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How Have Markets Affected the Governance of Agrobiodiversity?

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Abstract

This chapter focuses on the role of markets (especially those of agricultural products) in agrobiodiversity governance. Over the past two decades, expansion of global agricultural product markets has, in general, furthered the simplification of agricultural and food systems, reducing the diversity within crop and animal species. Farmers who continue to conserve on-farm agrobiodiversity are providing global public goods in terms of food security and environmental sustainability insurance for the world's population, both currently and in the future. Yet because markets or other global institutions are not compensating farmers for conserving high levels of agrobiodiversity, these farmers face little private incentive to maintain on-farm conservation practices and may resort to practices that result in reduced levels of agrobiodiversity, which in turn could lead to the destruction of local food systems and general biodiversity loss. To enhance both agrobiodiversity conservation and income generation through market-based instruments, endeavors to place a value on agrobiodiversity that signal its true production cost and contributions to genetic resource usage should be further developed. It is proposed that payments for agrobiodiversity conservation schemes and niche market development through differential marketing, labels, certification schemes, and agrotourism are needed in concert to provide a robust foundation for agrobiodiversity conservation activities, building on both private sector investment and government funds. Depending on the context, these measures hold great potential for the successful marketing of agrobiodiversity and agrobiodiversity niche products through collective action. Constraints and potential unintended consequences of market-based approaches to agrobiodiversity conservation need, however, to be taken into account.

Introduction

To examine the impact of markets on the governance of agrobiodiversity, we analyze the interrelationships between agrobiodiversity, markets, and

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sustainability that are necessary to an integrated scientific framework of agrobiodiversity. We begin by explaining what the governance of agrobiodiversity entails and how it contributes to global food and environmental security. We then illustrate how the integration of farmers into markets generally leads to declining private incentives to conserve agrobiodiversity on the farm. We discuss several market approaches to *in situ* agrobiodiversity management that have the potential to lessen or even reverse this tendency and address factors that enable or constrain the marketing of agrobiodiversity products. In conclusion, we offer recommendations on how to support sustainable food systems and expand agrobiodiversity governance while promoting *in situ* conservation at the farm level through the marketing of agrobiodiversity products.

The Governance of Agrobiodiversity

For the purposes of this chapter, we follow the arguments of Johns et al. (2013) and Padulosi et al. (2011a): agricultural biodiversity, henceforth referred to as "agrobiodiversity," comprises cultivated plants and animals in agricultural ecosystems as well as wild foods and other products gathered by rural populations for their livelihoods through the application of traditional, locally sourced knowledge (cf. Chapter 8). A distinction is made between planned agrobiodiversity (i.e., the diversity of crops and livestock directly managed by farmers) and associated biodiversity (i.e., the biota in the agroecosystem that survive in the presence of local management and environmental conditions) (Jackson et al. 2007; Kontoleon et al. 2008).

The sustainability of global agriculture and related ecosystems is dependent on the use, enhancement, and consequent conservation of agricultural biodiversity (Bardsley 2003; Lockie and Carpenter 2010). Agrobiodiversity plays a pivotal role in enhancing farm productivity, developing resilient farming systems, generating income, providing ecosystem services, and climate regulation as well as creating food and nutrition security for the world's population (Kruijssen et al. 2009b; Padulosi et al. 2011a; Thrupp 2000).

Governance of agrobiodiversity has three components: access, use, and management. Access entails the legal entitlement, permission, or (free) admission to obtain available plant and animal genetic resources for food and agriculture (Andersen 2006). Use of these species and varieties for subsistence or sale implies having access to them. Management can take place both *in situ* (on the farm) or *ex situ* (outside natural habitats, normally in gene banks) (De Boef et al. 2012; Gauchan et al. 2005). Most agrobiodiversity is actively managed and consequently maintained *in situ* as part of smallholder family farming practices (Padulosi et al. 2011a). As certain key elements of genetic resources cannot be captured and stored outside natural habitats, dynamic *in situ* strategies that result in sustainable conservation are necessary to maintain traditional knowledge, to increase the adaptation and resilience potential of species and

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varieties, and ultimately to prevent global loss of plant and animal genetic resources (De Boef et al. 2012; Narloch et al. 2011a).

Farmers around the world as well as human society at large depend on agrobiodiversity for their multiple production objectives and livelihoods (Lockie and Carpenter 2010). Over many centuries, ancient agricultural settlements have made use of diverse plant and animal species and varieties to enhance productivity and adapt to new social and environmental challenges. Through on-farm diversification of crop species and varieties as well as landscape-level effects, smallholder farmers frequently aim to reduce the risk of food shortages and production fluctuations that result from abiotic shocks (such as drought), biotic stress (e.g., pest, disease outbreaks), and seasonality (Frei and Becker 2004; see also Chapter 6). Many traditional practices that were applied in the past to utilize, improve, and adapt agrobiodiversity in smallholder farming systems are still operational today in both large- and small-scale production systems; examples include the exchange of seed within and between different regions and the selection of best breeds for adaptive production (Thrupp 2000).

