Earthscan Food and Agriculture

THE COMMONS, PLANT BREEDING AND AGRICULTURAL RESEARCH

CHALLENGES FOR FOOD SECURITY AND AGROBIODIVERSITY

Edited by
Fabien Girard and Christine Frison

ROUTLEDGE

The Commons, Plant Breeding and Agricultural Research

The joint challenges of population increase, food security and conservation of agrobiodiversity demand a rethink of plant breeding and agricultural research from a different perspective. While more food is undeniably needed, the key question is rather about how to produce it in a way that sustains biological diversity and mitigates climate change.

This book shows how social sciences, and more especially law, can contribute towards reconfiguring current legal frameworks in order to achieve a better balance between the necessary requirements of agricultural innovation and the need for protection of agrobiodiversity. On the assumption that the concept of property can be rethought against the background of the 'right to include', so as to endow others with a common 'right to access' genetic resources, several international instruments and contractual arrangements drawn from the plant-breeding field (including the Convention on Biological Diversity, technology exchange clearing houses and open sources licenses) receive special consideration. In addition, the authors explore the tension between ownership and the free circulation and exchange of germplasm and issues such as genetic resources managed by local and indigenous communities, the ITPGRFA and participatory plant-breeding programmes.

As a whole, the book demonstrates the relevance of the 'Commons' for plant breeding and agricultural innovation.

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Routledge
Taylor & Francis Group
LONDON AND NEW YORK

earthscan
from Routledge

First published 2018
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge
711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book has been requested

ISBN: 978-1-138-08758-3 (hbk)
ISBN: 978-1-315-11038-7 (ebk)

Typeset in Galliard
by codeMantra

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Acknowledgements and dedications

With the exception of three essays, the contributions to this volume were first presented at an international workshop titled: 'The Commons, Plant Breeding and Agricultural Research. How to face the challenges of an increasing world population and the preservation of agrobiodiversity', co-organised by the *Maison Française d'Oxford* (MFO) and the *Centre de Recherches Juridiques* (CRJ) of Grenoble on the 30 September and 1 October 2016.

This workshop was part of the project 'ANR-15-CE21–0004', *CommonPlant*, selected for funding by the French National Research Agency (ANR).

We are grateful to the MFO for hosting the workshop. Furthermore, we wish to record our profound appreciation to the ANR for its research funding and the CRJ, *Université Grenoble Alpes*, for providing financial assistance during the editorial process.

Additionally, we would like to express our sincere gratitude to Laura Rival who co-convened the workshop held at the MFO in autumn 2016 and whose support, knowledge and insights significantly contributed to the success of our scientific endeavour.

Fabien Girard wishes to heartily thank Reia Anquet for her unfailing support and assistance in language editing. He also would like to thank Christine Frison for her trust and friendship all along this ambitious moral and intellectual undertaking.

Finally, F.G. wishes to express his deep sense of gratitude to Tania for her unwavering support and love.

Christine Frison wishes to acknowledge the financial support of the INDIGO project and of the *Fonds Wetenschappelijk Onderzoek – Vlaanderen* (FWO), and the institutional support of the Law Faculty of the University of Antwerp.

Additionally, C.F. thanks Professor Geertrui Van Overwalle for introducing her to Fabien Girard. From this encounter was born a fruitful collaboration and a sincere friendship. She wishes to express her gratitude to Fabien for enabling such a challenging, creative and truly collective research relationship.

F.G. and C.F.

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Française (with Ch. Noiville); (2014) 'Propriété industrielle et biotechnologies végétales: la Nova Atlantis (À propos de la recommandation du Haut Conseil des Biotechnologies)', RIDE 1: 59–109 (with Ch. Noiville); (2015) '"Though the treasure of nature's germens tumble all together": the EPO and patents on native traits or the bewitching powers of ideologies', Prometheus, 33(1): 43–65.

Patricia Guzmán-Aguilera, a lawyer trained in international environmental law, is a PhD candidate in Law at the University Rennes 1, France, where she is preparing a thesis on traditional seeds and biodiversity. She lectures in international environmental law and development at the University Paris-Sorbonne.

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IECTBA The Spanish Inventory of Traditional Knowledge on Agricultural Biodiversity (IECTBA, acronym in Spanish) is a project, promoted by the Spanish Ministry of Agriculture, for developing a public inventory that aims to compile previously published information on traditional knowledge regarding agrobiodiversity at two levels: species and landraces. The project started in 2016 and includes the participation of more than 80 scientists from several research centres and civil society organisations. The project aims to generate a global database of crop species and landraces available to the general public, and monographs of selected species and landraces.

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MIRES – *Méthodes Interdisciplinaires pour les Réseaux d'Échange de Semences*: Seed Source Networks Analysis – is an interdisciplinary program (Anthropology, Geography, Genetics, Biostatistics) for studying Seed System's Network structures (RNSC, INRA, CNRS).

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Christine Raimond is a geographer and director of research at the National Centre for Scientist Research in Paris, France. She works on peasant production systems in West and Central Africa (Chad, Cameroon, Burkina Faso), with interest on biodiversity and local knowledge.

Red de Semillas 'Resembrando e Intercambiando' – The loss of genetic resources in the agri-food system and the recovery of local varieties were the main objectives when creating the Red de Semillas '*Resembrando e Intercambiando*' (Spanish seed network) in 1999. This national organisation of a technical, social and political nature constitutes a meeting point of local projects in Spain; provides instruments to carry out activities to promote, use and defend cultivated biodiversity and farmers' rights; helps to coordinate activities amongst the different members, 25 local seed networks; enables capacity building of its members and local initiatives through training and promoting their participation in national and international projects.

The organisation has developed an important work in policy lobbying and building alliances in different spheres. One important example is the creation in 2012 of Let's Liberate Diversity, the European coordination of Seed Networks.

Victoria Reyes-García (PhD in Antropology, 2001, University of Florida, USA) is an ICREA Research Professor at the Institut of Environmental Science and Technology (Universitat Autonoma de Barcelona, Spain). Her research addresses the benefits generated by local ecological knowledge and the effects of the integration to the market economy on this type of knowledge. Reyes-García lived among the Tsimane', an indigenous peoples in the Bolivian Amazon, from 1999 until 2004. Since April 2006, she has coordinated the Ethnoecology Laboratory at ICTA-UAB. In 2010, she received a Starting Grant from the European Research Council to study the adaptive nature of local ecological knowledge using a cross-cultural comparative approach. She has co-authored more than 150 research papers.

