceability of the source of the GR in the often complex valorization chain down to final products. The tool he suggests exploring in this regard is the database. First of all, he gives an overview of GR-related databases, underlining that they, of course, primarily have the goal of managing the huge and ever increasing amount of data and making it accessible for R&D. Taking the example of a transgenic salmon with improved growth performance that can be used in aquaculture, he tests databases for the possibility of tracing the product to its sources. Two kinds of databases are

consulted: one that makes it possible to trace the genetic construct introduced into the salmon to the source species, which in this case is ocean pout and a variety of salmon, and the other that provides information about where the source species occur, which shows that it is many widely dispersed states. The author then draws conclusions from his case study about the traceability issue. In terms of 'horizontal' equity, he regards databases as a suitable tool for identifying occurrences of GR and points to the fact that species often spread widely, beyond the borders of geographical regions, so that regional agreements on the basis of Article 11, NP may have difficulties in identifying 'their' GR. In terms of effective monitoring, or 'vertical' equity, the author is positive about the contribution that databases can make in this respect but adds some proposals for improvement, in particular concerning the harmonization and use of unique identifiers of GR. A major flaw of the databases as they are is, however, that while identifying potential source states they do not enable the tracing of products to individual samples and states where the samples were taken. Although this might be improved through enormous organizational effort, the author suggests that provider states should seek their benefits by participating in the globalized R&D process rather than in shares from the benefits specifically drawn from 'their' sample.

In his chapter on 'Knowledge commons, intellectual property and the ABS regime', Gerd Winter starts with the observation that scientific knowledge on genetic resources, like most other scientific knowledge, widely enters the public domain. He finds this commendable in the interest of understanding and sustainably using biodiversity. The knowledge commons are, however, constricted by privatization claims. Winter discusses three of them that are most relevant in the GR field: copyrights, patent and breeders' rights, and – as a more recent addition – ABS rights introduced by states providing GR. While copyrights concern the form of a set of information, patent/breeders' rights as well as provider state rights are related to the content of the information, the former being tied to a developed state and the latter to a 'raw' state of the GR. Winter goes on to consider how the knowledge commons could be protected against privatization of the knowledge. Copyright claims could be mitigated by waivers and general licences as proposed by the Creative Commons movement. Patent/breeders' rights claims could be relieved by restrictions of access by commercial users to GR, and also by restricting the preconditions for, and the extent of, these rights. In contrast, in relation to provider states' ABS rights, the author suggests that provider states have an interest in vital common knowledge pools if they are enabled as participants to co-develop their own R&D capacity and thus share non-monetary benefits. However, such interests are impaired if knowledge is taken from the common pool and privatized through patent/breeders' rights and other forms of commercialization. Winter suggests three solutions that would secure the provider states (or more generally the

states hosting relevant GR) their share in commercial benefits. One is to establish a close monitoring of R&D processes, allowing any product to be traced back to its origin in a provider state. The second would entrust the database organizations with ensuring the sharing of commercial benefits. As this would involve substantial transaction costs and a fundamental reorganization of databases, the simpler but also more radical third solution would be a biodiversity tax. This tax would be due for the sale of products or services developed from genetic resources that were accessed under the CBD/NP regime. It would flow into global or regional GR-specific funds and be redistributed according to criteria that reflect the need to protect biodiversity in general but also the interest of resource states in generating income from their own resources.

International approaches

This part encompasses examples of pools that are set up (or it is proposed that they be set up) by international law and guided by international organizations. Following a discussion of the general international law framework for such pool systems, the first two case studies – on the PIP Framework and the multilateral system of the ITPGRFA – demonstrate how a strong global interest (in disease response and in food production), which has led to the formation of the pools, can be made compatible with ABS requirements. The third case study – pools on the basis of eastern African integration – illustrates the reasons for, and the possibility of, regional solutions for impasses resulting from 'horizontal' and 'vertical' inequity. Regarding the last example – a possible pooling of resources in marine areas beyond national jurisdiction – the topic is rather whether one should move from a situation of free appropriation to an ABS-compatible pool.