It is well recognized that smallholder family farmers in low- and middle-income countries have important roles to play in maintaining a dynamic and evolutionary state of agrobiodiversity conservation (Lockie and Carpenter 2010). Simultaneously, these agrobiodiversity-producing smallholders have become part-time farmers integrated within a wide range of product and labor markets (Zimmerer et al. 2015; see also Chapter 8). Indeed, smallholders conduct farming under highly varied circumstances and manage the majority of the world's rich stock of animal breeds and crop varieties. Through their governance practices, genotypes with unique and valuable traits are created and maintained for breeding and research (Frei and Becker 2004; Johns et al. 2013). The diversified agroecosystems maintained by smallholders are crucial for ensuring global food security because of their high resilience to environmental shocks, particularly in the context of climate and socioeconomic change (Frei and Becker 2004; Gonzalez 2011; see also Chapter 7). Furthermore, these diversified agroecosystems and landscapes provide a habitat for a large range of associated biota and contribute to sustainable production (Berg 2009; Bianchi et al. 2006; Frei and Becker 2004; Thrupp 2000). In summary, traditional food systems link the socioeconomic resilience of smallholder farmers with global food and nutrition security (Johns et al. 2013).

Currently, however, diversity hotspots (i.e., traditional "home gardens" and genetically diverse small-scale polycultural systems that include multiple landraces) are primarily found in environmentally heterogenic or marginal parts of Asia, Africa, as well as Central and South America, where pressure for intensification and specialization potentially conflict with diversification (Thrupp 2000; Van Dusen and Taylor 2005). The often lower levels of market infrastructure and agricultural technology in low-income countries can make farmers more reliant on local agrobiodiversity management. In richer and middle-income countries, genetic improvement to enhance the quality or

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quantity of food has become increasingly managed by professional plant breeders and formalized seed systems (Gauchan et al. 2005). It could be argued that there is less need for individual farmers in richer and middle-income countries to govern and invest in agrobiodiversity as a natural insurance against environmental risks (Van Dusen and Taylor 2005). However, current global trends suggest that certain farmers, agricultural and food institutions, and consumer groups are employing expansion practices that entail agrobiodiversity use and governance in richer and middle-income countries (Chapters 8 and 13).

Product Market Integration and Impacts on Agrobiodiversity Conservation

Changes in the production or marketing environment, or both operating simultaneously, can induce farmers to grow landraces and modern varieties because of their relative advantages (Gauchan et al. 2005; see also Chapter 8). The greatest threat to agrobiodiversity is nonuse that occurs as farming systems become increasingly homogenized and specialized (Lockie and Carpenter 2010). It has been suggested that 75% of the world's richness in agrobiodiversity has been lost over the course of the twentieth century (Brush et al. 2015; FAO 2010b; Gonzalez 2011; Padulosi et al. 2011a), through the introduction of genetically uniform modern varieties which have superseded local varieties. Regional studies, however, indicate that this supposed one-to-one replacement is less straightforward than commonly assumed (Brush 2004; Zimmerer 1997). Relative loss, commonly reflected as a reduction of the area dedicated to landraces, can partly be attributed to the perceived low economic potential of landraces compared to modern varieties. In practice, traditional plant and animal products in remote and marginalized areas often suffer from a lack of value additive methods, or the infrastructure and technology for transformation (Padulosi et al. 2011a), as well as missing or incomplete markets that result in high transaction costs (Van Dusen and Taylor 2005).

The word "market" can refer to several meanings, such as the physical location where the produce is exchanged (the local market) or a form of exchange based on a price mechanism. Markets offer smallholder farmers opportunities to participate and benefit from consumer demand and economic growth (Ferrand et al. 2004). Since smallholders are a heterogeneous group, the markets in which they participate differ in terms of size, location, links to other markets, power relations among market actors, and institutional environments (see also Chapter 8). Local-to-global agricultural product markets encompass periodic (e.g., daily, weekly) assemblies of buyers and sellers in a given place. Normally this takes the form of open-air markets but sometimes they are situated in more permanent, covered structures (Anderson et al. 2010). The useful description of a local agricultural market includes the elements of farmers

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being sellers and buyers in transactions involving commodities and seeds (and thus agrobiodiversity) (Fafchamps and Vargas (2005). These markets need to be seen as local institutions through which buyers and sellers (and those conducting barter exchanges) enact their transactions.

Some of the factors commonly related to market and economic development can have an adverse effect on the demand of farmers for agrobiodiversity on their farms by reducing the incentives to maintain it. This is due to increasing opportunity costs of maintaining diversity, the availability of new consumer products and substitutes for previously self-grown or collected products, as well as social and cultural change. Since most markets aim for homogeneity and nonseasonality, their capacity to handle diversity is limited. In addition, the availability of hired labor, inputs, or machinery may decrease the demand for diversity as will an increase in net return from agriculture due to increased income or cheaper inputs. Nonfarm sources of income, including income from smallholder migration and household remittances, can level out fluctuations in farm income and may decrease agrobiodiversity (Bellon 2004), though migration can also support higher levels under certain conditions (e.g., Andean maize in Bolivia) (Zimmerer 2014). The substitution of consumption products takes place when a crop with a high personal value (and its substitutes), for which previously the market was missing, becomes available (Van Dusen and Taylor 2005).