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He published two books on plant innovation and on access and benefit-sharing: *Gènes, pouvoirs et profits. Recherche publique et transformations des régimes de production des savoirs et des innovations en génétique végétale de Mendel aux OGM* (2009, with Christophe Bonneuil); and *Le pouvoir de la biodiversité: Néolibéralisation de la nature dans les pays émergents*: IRD éditions et Quae (2015, with Valérie Boisvert). His last publication is entitled: 'Public domain, free access and the coercive commons in plant sciences and global agro-biodiversity management', which has been recently submitted to the *International Journal of the Commons*.

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Colombia

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Colombia, Corte Constitucional. Sentencia C-501 de 16 de julio de 2014 Expediente D-10035. Magistrado Ponente: LUIS GUILLERMO GUERRERO PÉREZ. Norma demandada: artículo 306 (parcial) de la Ley 599 de 2000, modificado por el artículo 4º de la Ley 1032 de 2006

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G2/12 Tomatoes/STATE OF ISRAEL-MINISTRY OF AGRICULTURE II
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Acronyms and abbreviations

ABS	Access and benefit-sharing
ANILS	National Inteprofessional Dried Vegetables Association
ANR	Agence Nationale de Recherche
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture (FAO)
CONECT-e	Compartiendo el CONocimiento ECologico Tradicional
CoP	Code of practice
COP	Conference of the parties (CBD)
CPR	Common-pool resource *(theory of the commons)*
CRJ	Centre de Recherches Juridiques (University of Grenoble)
DHS	Distinction, homogeneity and stability
DNA	Deoxyribonucleic acid
DOI	Digital object identifier
DUS	Distinct uniform and stable criteria (UPOV)
EPC	European Patent Convention
EPO	European Patent Office
ETC	Group Action Group on Erosion, Technology and Concentration (formerly RAFI)
EU	European Union
FAO	Food and Agriculture Organization (UN)
FiBL	Research Institute of Organic Agriculture (Switzerland)
FL	France Libertés
FRAND	Fair, reasonable and non-discriminatory licensing conditions
FWO	Fond Wetenschappelijk Onderzoek-Vlaanderen (Research Foundation Flanders)
GATT	General agreement on tariffs and trade (WTO)
GIs	Geographical indications
GLIS	Global Information System (ITPGRFA)
GM crops	Genetically modified crops
GMO	Genetically modified organism
GZPK	Getreidezüchtung Peter Kunz

IAASTD	International Assessment of Agricultural Science and Technology for Development (under sponsorship of the UN and the World Bank)
IAD	Institutional Analysis and Development
IARC	International Agricultural Research Centres (supported by CGIAR)
IBPGR	International Board for Plant Genetic Resources (then IPGRI, then Bioversity International)
ICA	Colombian Agriculture Institute
ICDP	Integrated conservation and development programming
IDLO	International Development Law Organization
IECTBA	Spanish Inventory of Traditional Knowledge on Agricultural Biodiversity
IGC	Intergovernmental Committee on Intellectual Property, Genetic Resources, Traditional Knowledge and Folklore (WIPO)
INRA	Institut National de Recherche Agronomique (France)
IP	Intellectual Property
IPES-Food	International Panel of Experts on Sustainable Food
IPR	Intellectual Property Right
IRD	French Institute for Development Research
ITPGRFA or the Treaty	International Treaty on Plant Genetic Resources for Food and Agriculture (or the Plant Treaty)
IU	International Undertaking on Plant Genetic Resources (FAO)
IUCN	International Union for Conservation of Nature
MLS	Multilateral System of access and benefit-sharing (Plant Treaty)
MTA	Material Transfer Agreement
Nagoya Protocol	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the CBD
NGO	Non-governmental organisation
OSSI	Open source seed initiative
PBR	Plant breeders' right
PES	Payment for ecosystem services
PGI	Protected geographical indication
PGR	Plant genetic resource
PGRFA	Plant Genetic Resources for Food and Agriculture
PGS	Participatory Guarantee Systems
PIC	Prior informed consent
PPB	Participative plant breeding
PVP (A)	Plant Variety Protection (Act)

QUNO	Quaker United Nations Office
R&D	Research & Development
RdS	Red de Semillas (Resembrando e Intercambiando)
RSP	Réseau Semences Paysannes
SMTA	Standard Material Transfer Agreement (Plant Treaty)
SkE	Simalikalactone E
TFT	Transgenic Free Territory
TK	Traditional knowledge
TRIPS	Trade-related Aspects of Intellectual Property Rights (Agreement, WTO)
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPOV	International Union for the Protection of New Varieties of Plant
VCU	Value for Cultivation and Use
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

Introduction

Commoning the seeds: the future of agrobiodiversity and food security

Fabien Girard[1] *and Christine Frison*

Malaise in plant breeding: ploughing and plundering

About 805 million people were estimated to be chronically undernourished over the period 2011–2014, with a prevalence of undernourishment of 11.3 per cent globally and of 13.5 per cent for developing countries (FAO 2014b). The most severe deprivation is increasingly concentrated in sub-Saharan Africa, which is currently home to three-quarters of the world's ultra-poor (Ahmed et al. 2007). Over the past 50 years, the world population has doubled and is expected to reach 9 billion people by 2050. The increase in population is above the increase in yields of the three major cereals (wheat, maize and rice) that supply most nutritional needs (CBD 2008). Producing the necessary nutritious food for a growing population in the coming decades, and doing so in a sustainable manner, is a huge challenge facing agricultural systems throughout the world, especially in the planet's poorest and most disadvantaged regions.

So far, agricultural and food policies have remained narrowly focused on increasing productivity by strengthening or importing an industrial model of agriculture inherited from the 'Green Revolution' based on higher inputs of synthetic fertilisers and pesticides and the use of commercial seed of a few major crops. What might be called the 'efficiency-oriented' model (Garnett 2014) is overly turned to agricultural supply, productivity and technology. Accordingly, the main policy generally implemented is to boost per capita food production, i.e. food availability quantity (Burchi and De Muro 2016). To this end, a particular emphasis has been (and is still) placed on scaling-up the formal seed sector and promoting the commercialisation, distribution and adoption of improved crop varieties deemed to produce higher yields (Sanchez et al. 2009; AGRA 2013; Jayne and Rashid 2013). Backed by trade liberalisation measures, this neo-liberal agricultural model has largely resulted in a range of adverse effects, whether economic-,[2] social-,[3] agronomic-[4] or health-related,[5] that are impeding countries to reach food security objectives (IPES-Food 2016).