The international law stage for this part is set by Peter-Tobias Stoll in his chapter on 'ABS, justice, pools and the Nagoya Protocol'. Stoll lays out the international law background to the major concepts of the utilization of GR. His standard is justice with a view to bringing benefits to developing countries. He observes that both the bilateral exchange based on sovereign rights and multilateral exchange based on the pool idea have been introduced in order to achieve fair distribution. However, the bilateral model is at risk of failure because of limited jurisdictional reach, lack of control capacity and weakness in provider countries' bargaining power. Cooperative approaches may therefore ensure just solutions more effectively. Stoll distinguishes three types of approach: provider pools which strengthen the bargaining and control power of provider states, either by forming cartels or joining forces, especially in cases of transboundary GR; provider–user cooperation with a view to collaboration in research and development activities and sharing the resulting benefits; and pools which fully transcend the bilateral logic, such as the multilateral

system of the ITPGRFA. The author concludes his chapter by looking at legal bases for such cooperation in the Nagoya Protocol, especially Articles 10 and 11.

In her chapter on 'The World Health Organization's Pandemic Influenza Preparedness Framework as a public health resources pool', Marie Wilke discusses a global network of national influenza centres and WHO collaborating centres which exchange influenza viruses and antivirus medicine. She describes how the network was challenged when, during the global avian flu crisis in 2007, Indonesia noticed that a foreign company had applied to patent a vaccine it had developed on the basis of Indonesian material and refused to provide more material to the network, claiming violation of the network rules. Indonesia then bilaterally shared its GR with another firm in exchange for participation in the development of medicine. In reaction to this case the Pandemic Influenza Preparedness (PIP) Framework was adopted by the World Health Assembly and provided by an organizational infrastructure. Although non-binding under international law, it is made binding by contract on the basis of standard material transfer agreements (SMTAs), one concerning the members of the network, the other involving non-members, in particular pharmaceutical companies. The Framework lays down the rights and duties of participants, especially concerning the exchange of raw material as well as vaccines and medicine developed on the basis of the Framework. It also asks for royalty-free licences, the provision of a percentage of the vaccines produced at no charge, and a fee contributing to the running costs of the system. Wilke then assesses the system in terms of its effectiveness regarding the sharing of resources and information and its equitability regarding benefit sharing – using access to needed vaccines as a benchmark. While in principle she commends the PIP Framework as a major step forward, she also identifies flaws – most notably, that the duty of commercial non-members to share vaccines and medicinal products as well as patent rights and system costs is not standardized but open to individual negotiation. The system also lacks sanctions in case of breaches of rules, such as if a participant transfers material to third parties without prior consent. The author concludes her chapter by exposing the PIP Framework to the ABS regime. She believes that the case of pandemics is special because it necessitates a joint and timely global effort, and because the result of this effort must be made available to the entire world, and especially the poorer countries. In a setting of 'needs justice' (as Wilke calls it) the 'entitlement justice' of the ABS system is misplaced. The provider state will benefit from its participation in the general exchange system, while its interest in a special individual benefit is set aside. This is also compatible with the ABS legal framework which contains an opening clause in Article 8b) of the Nagoya Protocol.

In his chapter on 'The multilateral system of the International Treaty on Plant Genetic Resources for Food and Agriculture: lessons and room