World population growth coupled with urbanization, supermarketization, and changing dietary preferences and consumption patterns demand high productivity from our agricultural systems (Devaux et al. 2009; Westhoek et al. 2014). Emphasis is placed on food industry requirements for crop and animal products, such as "prices, relative advantage, consumer tastes, yield, standardized production and uniformity of maturity" (Padulosi et al. 2011a:141). Varieties that cannot comply with these standards are either ignored or marginalized into niche markets (Padulosi et al. 2011a). Another major constraint of traditional agriculture, commonly aggravated by lack of access to resources, is its low productivity in comparison to intensive farming systems (Johns et al. 2013).

During the Green Revolution in the 1960s and 1970s, technology packages transformed traditional agricultural systems into large-scale commercial monocultures (Frei and Becker 2004; Gonzalez 2011; Holt-Gimenez et al. 2006). These intensive farming systems are characterized by several requirements for high-yielding varieties, such as enriched seeds, synthetic pesticides, fertilizer inputs, and large quantities of water and fossil fuel energy (Frei and Becker 2004; Holt-Gimenez et al. 2006). Despite greatly increasing the global food supply by producing much higher yields than traditional farming systems, intensive agriculture leads to a range of social and environmental problems, including the marginalization of traditional farmers and worldwide loss of genetic diversity (Bardsley 2003; Frei and Becker 2004; Gonzalez 2011; Jackson et al. 2007; Thrupp 2000).

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The expansion of global markets over the past two decades—a nonuniform and complex process—has, in general, led to a simplification of agricultural and food systems and has significantly reduced crop and animal species diversity in several regions (Devaux et al. 2009; Khoury et al. 2014a; Narloch et al. 2011a; Van Dusen and Taylor 2005; Westhoek et al. 2014). As areas become increasingly integrated in regional and global markets, the opportunity costs to conserve on-farm diversity rise (Van Dusen and Taylor 2005). To sell their produce at these markets and receive economic incentives, farmers must comply with food industry requirements (Narloch et al. 2011a). Consequently, these incentives frequently lead them to disinvest in agrobiodiversity as an asset (Pascual and Perrings 2007), though countertrends also exist (discussed further below as well as in Chapter 6).

The introduction of intensive agricultural systems led farmers around the world to substitute agrobiodiversity as a form of natural income insurance for financial insurance from the market. Therefore, the adverse impacts of environmental and market conditions were no longer (or only partially) mitigated by growing a large variety of crop and animal species but rather by relying on agricultural policies such as crop yield insurance, extension services, subsidies, and other financial assistance (Baumgärtner and Quaas 2008; Lockie and Carpenter 2010). This tendency, however, leads to a market failure problem: in addition to providing on-farm benefits, agrobiodiversity provides public benefits such as a genetic reserve to cope with future change, increased control of diseases and pests, and an abundance of crop varieties, animal breeds, and food products for consumers worldwide (Pascual and Perrings 2007). In addition, agrobiodiversity provides environmental services and contributes to the restoration of degraded lands (Gruère et al. 2009b). The market valuation of agrobiodiversity, however, is considerably below the levels associated with its services of as public good (Baumgärtner and Quaas 2008). This undervaluation by the market poses a sizeable hurdle for agrobiodiversity valuation (see Chapter 6).

Market integration often times entails a simplification of agricultural landscapes, the expansion of the agricultural frontier, and increased uniformity of agricultural practices that result in disinvesting in natural capital and the governance of agrobiodiversity (Bardsley 2003; Kontoleon et al. 2008; Padulosi et al. 2011a; Thrupp 2000). Consequently, the world currently relies on a small number of crops and animals with a narrow genetic base for its global food security. For example, out of several hundred thousand known plant species, just nine species supply over 75% of global plant-derived human food (Padulosi et al. 2011a). The global area trade-off of both high levels of intraspecific and interspecific genetic diversity with monocultures endangers the global food system by increasing the likelihood of crop failure as a result of environmental shocks or outbreaks of pest and disease (Bardsley 2003; Gonzalez 2011; Holt-Gimenez et al. 2006).

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Declining Private Incentives to Conserve Agrobiodiversity

Farmers who conserve *in situ* agrobiodiversity provide a global public good—one that underpins food security and environmental sustainability for the world's population, both now and in the future (Holt-Gimenez et al. 2006; Kontoleon et al. 2008). Although this conservation process provides a public ecosystem service, the actual landraces being conserved fall under national control over which countries have sovereign rights (Sullivan 2004). Landraces and local animal breeds tend to perform well in marginal production environments and often have nutritional values and harvesting cycles complementary to modern varieties (Narloch et al. 2011a). The *in situ* conservation of genetic diversity results in a range of ecosystem services: the supply of highly nutritious food with unique flavors, maintenance of local cultures and associated traditional knowledge, as well as the provision of natural insurance against extreme events and global change (Narloch et al. 2011a).