Identifying the ins and outs of the model and sketching out new ways forward are challenging undertakings. The current situation has been the consequence of a series of shifts in plant breeding and in the ontology of seeds. The first shift relates to farmers' practices and to actors involved in the breeding process. There

has been a fast move from millennial farmers' practice of selection to cross breeding and creation of pure lines. This resulted in a dramatic change of actors in the agricultural chain: the genetic improvement switched from farmers all over the world to ever fewer professional breeders in developed countries on which farmers became more and more dependent for the supply of seeds. Foreshadowed by the new regulatory framework on variety registration (distinction, uniformity, stability – DUS – criteria), variety testing (value for cultivation and use – VCU) and certification put into place after the World War II, the second shift revolves around a new operational entity at the heart of seed policies: *the fixed cultivar whose homogeneity guarantees predictability and stability in any controlled environment.* Finally, in the 1980s, a third shift focusing on breeding techniques revolutionised breeding practices from cross-breeding to genetic modification (i.e. the introduction of single (or few) genes in an improved variety through molecular biology techniques), which resulted in a new major ontological break.

It is worth noting that these breakthroughs have been supported (and even sometimes spurred on) by the legal system. Law was instrumental in 1961, with the adoption of the International Convention for the Protection of New Varieties of Plants (UPOV Convention), enshrining a new form of exclusive right – the plant breeders' right (PBR), also known as plant variety right (PVR) – granted on a new plant variety meeting the core criteria of the then new experimental unit, i.e. *distinction, uniformity and stability (DUS)* (UPOV Conv. 1991, art. 6(1) (a), (c), (d)). The same holds for the third shift from classical breeding to genetic modification. While drawing on the reduction of the gene to a chemical molecule in molecular biology, courts were readily able to apply to the gene the same jurisprudence that was applied to all chemical compounds (Calvert and Joly 2011).

As Graham Dutfield's chapter accurately shows **in the first chapter of this book** (Chapter 1), within this new legal framework, local varieties and farmers' seed networks are heading towards marginalisation and disempowerment: first because of the replacement of landraces by modern cultivars and the reduction of farmers into passive end users, at the expense of their pivotal role as custodians and generators of agricultural biodiversity and innovators; and second because of the outlawing of farmer-to-farmer seed exchanges inasmuch as their local varieties generally do not fit the DUS criteria for registration and certification (Santilli 2012; Wattnem 2016). What is more, in severing the bonds between the seeds and the living systems and local knowledge embedding them, this new legislation has contributed to eclipse, if not obscure the vast array of local practices and customs underpinning the multifaceted relationship between woman/man and seeds still strongly present within small farming and indigenous communities. In parallel, it has triggered the process of crop and plant germplasm commodification on a globalised supply and production market through the recognition and strengthening of intellectual property rights (IPRs) on plant varieties, genetically modified (GM) crops, processes and DNA sequences. With the progressive shift from a model of governmental direct support for R&D to a model of private research financed by the market, it had become critical to set up incentives to spur investment by the private sector.

The recognition in the United States of the Plant Patent Act in 1930 providing protection for asexually reproducing plant varieties marked the first step. It was followed by the UPOV Convention in 1961, which was subsequently revised in 1972, 1978 and 1991, each time to accommodate the interests of breeders, ignoring the needs of many smallholder farmers and their innovative practices.[6] It represented a major step forward for breeders in providing them with PBRs on new varieties of plant which are distinct, uniform and stable.[7] About 20 years later, while abolishing the 'product of nature' doctrine (*Diamond v. Chakrabarty*: 447 U.S. 303 (1980)), the US Supreme Court paved the way for the patentability of seeds, plants and tissue cultures, formally recognised in *Ex parte Hibberd*. In the wake of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs Agreement), requiring that patent protection must be available for all fields of technology (Art 27(1)), the EU passed the directive 98/44/EC of 6 July 1998 (Biotech Directive) on the Legal Protection of Biotechnological Inventions. Admittedly, plant varieties are not considered patentable subject matters and are protected by PBRs. The Biotech Directive has nevertheless enabled the patentability of a great number of biotechnological inventions related to plants: microbiological processes, as well as technical or non-essentially biological processes (e.g., genetic engineering processes) (Llewelyn and Adcock 2006), GM crops, as well as the sequence or partial sequence of a gene, even if its structure is identical to that of a natural element, under certain conditions (see Chapter 1; also see Girard 2015).

In the past 30 years, similarly to transformations witnessed in other intellectual property fields, a continuous expansion of the boundaries of patentability of seed and a correlative erosion of the exclusions from patentability has occurred (Drahos 1999; Sterckx and Cockbain 2012).[8] As Graham Dutfield highlights in his chapter, this trend is even more acute in North America and has been compounded by a high concentration of firms in the breeding sector, as the result of a merger and acquisition wave (Chapter 1). A handful of seed and agrochemical companies dominates the market today (Howard 2009; IPES-Food 2017).

Now supported by strong IPR laws and non-IPR-related seed laws (registration, performance testing and certification), the 'efficiency-oriented model' has largely resulted in three major consequences.

First, to tensions between advancements in biotechnology led by mega-agribusinesses and small-scale farmers and farmers' seed networks (Frison 2016). The latter are detrimentally affected by 'over-regulation' on seeds, even though it has been shown that family farmers still constitute the basis for producing about 53–70 per cent (FAO 2014a; Graeub et al. 2016) of the world's food. Furthermore, farmer-managed seed systems (which include own-saved seed, exchanges with neighbours, and local seed markets) have been instrumental in building viable and diverse crop population over millennia and still provide more than 70 per cent of the seeds used worldwide today (McGuire and Sperling 2016). This demonstrates the central role of farmers as innovators; they have ensured and continue to ensure the spatial and social distribution of genetic, morphological and varietal diversity, increasingly recognised as critical for farmer productivity and

climate change adaptation (Coomes et al. 2015).[9] Local and diverse agricultural systems that produce indigenous crops and animal breeds are also seen as better equipped to provide the full range of micronutrients needed for good health than global supply chains (Toledo and Burlingame 2006; FAO 2010).

Second, the North/South divide, illustrating tensions between the biodiversity-rich 'South' and the technology-rich 'North', which has sparked 'seed wars' (Aoki 2008), or at least a tendency towards 'hyperownership' (Safrin 2004), the negative impact of which on the flows of genetic resources is only beginning to be documented (Halewood 2010; Ruiz and Vernooy 2012).