for further development', Evanson Chege Kamau first explains the main features of this pool of GR for cultivation. He points to the problem of defining what GR are under the management and control of a contracting state, and the importance of proper notification of the GR by contracting parties. He explains who may or may not have access to the GR of the multilateral system, and what conditions for access and utilization are laid down in the standard material transfer agreement (SMTA), including a viral clause and rules on sharing non-monetary and monetary benefits. Evaluating the system, Kamau regards it as effectively serving the interests of provider states because the use of their material can be traced through the system. He also finds it to be equitable because it prevents one provider state taking all the benefits while other states may have contributed to the generation of the provided brand of seed. He also commends the system for allowing unlimited research and development. However, the author also has some critical comments. He deplores the small number of states that have notified their GR to be covered by the system. One of the reasons, he observes, is an imbalance concerning natural and legal persons located in jurisdictions of contracting parties: they are entitled to use the system, but they are not obliged (only encouraged) to include their GR in the system. Concerning the contracting parties, the author suggests that better mechanisms should be found to persuade them to more generously and expeditiously notify the realm of covered GR. One mechanism might be that the provider states and persons should be given a somewhat more privileged position when funds collected from the commercialization of the GR are distributed. On the other hand, the fact that monetary benefits must be shared at a considerable percentage of gross sales may discourage users from accessing the system altogether, particularly as the US exchange systems provide a less costly alternative by allowing free access without any benefit-sharing obligation. As a last point, Kamau identifies a weakness in that the line is unclear between intellectual property rights (IPRs) based on GR in the form received on the one hand and IPRs based on further developments of the GR. He ends with commending the system as a highly valuable example of a common pool, which should, however, be improved in certain respects.

In his chapter on 'Exploring bases for building common pools in Eastern Africa', Evanson Chege Kamau underlines the rich biodiversity in the eastern African countries, and the fact that many of the GR are shared by several of them. He first discusses what effects the bilateral approach propagated by the CBD and further elaborated by the NP will have on the use of these GR and the sharing of benefits drawn from them. He illustrates this with the example of *vernonia galamensis*, an oil plant highly valuable for industrial uses (e.g. as a plasticizer) and medicinal treatment (e.g. for skin diseases). Although occurring in many other countries in East and also West Africa, Ethiopia, which is a centre of origin of the plant, entered into an MTA with a British company that foresees the sharing of

non-monetary and monetary benefits. This leads Kamau to ask whether it is equitable that Ethiopia takes all shares. As a corollary, he doubts that the country is really capable of controlling the possibly complex downstream process of valorization of the plant, thus also losing on equity in the vertical dimension. The author goes on to confront the bilateral model with a multilateral concept which would make use of the opening clause in Article 11 NP for regional approaches. Such a concept could be designed to share benefits among resource states as well as provide a better logistical basis for tracing benefits drawn from the common GR. It could be developed in either of two organizational frameworks: the Eastern Africa Plant Genetic Resources Network (EAPGREN), which aims at improving GR exchange and uses, and the East African Community (EAC). Kamau describes the structures and activities of the two. He pleads in favour of EAC because of its firmer organizational infrastructure and the fact that with the already existing Protocol on Environmental and Natural Resources Management as well as the upcoming decision on East African Community Transboundary Ecosystems Management, it has or will have secondary legal acts that already address pool issues and provide grounds for further elaboration.

The book closes with a chapter on 'Common pools for marine genetic resources: a possible instrument for a future multilateral agreement addressing marine biodiversity in areas beyond national jurisdiction' by Thomas Greiber. The author first points to the multitude of potential uses of marine GR living in the marine areas beyond national jurisdiction (ABNJ), that is, the high seas, the deep seabed and ocean floor, including its subsoil. The potential value is reflected in the recent increase in research and bioprospection as well as related patents. This has raised international awareness about the sustainability of uses and benefit sharing. One of the outcomes of the debate is a resolution in 2011 of the UN General Assembly that initiates a process towards a legal framework ensuring sustainable use of marine biodiversity including genetic resources and benefit sharing. Greiber predicts that, as in the Aichi negotiations that led to the Nagoya Protocol, a deal may be struck implying that conservation measures will find consensus on the condition that the sharing of benefits from uses is conceded. This means that GR in the ABNJ are, in a way, pooled with a view to allowing unlimited research and development on the one hand, and asking for benefit sharing on the other. Greiber then considers existing legal frameworks as a basis for such pooling. One could be the CBD plus NP but he interprets these conventions as not reaching beyond the national jurisdiction. Closer to the point would be a protocol under the UN Convention on the Law of the Seas (UNCLOS). While, as Greiber shows, access to GR would not fall under the regime of the Area because it is confined to access to mineral resources, it does qualify as one kind of freedom of use of the high seas and a general freedom to research for both non-commercial and