Most providers of agrobiodiversity services reside in remote areas of low-income countries (Narloch et al. 2011a), whereas agrobiodiversity services function more generally across middle-income and rich countries (Zimmerer et al. 2015). Since markets or other global institutions are not compensating farmers for conserving higher levels of agrobiodiversity, many of these farmers have little private incentive to maintain on-farm conservation practices and may resort to reducing agrobiodiversity, leading to impoverished local food systems and possible biodiversity loss (Holt-Gimenez et al. 2006; Lockie and Carpenter 2010; Perrings et al. 2009). Once connected to regional and global markets, and facing the demands of economies of scale, it is often more profitable for agriculturalists to specialize—that is, to grow only a few varieties favored by the market (Pascual and Perrings 2007)—or to resort to cultivating a combination of traditional and modern varieties for home consumption and income generation (Jackson et al. 2007).

Smallholder farmers in low- and middle-income countries tend to be disproportionally disadvantaged in terms of their inclusion into national and global economies: they have to operate within imperfect market conditions, have limited technical skills to comply with markets demands and bargaining power, and often lack access to information and the other inputs required for building competitive production systems (Devaux et al. 2009; Kruijssen et al. 2009b). In addition, many smallholder households are subject to increased shortages of labor time, frequently gendered through migration and other off- and nonfarm activities, and are often associated with agrobiodiversity loss (Zimmerer et al. 2015; Zimmerer and Vanek 2016). Consequently, their efforts to offset high transaction costs by maximizing production over the short term can lead to the erosion of local environments and natural habitats (Bardsley 2003; Holt-Gimenez et al. 2006; Thrupp 2000). Indeed, unsustainable intensification is a common pitfall when new boom crops, including potential booms of high agrobiodiversity crops, enjoy sudden demand (Hermann 2013). In addition,

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smallholders lack well-functioning financial insurance mechanisms that compensate for agrobiodiversity conservation, and farmers in low- and middle-income countries are increasingly at risk for adverse weather conditions, volatile global agricultural commodity markets, and the accumulation of debt (Frei and Becker 2004; Holt-Gimenez et al. 2006). The trade-off between income increase and on-farm agrobiodiversity conservation can potentially lead to a reduction of agrobiodiversity and a general degradation of natural resources through a simplification of production systems (Bardsley 2003; Kontoleon et al. 2008; Thrupp 2000).

Underlying dynamics are "the failure of markets to signal the true cost of biodiversity change in terms of ecosystem services, the failure of governance systems to regulate access to the biodiversity embedded in 'common pool' environmental assets, and the failure of communities to invest in biodiversity conservation as an ecological public good" (Perrings et al. 2009:231). A simplified conceptual framework, presented in Figure 15.1, aims at better understanding the complex relationship between markets and agrobiodiversity as well as the trade-offs between income generation and on-farm agrobiodiversity maintenance (Kruijssen et al. 2009a:416):

> One could imagine a farm household with a given level of household income and a certain level of agricultural biodiversity (inter- and intraspecific) present on its farm [in Figure 15.1, this is point 0]. Economic development takes place leading to an increase in farm household income from I to I^{i} [Intervention 1]... [T]his leads to a reduction in diversity from A to A^{i}, either because of a reduction in the variety of the original crop or because the crop portfolio has been replaced with a different (uniform) crop. The change thus leads to a shift of this particular farm household [in Figure 15.1, from 0 to I^{i}] along curve I [the income curve]. The theoretical trade-off that takes place is then the difference between the income increase and the agrobiodiversity lost. Quantifying the trade-off requires assigning a monetary value to the resources lost...Reducing the trade-off would require a change in the relationship between agrobiodiversity maintained on-farm and household income. This is represented in Figure 1 by the shift to curve II [in Figure 15.1, through Intervention 2 or 3]...[T]he reduction in agrobiodiversity is now reduced to A^{ii}–A and the outcome for this farmer is [in Figure 15.1, Intervention 2], leading to a reduced trade-off. The scale of the axes can vary among cases and will change the slope of the curve.

Nevertheless, farm household decisions are not solely based on profit maximization. Smallholder farmers often use this diversity to address a range of ecological niches on their farms, to reduce risk, or to provide internal demand for a variety of products, cultural values, identity, and taste preferences. In some cases, market chains of specialized products positively affected the agrobiodiversity maintained on farm as well as the livelihoods of those participating in the chain (Devaux et al. 2011; Keleman et al. 2009). For instance, the marketing development of African garden eggs demonstrated an increase in

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social welfare: not only did this generate income for local producers and chain actors in Ghana, it promoted the sustained use and conservation of agricultural biodiversity (Horna et al. 2007). The cases of emmer in Italy and kokum in India (Kruijssen et al. 2009a), have shown that the trade-off can potentially be reduced with proper interventions and bring substantial economic benefits to poor smallholder farmers.