Third and finally, the entanglement of property rights on resources and the development of patent thickets (Heller and Eisenberg 1998) in plant breeding (Cukier 2006), described as likely to lead to 'a tragedy of the anti-commons' and, according to some studies, already responsible for the slowdown in innovation for certain crops (Graff et al. 2004).

The aim and scope of this book

This book addresses how to find a way out of the current political and legal impasse. If food production has to increase so as to answer the growing world's population needs, this should be done in a more sustainable manner. It should take into account the need to minimise the negative impact on the environment and to conserve biological diversity, the increasing risks related to climate change and the multifaceted dimension of food security and notably the *entitlement to appropriate food for a nutritious diet, nutritional capabilities and stability over time* (Burchi and De Muro 2016).

This prospect urgently calls for the development of a sustainable crop production system that relies less on the destruction of natural resources (e.g., soils, water-aquifer), on fertilisers and pesticides and that provides for the protection of innovative agroecological practices carried out by farmers and local and indigenous communities.

Curbing the right to exclude: towards an inclusive property

The first avenue of reflection explored in **the first part of the book** ('Access, Benefit-Sharing and Licensing') focuses on the concept of property as it has been established by classic liberal and neo-liberal thinkers and strives to question private ownership and what can be seen as its main distinguishing feature in the Western world, namely the right to exclude. It draws on the growing literature calling for a fair and equitable access regime to vital resources and on Crawford Macpherson's (Blomley 2015), Jeremy Rifkin's (2000) and Paul Mason's (2015) works on the pitfalls of liberalism, denounced as relentlessly *de-commoning* the physical and social infrastructure of life and negating human fulfilment. This series of chapters investigates the potentialities of the 'right of access' or 'right not to be excluded' (Rifkin 2000). Exploiting further the 'bundle of rights' approach of property, this collection of essays assesses how individual and private property

could be reconceptualised and recrafted so as to better account for *others*. This includes notably their equal right to develop their capacities, right to flourish and to be *included* in the use and disposal of units of the resources provided by nature and which are under the owner's full dominion. Above all, it yields invaluable insights into the transformations underway in plant breeding and agricultural research. This way forward seems to be praised by some major players of the seed industry themselves. Lamenting the risks of legal uncertainty, dependency on patent holders, the heavy costs of monitoring for patented elements, as well as litigation risks (ITPGRFA 2013), the seed industry now advocates the development of an online industry-licensing platform for patented native vegetable traits. The debate, initiated within the framework of the ITPGRFA, has resulted in the setting up of the new clearing-house, the International Licensing Platform Vegetable Association (ILP) founded on 13 November 2014 (Kock and ten Have 2016). The clearinghouse mechanism systematises the patent license agreement model in striving to match, through a sort of 'exchange office', patent holders and potential users of the patented technologies (Van Overwalle 2013). As Geertrui Van Overwalle recalls in her chapter (Chapter 5), the ILP qualifies as a standard license clearinghouse in that it aims to provide members with both access to a portfolio of patent-protected technologies (there is pooling of patented traits) and standardised access to the inventions under transparent, fair, reasonable and non-discriminatory (FRAND) licensing conditions (Kock and ten Have 2016). This and other similar projects[10] can be assessed against the background of 'the right to access', as they allow for the possible reframing of property rights and bear witness to the current shift, in intellectual property, from legal entitlement (property rules) towards liability rules (Merges 1996). Likewise, and in the wake of the open source software movement, licensing agreements have been seen as a way to foster seed exchanges between farmers and to spur and protect the development of farmers' new varieties (Kloppenburg 2014). Affixed for instance on seed packages, these copyleft licenses may enable the free use of seeds, including for further breeding, provided that any seeds or enhancements of the seeds obtained thereof are subjected to the same conditions. Relying on two major instances of open licenses for seeds, the 'Open Source Seed initiative' (OSSI), based in the US, and the 'Open Source Seed' (OSS) initiated by the German NGO Agricol (Kotschi and Rapf 2016), Eric Deibel (Chapter 4) makes a strong case for their widespread use, as they can 'challenge how the life sciences increasingly consider living material as disembodied, decontextualised and instantly transmissible across the globe as a digital technology'.

Finally, the last two chapters assess the right not to be excluded within the framework laid down by the Convention of Biological Diversity (CBD) and the Nagoya Protocol on access and benefit-sharing (ABS). These two binding international instruments which, while reaffirming that States have sovereign rights over their own biological resources (CBD, art. 3), recognise that each Contracting Party shall provide and/or facilitate the access and transfer to other Contracting Parties, technology that is relevant to the conservation and sustainable use of biological diversity (CBD, art. 15§1). Reviewing the *Quassia*

amara case between French National Research Institute for Research Development (IRD) which filled a patent application on *Simalikalactone E* (hereafter SkE) – a molecule with antimalarial properties extracted from a plant in French Guiana (*Quassia amara*) – and the Foundation *France Libertés*, the opponent in pending opposition proceedings before the European Patent Office, Frédéric Thomas's chapter brings some light on the flaws in the implementation of ABS schemes under the Nagoya Protocol (Chapter 3). The chapter aptly captures the ontological tension conveyed by the patent regime, as it forces researchers, albeit pervaded with a monist conception of Nature (a 'second nature' with human inside) and an open access culture at the research stage, to embrace, at a further stage of the research process, a dualist view Nature/Society ultimately leading to living things being taken out of the realm of discovery to enter that of invention and patent. This tension, he argues, makes the proper functioning of ABS schemes impossible and encourages misappropriations. Advocating a new alliance between public research and civil society, Frédéric Thomas suggests a new direction: if we accept a monist conception of Nature, the question is not so much whether local populations deserve compensation, but rather whether they have been involved, to a lesser or greater instance, in the research process (Chapter 3). If so, we should then decompose the full IPR (normally held by the patent holder) into as many 'sticks' (of the bundle) as there were legitimate participants in the research, before endowing *inter alia* local population with some rights of use or access. Access is then conceived of as a two-way mechanism benefiting not only the user but also to provider of the resource.