commercial purposes. These freedoms are at the same time limited by obligations to preserve resources and share non-monetary benefits, including research cooperation, publication of research results and knowledge transfer. Within this loose legal framework, various options for a new convention are imaginable. Greiber outlines some core issues which may bridge the gap between some industrialized countries that are satisfied with the *status quo* and the developing world that strives for benefit sharing: the conception of marine GR as a common concern of mankind, the scope of the regime to cover both non-commercial and commercial research, procedures for access to be laid down by flag states and setting environmental protection conditions, rules for equitable benefit sharing by the setting up of transnational material collections, data pools and collaboration requirements, as well as a flag state system of monitoring and compliance control.

Conclusions

Surveying the variety of common pools it appears that the pool approach does provide opportunities to enhance R&D in the interest of biodiversity protection and generation of useful products. If the pools are to be further developed, two aspects should be kept in mind: that the diversity of forms warns against a 'one size fits all' solution, and that care must be taken to overcome the difficulties of construction and maintenance of pools.

Concerning the diversity of forms, further work on a general categorization of pools is needed. Taking their primary objectives as major characteristic, the following types may be distinguished:

1 *Grassroots pools* (such as the Potato Park in Peru), which comprise 'wild' GR and scientifically untested TK. They aim at local services and are socially embedded. They are reinforced in order to defend themselves against competition from and exploitation by the modern sector. They are ruled by customary law but deserve a supportive framework of national legislation.
2 *Stipulating pools* (such as the Hoodia network of the San in Southern Africa and the Pacari association in Brazil), which bring together holders of GR or TK who wish to pursue their rights of benefit sharing. They can build up organizational capacity to trace products to provider states and ensure the equitable distribution of benefit shares among participants of the pool. They may also aim to publish their knowledge in order to prevent patenting by third persons, or strive to obtain intellectual property rights themselves.
3 *Basic research pools* (such as the network of botanical gardens IPEN, but also the worldwide public domain of taxonomic research and knowledge), which encompass collections, databases and print media on 'wild' and cultivated GR and related MK. They aim to enhance

biological knowledge, primarily by understanding biodiversity and thus providing a basis for its protection and further use. They defend the public domain character of biological material and knowledge. However, considering that even basic research results (especially in genomics and microbial research) are suitable for patenting, they are under increasing pressure to become commercial. This entails problems similar to those of applied research pools.

4 *Applied research pools* (such as the multilateral system of the ITPGRFA), which contain collections of cultivated GR and related MK. They aim at cooperative R&D and serve as an infrastructure for commercialization including attaining intellectual property rights and developing marketable products. As they enable commercial benefits, they are under pressure from the ABS regime to ensure benefit sharing with providers of pool resources. This can, for instance, be done by giving the provider privileged status concerning the sharing of benefits.

5 *Commercial development networks* (such as the intercompany exchange networks concerning high yield animal, forest and plant GR), which are platforms of cooperation or market transactions between owners of GR and MK. They tend to avoid forming a pool in order not to lose commercial opportunities. With the upcoming ABS regime, they must, however, adapt to benefit-sharing obligations and will have to decide whether to form pools that collect and distribute monetary benefits, either as a separate organization or as part of a research and development pool.

The legal basis for improved forms of pools could be Articles 4 (2) and (4), 10 or 11 of the Nagoya Protocol. But they can also be started as local, national or transnational initiatives which ripen over time to be embedded in an international treaty and organization only at a later stage of development. Furthermore, it may be advisable to abandon the clear distinction between the three basic concepts and instead suggest that common pools can be combined with elements of the models' 'free appropriation and use' and 'property and market'. This is particularly apparent if one considers the relationships between a pool and external actors. While socializing resources internally, pools often act as owners of their resources externally, excluding non-participants or entering into market-like transactions with them.