Placing a Value on Agrobiodiversity

As demonstrated by Figure 15.1, to enhance both agrobiodiversity conservation and income generation through market-based instruments, value must be placed on agrobiodiversity that signals its true cost and contribution to genetic resource functions. This value can be subdivided into

- use value, which encompasses the direct contribution of agrobiodiversity to food security, nutrition, and income generation through cultivation practices,
- nonuse value, which refers to the ethical value of agrobiodiversity and its role in food culture, and
- option value, which represents the potential to realize future value by providing genetic material for innovation.

We note that use value of agrobiodiversity is closely related to its insurance value in the case of temporal and economic stresses (Padulosi et al. 2011a).

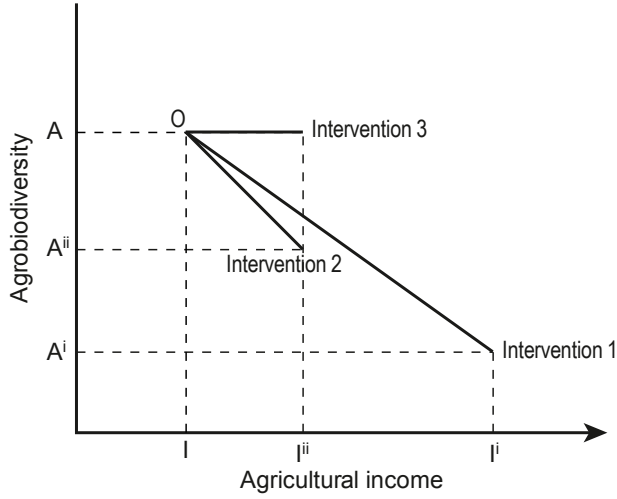

Figure 15.1 Conceptual framework of trade-off income (I) generation and *in situ* agrobiodiversity (A) maintenance (after Kruijssen et al. 2009a).

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Agrobiodiversity is classified as an impure public good because of the rivalry involved in its use and the difficulty of excluding users (Kruijssen et al. 2009b; Pascual and Perrings 2007). Agrobiodiversity is prone to market failure because of its characteristics as an impure public good, with intergenerational and interregional dimensions: agrobiodiversity has both public and private economic attributes, and farmers (as a group) tend to generate less diversity than is desirable to contemporary and future societies (Kontoleon et al. 2008; Kruijssen et al. 2009b; Smale et al. 2004). In addition, there are no markets for *ex situ* ecosystem services that depend on *in situ* agrobiodiversity (Pascual and Perrings 2007). This means that public interventions are needed to increase the private value of agrobiodiversity by economically incentivizing farmers to conserve plant and animal varieties with high public value on their farms (Kruijssen et al. 2009b; Pascual and Perrings 2007). Because of its public good characteristics, agrobiodiversity will be undersupplied if left to the market (Perrings et al. 2009).

At the sociocultural level, the conservation of agrobiodiversity builds on the preservation of traditional knowledge. Economic and institutional levels require the existence of markets, infrastructure, and a supportive institutional and legal framework (Padulosi et al. 2011a). To create efficient and effective markets for agrobiodiversity conservation, several steps would be needed to capture its public good values and prevent global free-riding on the services of small-scale traditional farmers. To this end, it is crucial to reconcile private and social values with regard to agrobiodiversity (Lockie and Carpenter 2010).

First, values of agrobiodiversity need to be identified and measured in price data. To this end, tools need to be developed (Pascual and Perrings 2007:259) to help (a) assess the functional role of species in their crop- and noncrop habitats, (b) identify the biotic and abiotic components of agroecosystem structures that support the provision of ecological services at the landscape level, and (c) assess the contribution of such ecological functions to human well-being. Subsequently, mechanisms and markets should be introduced that allow the demonstrated and measured values of agrobiodiversity to be channeled between its cost bearers and beneficiaries, allowing the cost bearers to receive benefits for their roles in agrobiodiversity conservation (Kontoleon et al. 2008; Narloch et al. 2011a).

However, ensuring that the importance of agrobiodiversity is effectively valued by market mechanisms is a complex matter. Generally, there is a lack of market acknowledgement of *in situ* agrobiodiversity conservation aggravated by continuous financial support for intensive agriculture through macroeconomic policies, such as subsidies and price controls that stimulate nonbiodiverse farming practices (Lockie and Carpenter 2010; Pascual and Perrings 2007). Fortunately, worldwide recognition is growing of the value of traditional varieties, landraces, and underutilized species in the context of climate change, rural poverty, and malnutrition (Padulosi et al. 2011a). Increasingly "attention is being given to the potential role markets can play for agrobiodiversity

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conservation through product differentiation and increasing competitiveness in niche and novelty markets" (Kruijssen et al. 2009b:46). Over the past decades, several international governance efforts have been made to increase the value of agrobiodiversity and other types of genetic diversity. These efforts include the establishment and testing of access and benefit-sharing systems, based on the Convention on Biological Diversity (CBD) since 1992 (Reichman et al. 2016), and the introduction of participatory plant-breeding initiatives since the mid-1990s (Ceccarelli and Grando 2007). The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, an international agreement enforced as of 2014, is a relatively new instrument aimed at increasing the value of genetic resources.