However, as pointed out by Elsa Tsioumani in her chapter, sharing is currently in direct conflict with a political and economic system that is increasingly transforming genetic resources and knowledge into commodities (Chapter 2). She insists that discussing and redefining the boundaries between what must remain in the public domain, what may be managed as a commons and what can be privatised is more than ever a critical issue for regulators and academics alike. To this end, she assesses the concept of benefit-sharing. She questions whether fair and equitable benefit-sharing remains a promising concept nowadays, in the same way it was at the time of its inception. She interrogates whether it has injected any fairness and justice in the R&D sphere, and whether it has come up with a workable defence against IPRs policies that over-empower the right to exclude. Analysing the Multilateral System of access and benefit-sharing of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) – a highly sophisticated system to operationalise benefit-sharing at the interstate level – Elsa Tsioumani (Chapter 2) recognises that it has not succeeded in legally enforcing user-based benefit-sharing (Kloppenburg 2014) and has not promoted agrobiodiversity conservation. As a result, she concludes that very little monetary benefits have been shared, and that perhaps the concept of fair and equitable benefit-sharing should be adapted to the current issues at stake. Notably, she links this with a human rights' framework, which requires investigating primarily *who benefits* from any technological advances and placing the needs of the most vulnerable groups at the centre (De Schutter 2009).

The commons and commoning for the future of plant breeding and agricultural research

In **the second part** ('Theoretical Frameworks'), the book works toward a full-fledged assessment of the meaning, as well as the value and drawbacks of the 'Commons' for the future of plant breeding and agriculture research. The last decade has seen a growing interest in, and thorough reflection on, the commons – natural resources commons as well as intellectual commons – especially in the United States (Benkler 2007; Boyle 2008a, 2008b; Weston and Bollier 2013; Bollier 2014) and in Italy (Lucarelli 2011, 2013; Mattei 2011, 2012, 2013; Marella 2012, 2017; Rodotà 2012; Bailey and Mattei 2013; Dani 2014; Spanò and Quarta 2016). But very few studies have been carried out on the commons in plant breeding.[11] It was thus felt there was a need to fill the aperture in this area of knowledge, also because the term 'commons' is frequently used when it comes to the ITPGRFA,[12] participatory plant breeding or even open source licences for seed. Likewise, it was surmised that landraces and associated knowledge 'held' and managed by local and indigenous communities could be grasped as local common-pool resources (CPRs) within the meaning of Ostrom's works on collective governance of natural and finite as well as intellectual resources (knowledge commons) (Ostrom 1990; Hess and Ostrom 2007). According to a now mainstream definition in institutional economics, the commons is to be understood as an institutional system made of three components: (i) a CPR; (ii) a community which has access to, and manages the resource and (iii) institutional arrangements regulating the preservation, management and consumption of the resource, including rules related to the appropriation of the resource.[13] At this juncture, any further discussion on the issue must be preceded by a caveat: '[…] there is no automatic association of CPRs with common-property regimes – or, with any other particular type of property regime' (Ostrom and Hess 2008: 119). Contrary to the socio-philosophical and constructivist understanding of the commons,[14] it is contended throughout the book that the commons is not necessarily about pushing for the acknowledgement of a third way between public and private ownership (this approach is that of the '*beni comuni*' in Italy: Mattei 2012), even though state and private ownership are now both pervaded with a neoliberal ideology, what impels us at least to reconsider the subject/object relation.

In his chapter devoted to new encounters between private law and the commons, Michele Spanò (Chapter 6) illustrates how private law can be a home for flexibility and creativity and provide answers to secure protection and long-term management of CPRs. Specifically drawing on Anna Tsing's ethnographic work (2015) on an aromatic Japanese mushroom, he argues for private contracts and privatisation as innovative ways to foster new encounters and exchanges. To this end, the interstice created by privatisation should be exploited: 'Privatization is never complete; it needs shared spaces to create any value. That is the secret of property's continuing theft—but also its vulnerability' (Tsing 2015: 271). As no mushrooms emerge from underground fungi without forest disturbance, private

contracts and the extractive activities they allow are seen as a chance to awake the 'communally living underground body of the forest' (ibid.). Opening up 'the possibilities of latent commons, human and not human' (ibid.), contracts can no longer turn mushrooms into assets and commodities on a 'disembedded' market, as the many entanglements between humans and non-humans, values and local ties are now becoming increasingly visible and cannot go unnoticed. In the same line of thought, the open source movement for seeds and similar initiatives described by Victoria Reyes-García and her colleagues (Chapter 12) in the field of traditional knowledge (TK) databases, show how, in a new intellectual framework, IPRs can be '[…] exercised to share and socialize intellectual property – counter to the very meaning of the exclusivity that characterizes it' (Dusollier 2007: 1394).

Yet, if the path-breaking framework designed by Ostrom and the Bloomington school of political economy is a fundamental starting point, it is not fine-grained enough to capture the physical as well as ontological complexity of seed. As Fabien Girard's chapter illustrates (Chapter 7), due to its coevolutive (it is the result of interactions between communities and the physical world), reproductive and hybrid nature (it is both physical and informational), a seed displays a high rivalry and a low excludability. Accordingly, following the economic typology of goods (public/private/club/common), seed should be treated as a public good. Here is something of a blind spot in the mainstream typology which does not account for the impact of technical (e.g., cytoplasmic male sterility) and legal measures (e.g., PBRs, patents, licensing agreements) on the excludability (and rivalry) of a good (see Halewood 2013). Besides, as we are reminded by Laura Rival in her fascinating account of Gudeman's anthropological investigation of property and access, Ostrom's model overemphasises market ends and the achievement of efficiency (hence the focus on the 'right to exclude'), to the detriment of the 'internal politics of attachment, membership, sharing, redistribution, obligation, gift, reciprocity' that characterise any community (Chapter 8).

Not only does this mean that we should distance ourselves from an 'essentialist' vision of goods – and that we should instead endorse a refined framework including new parameters, such as the effective demand for a good and the property regime applied to it (Nahrath 2015) – but that we are also urged to put a greater **emphasis on what is finally the central component of a commons:** '[…] the interactions of people and resources […]' (Ostrom and Hess: 13). As evidenced by the literature on the commons knowledge (Madison et al. 2010), it is at this interface between resources and community that we should stand if we want to capture the full potentiality of the commons.

This time, in line with a more constructivist approach of the commons (Dardot and Laval 2014; Amin and Howell 2016; Marella 2017), **Parts III** ('The struggle for the recovery of the shrinking bio-commons') **and IV** ('A new vitality for the bio-commons?') of the book expand on the *generative* dimension of the commons and goes on to underline the symbolic framework and often unformulated norms underpinning the relationship between a community and a resource. It also lends credence to new 'commons narratives' equating the commons to collective political constructs.