Concerning the difficulties of construction and maintenance of pools, it is remarkable that in many of the analysed cases the problem of possible under-supply of the pool arise, both at the use and the provision end. At the use end of pools, users at times strive to take material or knowledge from the pool without providing R&D results and commercial benefits in exchange, thus acting as free-riders. At the provider end of pools, providers may prefer not to submit their GR or TK but rather enter into

bilateral relations with individual users, because they do not anticipate benefits flowing to them from the pool.

These problems of under-supply can arguably be solved by appropriate rules and their implementation. At the use end the obligation of users to share non-monetary and monetary benefits with the pool must be strengthened and enforced. In addition, the availability of intellectual property on GR, TK and MK should be confined to the final stages of the valorization chain, thus freeing R&D from restrictions at a premature stage.[7] At the provider end, appropriate incentives for providers to participate must be elaborated and enforced. A crucial question in that regard is whether the actual provider should be granted privileges over other resource holders. If the answer is in the affirmative, it is crucial that mechanisms are available to track products down to an original sample and the location where it was taken from.

Alternatively, and as a means of avoiding the potentially enormous technical and financial costs of such tracking, the right to benefit shares would be decoupled from the specific GR or TK and their provider. Resource holders would receive benefits according to appropriate allocation rules which can still reward those who are particularly supportive of the pool. Those pools which aim at R&D as such (types 1, 3 and 4) rather than the stipulation of benefit sharing or commercial development (types 2 and 5) could even be released from managing the flow of benefits, and especially from claiming and allocating shares in monetary gains. These shares could be managed by separate regional or global funds, covering a single resource or cross-cutting several or even all resources. The concept causing the least transaction costs would be a charge laid on commercial monetary benefits from products or royalties based on GR and TK. As suggested in some of the chapters, it seems that such a charge, if appropriately designed, could disburden the R&D common pools, bring about both 'horizontal' and 'vertical' equity, enable research and development of GR and TK, and provide knowledge and means for biodiversity conservation.[8]

Notes

1 One might be tempted to conceive GR and TK for 'free allocation and use' as a common heritage of mankind, but this would be misleading because the idea of commonness assumes the existence of rules on joint use and benefit sharing.

2 These difficulties will be alleviated by obligations on user states to ensure that access to GR/TK complies with provider state requirements, see NP, Articles 15–18. However, according to dominant interpretation, these obligations only concern the access to GR/TK, not however their utilization. Therefore, the user state does not have to check whether the research and development within its jurisdiction complies with the conditions set by the permit and/or the access agreement (Buck and Hamilton 2011: 52). This low level of obligation is also reflected in the 2012 proposal of the EU Commission for an ABS Regulation, which only requires checking whether a permit was obtained

and/or an access agreement was concluded (see European Commission 2012, Article 4).

3 As an alternative, cartels of provider states have been proposed (Vogel 2007). However, while these may ensure better sharing of benefits they appear not to provide an appropriate framework for cooperation in R&D by providers and users.

4 See as examples the agreements between Ethiopia and a British company on the plant *vernonia galamensis* (Chapter 18) and between Indonesia and a US company on an avian flu virus (Chapter 16).

5 An example of the first group is the collection of traditional medicinal knowledge in China (Chapter 8); an example of the second is the multilateral system of the ITPGRFA (Chapter 17).

6 On the concept of transnational rule making, see Dilling, Herberg and Winter 2010.

7 This could be done by reconsidering the protection of discoveries, raising the thresholds for the patent preconditions of novelty, inventive step and utility, and shrinking the protective scope of a patent right. See Chapter 14; Rimmer 2008: 9.

8 One might fear complications because of the large number of transactions that would be taxed. This is, however, not necessarily so because only a very small percentage of bioprospected 'wild' GR and TK lead to commercial gain (Cragg *et al.* 2012).

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