According to Johns et al. (2013:3437), the successful incorporation of agrobiodiversity products into modern markets requires overcoming the disadvantages of small-scale agriculture, accommodating the unique character of agrobiodiversity, taking into account the economic and social needs of smallholder communities, and avoiding or mitigating the potential negative consequences of market integration on agrobiodiversity conservation. If market chains of agrobiodiversity-specialized products (based on agrobiodiversity traits) were created, on-farm agrobiodiversity maintenance could be enhanced as could the livelihoods of the participating farmers in the chain (Kruijssen et al. 2009a). Analysis of market type, products, and situations involving agrobiodiversity products should be conducted to increase understanding of how agrobiodiversity could be used to improve livelihoods and maintain *in situ* biodiversity, keeping in mind that markets may not always be the most suitable tool to conserve agrobiodiversity (Giuliani et al. 2011). As certain types of markets and products will be more beneficial than others, it is important to analyze those circumstances under which agrobiodiversity product marketing could be most successful and sustainable, and to obtain a clear understanding of the trade-offs between increased income and maintenance of diversity in production systems (Kruijssen et al. 2009a). Similarly, we strongly recommend that future research focus on trade-offs between promoting few landraces versus multiple landraces and between different use, nonuse, and option values of agrobiodiversity.

Market Approaches to *In Situ* Agrobioversity Management

If left to market dynamics, agrobiodiversity as a public good will be undervalued (Pascual and Perrings 2007). However, by economically incentivizing farmers to change their land development decisions, innovative and flexible market approaches to *in situ* agrobiodiversity management have the potential to contribute to sustainable agrobiodiversity governance, to mitigate and adapt to climate change, and to improve livelihoods (Kruijssen et al. 2009b; Pascual and Perrings 2007). Several social movements in the Global North and South are advocating for the development of sustainable food systems that reduce

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greenhouse gas emissions, promote and value the use of agrobiodiversity, rely on local inputs, support the livelihoods of small farmers, and connect farmers and consumers through direct and inclusive value chains (Gonzalez 2011; see also Chapter 6 and 8; Jackson et al. 2007).

Linking agrobiodiversity products successfully to markets can play an important role in this dynamic. In fact, appropriate value chain and market instruments can induce consumers to behave in ways that are consistent with socially optimal outcomes (Perrings et al. 2009). Currently many valuable agrobiodiversity products—from exotic fruits and heirloom varieties to animal products from native breeds—are not well known among the greater public. Agrobiodiversity products could be introduced to consumers worldwide if (a) niche value chains were developed; (b) marketing, food literacy, and consumer behavior research were improved; and (c) production differentiation was better valued (De Boef et al. 2012; Padulosi et al. 2011a). Doing so might generate enough revenue for smallholders to allow agrobiodiversity conservation to pay for itself (Perrings et al. 2009). Market approaches that aim to place a direct monetary value on agrobiodiversity or contribute to the development of niche markets for agrobiodiversity products range from actual niche market development, certification schemes, and payments for agrobiodiversity conservation services (PACS) schemes to agrotourism (Lockie and Carpenter 2010; Pascual and Perrings 2007). On the supply side, some form of collective action is often indispensable to building successful value chains for agrobiodiversity products. Direct payment is possible for the direct values associated with agrobiodiversity production, consumption, and service provision, although other types of values (e.g., option or intrinsic value) are more difficult to link to market approaches.

Certification Schemes and Labels

In a context of increasing international trade and product uniformity, calls for market transparency, sustainable consumption, and the conservation of agrobiodiversity have led to the development of a range of private labels and certification schemes for food products. This, in turn, could facilitate the development of niche markets for agrobiodiversity products by allowing consumers to make informed decisions (Gonzalez 2011; Jaeger et al. 2017). As Gauchan et al. (2005:294) report:

> When consumers are willing to pay a premium for a quality that is associated uniquely with an identifiable landrace or group of landraces grown in a specific geographical area, the price differentials that result can generate an economic incentive for farmers to continue growing them.

Certification schemes are commonly implemented by using price premiums to reward sustainable producers or to exclude nonsustainable producers from certified value chains (Kontoleon et al. 2008). Examples include products that

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are specifically linked to regional markets, cultural knowledge, traditional processing methods, or a specific region or denomination of origin (Kontoleon et al. 2008; Lockie and Carpenter 2010). Several attributes of underutilized species could contribute to their marketability and branding strategies, such as a striking name, traditional knowledge and utilization, geographical origin, or history of a product (Will 2008). Geographical indication, protected designation of origin, and traditional specialties guaranteed—all labels with an international reputation that protects and links a product to a locality with its particular history—are useful for product promotion (Will 2008). However, we note that certification schemes and labels depend on dedicated consumers' preferences and their willingness to pay (Gauchan et al. 2005).