The series of chapters drafted by anthropologists and ethno-biologists provide a clear and accurate picture of the interlacing between resource and community and the importance of 'sharing discussion and thought (*koinônein logôn kai dianoias*)' (Aristotle, *The Nicomachean Ethics*: 1 170b10–14) for a community to arise, persist and/or thrive. Exploring three different and contemporary settings – the French farmers' movement: the '*Réseau Semences Paysannes*' (RSP), the Spanish seed network: '*Red de Semillas: Resembrando e Intercambiando*' (RdS) and three Swiss organisations (*Getreidezüchtung Peter Kunz – GZPK*, *Gran Alpin* and *Pro Specie Rara*) committed to the conservation and sustainable use of agricultural plants and animals – Elise Demeulenaere's chapter (Chapter 13), Victoria Reyes-García et al.'s contribution (Chapter 12) and Susette Biber-Klemm's case studies (Chapter 15) carried out in Switzerland insist in either case on the *praxis* of peasants-commoners aiming to save or revive landraces, heirloom varieties and TK needed to select, improve and adapt them to the local environment, as well as to defend on-farm breeding. At an analytical level, despite the differences between the three experiences, the pattern of commoning displays a set of political and technical actions aimed at drawing the boundaries of the group (through rules of inclusion). These actions allow for a strengthening of 'community of practices' through discussion, experimentation and sometimes cooperation with scientists as well as advocacy strategy through networking. Also, harnessing the common resource is a way to accommodate the needs (e.g., for baking bread, crop-livestock farming, biodynamic or organic agriculture) and values (e.g., *terroir*, shift away from the industrial model, struggle for seed sovereignty and autonomy) of the community and its environment without losing sight of the need for its preservation and maintenance. Likewise, as in all cases, the community is directly mediated by the seed – which is not a means to an end, but an end in itself – the seed is the catalyst for the group's identity, norms of adhesion and of seed circulation within the collective.

However, there are a few notable differences between the three. In contradistinction with the RdS' aim to open a large space for access and exchange of landraces and TK (more in line with international calls for 'free biodiversity' or 'liberate the seeds' – see Chapter 13), the French RSP favours socially constrained exchanges of peasant seeds between the farmers-commoners. For instance, members of the RSP must abide by the rules of exchange strongly disparaging commercial exchanges (seed purchase) and praising instead a gift-counter-gift dynamic. While restraining the grip of the 'disembedded' market, exchanges are more deeply rooted in the social, cultural and economic value underwriting the life of the community and ruled by the discrete identity of the seed. Admittedly, the link between seed provider and recipient is governed by unwritten rules of trust and hierarchy (e.g., prestige of the provider, outstanding character of the seed collection). But these rules operate against the backdrop of the ontological status of the seed: attachments between providers and recipients are mediated by the seed itself, as *entitlement to the seed* is ultimately decided on the ability of the candidate to be 'tested' and 'tamed' by the plant, on her aptitude to embrace a new world's vision wherein humans and non-human can

coexist (Demeulenaere and Bonneuil 2011). This is what Susette Bibber-Klemm calls the sociocultural 'embeddedness' of seed networks.

This brief account of modern struggles in Western societies has ghostly echoes of a European rural past. It may also mirror experiences of worse-off local communities and indigenous peoples fighting all around the world to maintain their resources, associated knowledge, customs and ways of life. However, the comparison might be misleading. Just as the overemphasis on collective action problems seen through the lens of the market overshadows the multifaceted attachments between the community and the 'resource', so too the insistence on efficiency-oriented institutions distorts the proper vision of what are seed systems in traditional societies. Indeed, Éric Garine and his colleagues (Chapter 9) insist in their chapter that seeds are much more than an input to agricultural production for farmers – they are a source of wealth, pride, and identity; above all, seed systems are shaped by social structure (kinship) and symbolic values. Drawing on Gudeman's insight, we could further argue that seed is part of the 'Base', i.e. the 'shared materials and services of a community', 'a heritage that lies outside the person as material resources, tools, and knowledge, and within as sediments from others that create an identity' (Gudeman 2008: 28). In other words, and as evidenced by Badstue et al.'s field study in the Central Valleys of Oaxaca, Mexico (2006), **there is no such a thing as a defined group of farmers and specifically tailored institutional structures related to seed supply**. At the most, the study reveals informal institutions with fuzzy rules 'that are not predetermined and that adjust to contingencies' (Badstue et al. 2006: 268). In their chapter Éric Garine et al. also note that 'farmer seed systems are an emergent property of pre-existing social forms of organisation which define the role and status of individuals and which pre-exist seed transactions' (Chapter 9). This means that even though traditional farmers arguably express needs (e.g., landraces that are locally adapted to environmental conditions) and preference (taste, colour, etc.), and experience problems related to seed (crop failure, loss of seeds, climate hazards, climate change), they satisfy the former and cope with the latter according to principles and rules partially alien to calculative reason or formal rationality.[15] If, from an efficiency-oriented perspective, it may seem that farmers exclusively act as rational actors when they rely on seed and information provided by close relatives and owners of neighbouring plots – for, in so doing, they can enhance the *reliability* of what is accessed – transactions are in fact mainly governed in the wider context of the social relation between the involved parties, even if they are often being mediated by nodal farmers representing more secure sources of supply (e.g., the 'Big Boss', the most knowledgeable members of the community, expert cultivators, the healer). Beyond ethnicity, language and kinship, it has been established that several socio-economic factors such as age, gender, wealth and income status, education or social status can also act on seed circulation (Jarvis et al. 2016). Finally, being more than a biological object, seeds can also circulate following different paths according to their biocultural values (e.g., plants are differently valued depending on whether they are grown for starchy food, side dish food or snack food).

Nevertheless, the importance of local markets for sourcing seeds should not be underestimated. Éric Garine and his colleagues (Chapter 9) insist that seed purchase probably accounts for a large proportion of seed transactions, even though it might be assumed that the frequency of market exchanges (purchases or barter where quantities are calculated based on market prices) positively correlate with the breadth of the social distance between supplier and recipient (in other words, purchases and barters can take place because social constraints have less of a hold on transactions between acquaintances and strangers – Badstue et al. 2006).