Payments for Agrobiodiversity Conservation Services

The conservation of agrobiodiversity is perceived as an ecosystem service that provides global benefits for which the wider community should pay (Narloch et al. 2011a). PACS are a subcategory of payments for ecosystem services (PES) schemes, which unites buyers and sellers in market-based, voluntary transactions to compensate for or trade environmental services (e.g., agrobiodiversity conservation). It also provides financial or in-kind incentives to actors that maintain or enhance the ecosystem service (Lockie and Carpenter 2010; Perrings et al. 2009). A variant of PES schemes are direct compensation payments, which are paid by government agencies to landowners for taking private land out of production and into conservation (Pascual and Perrings 2007). Less common, but upcoming are market creation methods for agrobiodiversity conservation, such as transferable development rights and auction contracts for conservation (Perrings et al. 2009).

As relatively new phenomenon, PACS increases the private benefits from *in situ* agrobiodiversity conservation of socially valuable, underutilized plant and animal species or varieties through a PES scheme, hence stimulating their conservation and utilization (Narloch et al. 2011a). We wish to stress that accurate information on the conservation status and monetary values of agrobiodiversity conservation is indispensable for the creation of effective PACS mechanisms, and that pricing access to ecosystem services could have the side effect of excluding and marginalizing local populations (Perrings et al. 2009). Furthermore, problems may arise in the identification of potential buyers and the articulation of meaningful conservation goals (Narloch et al. 2011a). PES schemes can be linked to benefit-sharing mechanisms, such as the pilot schemes being promoted by European Seed Association members on a voluntary basis.

Agrotourism

An alternative measure to promote *in situ* conservation of underutilized plant species as well as rare and useful animal breeds is agrotourism, a form of

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tourism that capitalizes on rural culture as a tourist attraction (Jaeger et al. 2017; Perrings et al. 2009). Through agrotourism, the use of typical regional breeds and varieties may be maintained to exhibit a landscape replete with cultural, historical, and natural characteristics. Farmer cuisine and the use of local landraces, breeds, and products are often highly valued by certain types of tourists willing to provide additional income to local farmers. Agrotourism fosters regional development and agrobiodiversity governance through schemes of equitable profit sharing. It is, however, dependent on the local context; that is, whether agrobiodiversity conservation and local economic development are consistent goals (Perrings et al. 2009).

Collective Action on the Supply Side

Without well-established value chains, underutilized agrobiodiversity products face several constraints for initial demand creation: high transaction costs for new business development, limited knowledge about technical issues for value addition, and access to capital resources. Hence, to achieve economies of scale and investment, "smallholders typically require market-based actions or incentives, some form of collective action that combines efforts of several producer households" (Johns et al. 2013:3437). Collective action can be defined as the coordinated behavior of groups toward a common interest (Kruijssen et al. 2009b). By uniting farmers and other value chain actors in the quest to deliver a stable and high-quality agrobiodiversity product, collective action can lead to a more equitable distribution of costs and benefits along the value chain, as well as enhanced market access and bargaining power, which in turn could increase market effectiveness and efficiency (Kruijssen et al. 2009b). In practice, collective action can result in producer groups, cooperatives, or other forms of clusters to organize supply.

Comparative analysis on collective action indicates that collaboration among actors could help the less advantaged actors improve their market position (Kruijssen et al. 2009b). Increased social capital can reduce risks, support sustainable production, and facilitate investments in processing technology. Nevertheless, collective action for smallholder market linkages is costly. High levels of effort and investment are required to achieve successful and sustainable collaboration among stakeholders and individuals. In addition, the environment, including the policy framework, needs to be conducive to collaboration (Giuliani et al. 2011).

Constraints for Marketing Agrobiodiversity Products

Given the private and public value of agrobiodiversity products, market access for products derived from underutilized species or landraces provides an opportunity both to enhance smallholder well-being and to contribute to *in*

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situ conservation. Market-based incentives are, in principle, among the most sustainable mechanisms for *in situ* conservation of agrobiodiversity because public interventions are unnecessary when they function well (Gauchan et al. 2005). Depending on the context, labels, and certification schemes, agrotourism and PES systems offer great potential for the successful marketing of agrobiodiversity and derived niche products through inclusive and integrated value chains. However, initial lack of demand, thin or small volume markets, as well as underdeveloped information systems limit opportunities for smallholder producers.

Hence, developing value chains and creating niche markets for agrobiodiversity products requires extensive start-up investment and technical assistance for adequate production, processing, packaging, and distribution processes. This could be provided by nonmarket institutions, such as government agencies and nongovernmental organizations (NGOs) (Gauchan et al. 2005; Johns et al. 2013).

Another reality for the marketing of landraces is that smallholders, who are reliant on their own production for consumption, may prefer to select taste and quality attributes that are not necessarily valued by urban consumers (Gauchan et al. 2005; see also Chapter 8). This is problematic because only those agrobiodiversity products that match consumers' tastes and preferences will be included in financially viable niche markets, resulting in the neglect of many underutilized species (Narloch et al. 2011a). Not all diversity can be marketed. To conserve varieties with uses restricted to traditional farmers, other business-led initiatives may need to be promoted (e.g., using a PES scheme). Alternatively, farmer cuisines and agricultural systems that build on diversity may need to be maintained. When global beneficiaries are not willing to pay the providers of agrobiodiversity, other agents (e.g., governments, NGOs) could act as buyers (Narloch et al. 2011a), as in the school feeding programs that have been implemented in Peru, Brazil, India, and Uganda (e.g., Beltrame et al. 2016).

Toward the Sustainable Governance of Agrobiodiversity

Synergetic valuation practices involving sustainable farming and changes in agricultural policies and institutions can potentially overcome the conflict between sustainable agrobiodiversity governance and markets (Thrupp 2000). In this context, sustainable agriculture is characterized by reducing the environmental footprint of agriculture, reliance on both farmers' knowledge and scientific innovations, and the quest to enhance and conserve agrobiodiversity (Gonzalez 2011; Jackson et al. 2007). Supporting and investing in the governance of local agrobiodiversity through sustainable agriculture renders possibilities to offset risks created by the dominant agricultural and development paradigm (Bardsley 2003).

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PACS schemes and niche market development through labels, certification schemes, and agrotourism should occur in complement to provide a stronger foundation for agrobiodiversity conservation activities, building on both private sector investment and government funds (Narloch et al. 2011a). However, several possible unintended consequences of market-based approaches to agrobiodiversity conservation need to be taken into account. For instance, although market-based approaches could raise demand for agrobiodiversity products and increase income for those farmers that conserve agrobiodiversity, they may also result in specialization and homogenization (Kruijssen et al. 2009b). To generate saleable surpluses based on consumer preferences, farmers may be required to focus on the cultivation of a reduced number of plant or animal species or varieties for successful niche markets, which would lead once again to unsustainable *in situ* conservation practices and expose farmers to market supply fluctuations and adverse weather conditions (Johns et al. 2013; Kruijssen et al. 2009b). All too often, the development of niche markets has resulted in unsustainable intensification and a gradual takeover by medium- to large-scale farmers (Tobin et al. 2016). Examples include the development of potato landrace, quinoa, and maca value chains in Peru. While local markets can be important for agrobiodiversity, studies also show they may contain lower levels relative to nonmarket transactions (e.g., millet diversity in seed fairs; Smale et al. 2014). Finding the right mix of market and nonmarket incentives is a challenge and must be carefully considered if we are to achieve the viable maintenance of agrobiodiversity. Indeed, no market can absorb all of the diversity that exists. Therefore, market approaches should be complemented by activities (e.g., school curricula, diversity seed fairs) that promote livelihoods and farming systems which value diversity. Furthermore, public awareness campaigns are necessary to underline the nutritional, taste, and traditional values of products and attract consumers' preference for different species. One example of this is found in the Kolli Hills, India, where the M. S. Swaminathan Foundation has helped local farmers increase the markets for minor millets (besides that of white rice) by developing new recipes and diversifying the products (Gruère et al. 2009a).

Moreover, to manage the trade-offs that occur between market integration and maintenance of *in situ* agrobiodiversity, it is essential to consider the diverse levels of the managed agrobiodiversity (e.g., household or community/village level). Even though there is a tendency to focus on a restricted number of varieties at the private household level, diversity at the community level can still be maintained as different households specialize in diverse crops. Hence, the outcome of a trade-off analysis (Figure 15.1) depends on the level of considered diversity as well on the type (Kruijssen et al. 2009a). Above all, it is of high importance to incorporate the interests, needs, and institutions of smallholder farmers in market-based approaches for agrobiodiversity conservation (Johns et al. 2013). Furthermore, capacity development on value addition and marketing practices for farmers and other value chain actors is crucial to create

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enabling environments for niche markets focused on agrobiodiversity products (Padulosi et al. 2011a).

Questions that remain to be answered focus on the public good characteristics of agrobiodiversity and its conservation. Because farmers are rational actors, there is no guarantee that, when given the choice, they will choose to conserve agrobiodiversity to benefit our global society if they do not gain a personal benefit (e.g., income or access to preference traits). Farmers do not select crops and varieties to grow based on a rationale to conserve; their decision making is informed by both market- and household-level criteria. Furthermore, from an evolutionary perspective, we must expect that some agrobiodiversity will be lost while new diversity will be added. By creating or re-governing markets in such a way that agrobiodiversity is recognized and maintained or enhanced, it may be possible to increase these benefits and maintain on-farm agrobiodiversity (Kruijssen et al. 2009a). Nevertheless, cultural, social, or political factors may support or block conservation, even when market incentives are in place to stimulate conservation (Perrings et al. 2009). For instance, when cultural change occurs and traditional knowledge erodes, accelerated by economic development, reduced demand for diversity may result (Bellon 2004). Depending on local context, the goals of local economic development and agrobiodiversity conservation may be misaligned.

To move effectively forward in the future, we need to address the following: To what extent can resource-poor farmers be expected to display sustainable agrobiodiversity governance, and how high should the benefits of *in situ* conservation be to stimulate this behavior? What is needed to develop place-specific, market-based frameworks that successfully engage farmers in agrobiodiversity conservation? To what extent do niche markets for agrobiodiversity products have the potential to reach more and larger consumer segments without compromising agrobiodiversity conservation?

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