Unless confined in a bag of seeds, itself jealously kept by an egoistic farmer, seeds can easily circulate and be widely disseminated through different communities and environments where they keep evolving. Seed circulation raises the issue of communities' borders. Communities are Janus-faced: being more often than not nested into each other, they overlap and communicate. At the same time, they can remain firmly closed to 'foreigners'. Overestimating the importance of norms regulating access and the right to exclude, the literature on the commons generally misses the point of contact between two Bases or communities. To be sure, *free riders* (e.g., opportunists, enemies, bioprospectors) may be forcefully rejected and denied any access to the seed and related knowledge; but there is still room for benevolence towards *outsiders*. These are not necessarily called upon to integrate the community and fully access the great wealth of resources, values and knowledge that allow for its sustainability. In most cases, they only represent the porous side of the commons, the flexible border (that may change over time) where, to paraphrase Laura Rival in her chapter (Chapter 8), membership is normally negotiated, but where more surface-level (i.e. less socially constrained) relationships can be initiated and allow for the circulation of seeds through seed networks. They reflect the importance of 'reciprocity', elegantly described by Gudeman as 'an overture – a supplication and response – of identity and base sharing' (2008: 41). Recent studies show the role of 'bridging' or 'connector' farmers playing a central role in connecting other communities (i.e. subnetworks) and they are critical for flow of seeds or genetic materials across communities.

How can these local bio-commons be protected and fostered, the shrinking or endangered ones as well as the innovative ones? How to encourage on-farm management and sustain farmers' efforts to select and manage local crop populations? Depicting the struggle of Colombian farmers to achieve the 'collective building of living systems of traditional seeds' ('*sistemas vivos de semillas campesinas*'), Patricia Guzmán-Aguilera gives us a hint of what might be done locally: the support and promotion of seed custodians; the reinforcement of community seed houses; the putting into place of quality assurance systems that attest to producers' compliance with a set of criteria and the creation of traditional seed markets (Chapter 11). Whatever their merits, most of these measures are conditional upon the assertion of farmers' rights to save, use, exchange and sell farm-saved seed. Besides, it remains critical to exempt landraces and farmers' new varieties from mandatory registration requirements and seed release regulations.

Finally, the conservation and development of the local bio-commons shall depend on the appropriate protection of indigenous peoples', local communities' and farmers' agricultural innovation, i.e. landraces, new varieties and related TK. Given that the CBD, the Nagoya Protocol and the ABS schemes are not completely implemented worldwide, that they are ill-suited to agricultural biodiversity systems and that, in any event, they have proven insufficient to provide against all instances of misappropriation, the challenge remains in how to work out a remedy to substantially protect the plant genetic resources and especially their associated TK. Many propositions are made throughout the book to curb biopiracy and to promote the local bio-commons. For example, in her chapter on Geographical Indications (GIs) and the Commons, Barbara Pick (Chapter 14) assesses the relevance of GIs for the preservation of traditional methods of production and natural resources. Drawing on the case study of the French *Lentilles vertes du Berry* (Protected Geographical Indication (PGI) under the European law), she shows how the specific features of GIs (they are a form of collective monopoly right and can potentially be held for an unlimited period of time) make them particularly amenable to accommodate the nature of TK. The book also expands on IPRs, such as PBRs that might be redesigned so as to protect landraces and local varieties. Fabien Girard (Chapter 7) reminds us that this path has been taken by Thailand, India and Malaysia where domestic legislation allows for a community to claim a *sui generis* right on a local variety. There are also legal developments underway in Colombia where the Constitutional Court opened the way for the recognition of community rights on local varieties within the framework of the UPOV convention. Nevertheless, both Patricia Guzmán-Aguilera (Chapter 11) and Geoffroy Filoche (Chapter 10) demonstrate that local varieties generally do not meet the criteria for protection under PBR laws. Importantly, given their complex pedigree, landraces represent populations of genotypes, and it is often overly difficult if not impossible to delineate the contribution of different communities. Therefore, it may be difficult to grant rights to a single community without arbitrarily wiping out the role of other deserving groups of farmers.

This is a common and more general objection to bioprospecting contracts based on mutually agreed terms and entered into within the framework of the CBD and the Nagoya Protocol. It is well documented that, in some instances, these contracts have raised disputes between communities, and have thus been denounced as unfair for the communities excluded from benefit-sharing despite their involvement in the collective management of the resource accessed (Brush 2004: 241).

It is true that, in some cases, the risks of negative interactions between communities remain low. As Geoffroy Filoche (Chapter 10) illustrates in his account of the Sateré-Mawé's efforts towards the reappropriation of Guarana, an Amazonian vine which is part of their culture, attachments and entanglements between a *community, a territory and a resource* can be so strong as to generate a new 'entity' which is incommensurate with the status given to the 'resource' outside the community. In the case of the Sateré-Mawé, Guarana, which has become an integral part of the Brazilian identity, is neither a raw material for industry, nor an 'element of biodiversity', or a collection of 'plant varieties' or a 'typical

product'. The Sateré-Mawé's Guarana emerges as a 'hybrid of nature and culture' that the community managed to single out as the 'native' or 'real' Guarana through the establishment of a common property regime.

Then again, how to proceed beyond these rare instances where a discrete resource can be connected to a distinctive community and organised around rules and institutions for collective actions? As Fabien Girard reminds us in his chapter (Chapter 7), the recent *Mo'otz Kuxtal* voluntary guidelines (Morgera 2017) gives ground for hope in a better implementation of ABS schemes. Indeed, emphasising the role of customary laws and 'community protocols', the voluntary guidelines provide *all the communities* involved in the management of a resource – e.g., those involved in the management of a metapopulation (see Brush 2004: 242–3) – with a means to define themselves at an intercommunity level (Munyi and Jonas 2013) and to set out their rules and social practices and the way they expect bioprospectors to engage with them. While they avoid 'cutting collectives', i.e. producing a collective *tailored* to sorting out between deserving and underserving 'contributors' to the production of the new technology (see Hayden 2007), community protocols guard against tensions between communities and push for the recognition by States and international organisations of local customs and practices, other cosmographies and non-human agency. Elsa Tsioumani (Chapter 2) advocates that ABS schemes could be further reinforced through an amendment to TRIPS requiring to disclose the origin of genetic material and evidence of prior and informed consent and benefit-sharing in patent applications.

At the risk of concluding with an overly pessimist tone, it should nevertheless be remembered that community protocols also represent threats to cohesiveness and lifestyle of communities. As we have said, the strength of traditional farming and farmer seed networks is that decision-making operates against the backdrop of undifferentiated social norms and values and in a decentralised way. This '"multi-niche" situation', which allows for human and social mobility, the fluidity of knowledge and seed exchanges and the ongoing adjustment of social practices, is expected to 'conserve diversity to a greater extent than if customs, regulations, markets, uses and environments were uniform and enforced' (Jarvis et al. 2016: 267). In sum, community protocols imply the design of institutions of collective actions (with an emphasis put on the 'right to exclude') conducive to uniform and efficiency-oriented practices and which are very likely to disrupt the dynamics of seed exchanges within local communities.

The path of the global commons: thinking global for the seeds?

While zooming at the unit level of the bio-commons, all chapters above point to the interconnections that communities and local bio-commons have with each other. This multilayer interconnected network highlights the interdependence of seeds and of communities and implies necessarily another layer of analysis: the global level. **The last part of the book** ('Part V: Thinking global: a global commons for the seed?') focus on this global level, trying to grasp the issues at stake in a global seed commons.

Sélim Louafi and Daniele Manzella's chapter uncover the various dimensions of heterogeneities aggregated with the global commons established under the ITPGRFA (Chapter 16). Through a thorough technical analysis of the Multilateral System – an advanced expression of cooperation for management, conservation and distribution of globally pooled resources – they demonstrate that the existing benefit-sharing mechanisms 'do not fully address the high heterogeneity of actors and resources revolving around the Treaty commons'. They contend that 'the cooperation logic enshrined in the Treaty is implicit in the global scale of its access and benefit-sharing mechanism'. However, they argue that the participation and empowering functions of the MLS, yet essential in the conception of equity promoted by the Treaty, have remained imperfectly addressed so far due to the contractual logic and the project-based approach for the disbursement of funds. Sélim Louafi and Daniele Manzella (Chapter 16) propose an institutional framework that would 'anticipate, integrate and respond to heterogeneity and fragmentation before conflicts arise and the commons management is undermined'. Represented by a multi-stakeholder platform, it intends to fully exploit, rather than suffer from, heterogeneity, thereby allowing the global seed commons to function efficiently at the global level.

Finally, Christine Frison's chapter concludes this book with an analysis of underlying commons principles behind the ITPGRFA system that could harness its potential to reach food security and sustainable agriculture objectives (Chapter 17). One can arguably identify, as Christine Frison does, a narrative that shows a clear willingness to design an effective global seed commons where seeds would be accessible for all its stakeholders, including smallholder farmers, in order to reach food security and sustainable agriculture. However, practice shows that the seed commons is only effective for researchers and breeders. Moreover, a clear contradiction exists within the Treaty, between its objectives and the designed obligations to reach them, in particular regarding the limited recognition of Farmers' Rights at the international level. As it does not mitigate the imbalance of rights opposing smallholder farmers and big seed/agrochemical multinationals on the issue of the appropriation of seeds and their related knowledge – reinforcing exclusion rather than an inclusive approach –, the Treaty remains unable to reach its objectives. Building on these results, Christine Frison unravels six specific underlying principles deriving from the 'philosophy of the commons' in her analysis of the global seed commons: (1) sustainability; (2) interdependence; (3) the anticommons dilemma; (4) the physical and informational components inextricably bound to the use of seeds; (5) the global seed community and (6) diversity, heterogeneity and complexity (Chapter 17). These underlying principles should be better expressed in the rules and procedures of the global seed commons in order to mitigate the identified constraints in the implementation of the Treaty and contribute to the realisation of its overall goals. Christine Frison pleads for a real 'global seed commons' to be redesigned during the ongoing review process, i.e. one that involves all its stakeholders, in order to face major social challenges such as producing sufficient and quality food in times of climate changes and persisting world hunger and poverty (Chapter 17).

Notes

1 Girard's contribution to this research was supported by the ANR (Project 'ANR-15-CE21-0004' CommonPlant).
2 Countries' dependence on food imports (Laroche Dupraza and Postollec 2013).
3 Marginalisation of small-scale farmers and especially youth and women (UNDP 2003; Ziegler et al. 2011).
4 Biodiversity losses (Scherr and McNeely 2008) and soil degradation (Bourguignon and Bourguignon 2015).
5 Non-communicable diseases (Ye et al. 2013).
6 See Graham Dutfield's chapter on this aspect (Chapter 1).
7 In the United States, UPOV-like rights have been implemented by the Plant Variety Protection Act 1970. It had opened up protection for new, distinct, uniform and stable sexually reproducing crop varieties.
8 A tipping point has been reached in 2015 in the 'Broccoli' & 'Tomatoes' cases, as the Enlarged Board of Appeal of the European Patent Office (EPO) ruled that plants or seeds obtained through conventional breeding methods are patentable; thereby widening the extent of patent claims over plants and plant varieties. These two cases are further discussed by Graham Dutfield.
9 There is evidence that biodiversity has positive impact on food security (Wittman et al. 2017). Conversely, 'support for indigenous and traditional food systems as the basis for food security can also have a protective function for the maintenance of regional agrobiodiversity' (ibid.: 1292).
10 The ILP comes after several initiatives which have been on the rise over the last decades. Can be mentioned, for instance, projects 'patent Lens' and 'Public Sector Intellectual Property Resource for Agriculture (PIPRA)', two clearinghouses databases which provides information on patented inventions; or the 'European collective management of Public Intellectual Property for Agricultural Biotechnologies' (EPIPAGRI), launched by the French *Institut national de la recherche agronomique* (INRA) and endorsed by the European Commission, which was a technology exchange clearinghouse (van Zimmeren 2009).
11 See: Halewood (2013), Dedeurwaerdere (2012a, 2012b), Schmietow (2012), Byerlee and Dubin (2010), Onwuekwe (2004), Falcon and C. Fowler (2002). The most comprehensive study is the collective book edited by Halewood et al. (2012). Also see, Frison (2016).
12 Halewood et al. (2012), Halewood and Nnadozie (2008), Helfer (2005), Raustiala and Victor (2004), Safrin (2004), Falcon and Fowler (2002).
13 In contradistinction with Hardin's account of the tragedy of the commons (1968), a commons in not an open access resource. One of its distinctive features, in institutional economics, is to encompass a 'right to exclude' and to regulate not only the management of the resource but also who is entitled to extract units of the resource (Ostrom 1990).
14 See *inter alia* the works of Mattei (2011, 2012, 2013) and Lucarelli (2011, 2013).
15 In this respect, it may be difficult to contend that kinship and intra-community relationships play a similar role to the one that seed certification has in formal seed sector (comp. with Badstue et al. 2007).

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Which scale to understand seed fluxes in small-scale farming societies? Snapshots of sorghum from Africa

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