13

Seeding Relations

Placemaking through Ecological, Social, and Political Networks as a Basis for Agrobiodiversity Governance

Guntra A. Aistara

Abstract

Agrobiodiversity governance is often guided by estimates of countable and measurable objects, from the number and diversity of heirloom seeds or landraces grown in a certain location, to the frequency of seed exchange among actors and rates of disappearance of varieties. Such variables provide important information about conservation status at different scales but do not necessarily capture the dynamic social roles and relationships of seeds and agrobiodiversity to local cultures and communities. This chapter explores (a) the cultural roles of seeds in agrobiodiversity governance as a set of interwoven processes that are mediated by, and which in turn mediate, relationships between people, their practices, and knowledge systems; (b) networks with other people and other species; (c) attachments to cultural landscapes and histories or places; and (d) the broader politics of agriculture and rural development. It argues that relational processes are a necessary part of an analytical framework and crucial for understanding the role that social networks play, at multiple scales, in agrobiodiversity governance, including creating, managing, preserving, or "losing" diversity in the long term.

Introduction

Although farmers have been directly involved in the selection and saving of new varieties of plant and animal species since the beginning of agriculture, the roles of the farmer and local community within seed systems have changed commensurate with the rise of industrial agriculture, specialized breeding programs, and gene banks (Brush 1999; Kloppenburg 1988; van Dooren 2008). As a concept, *agrobiodiversity*—"the variety and variability of animals, plants and microorganisms that are used directly or indirectly for food and agriculture"

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

(FAO 2004)—was introduced only recently, and it directs attention to the number of species, seeds, breeds, and varieties rather than to the relations and networks through which they emerge, are managed, and maintained. These dynamic multiscalar and multispecies relationships have important historical, cultural, social, and ecological dimensions that must be understood if we are to better preserve diversity and enable effective governance.

In this chapter, I explore how farmers and communities create and maintain agrobiodiversity through their place-based seed practices and multispecies socioecological networks in different cultural contexts, analyzing complex relationships that sustain these practices. Each local seed network is embedded within long-term historical and ecological conditions as well as contemporary social and political processes, all of which determine practices and meanings that surround agrobiodiversity. I draw upon cases from different parts of the world to illustrate the types of relationships that both mediate and are mediated by the management and governance of agrobiodiversity across scales. The selected examples permit us to consider important questions in regard to seed networks and, more broadly, agrobiodiversity governance:

- How do historical trends, ecological conditions, and cultural norms influence current practices and networks of seed saving and exchange as well as symbolic meanings of seeds and agrobiodiversity?
- How are place-based seed networks situated within broader surrounding agricultural and rural policy landscapes across scales?
- How do farmer groups and communities negotiate access to resources and engage with legal codes and international treaties that influence their relationships to land, seeds, other species in the landscape, and other political actors?

Insights into these areas of concern can help us progress beyond counting levels of existing or lost agrobiodiversity toward an understanding of the cultural and affective motivations that underlie the production and maintenance of agrobiodiversity as well as the power dynamics within local communities and across scales that facilitate or hinder the governance of agrobiodiversity over time.

I begin with a discussion of farmer practices and knowledge systems that sustain agrobiodiversity, followed by a look at the social networks that maintain these practices and influence genetic diversity. Thereafter, I review power dynamics and property politics that structure possibilities for groups to perpetuate or reinvent these practices and social networks, followed by a discussion of how these practices, social networks, and broader politics constitute a form of placemaking that produces cultural and ecological landscapes. I propose that these interlocking practices, social networks, and power dynamics are key elements in agrobiodiversity governance. Particular attention is given to the cultural and political dimensions of these relationships, which to date are only marginally covered in much of the literature on agrobiodiversity governance,

From “Agrobiodiversity: Integrating Knowledge for a Sustainable Future,”
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

as they are crucial for understanding farmer motivations and possibilities to maintain agrobiodiversity in the future.

A Note on Concepts

As documented elsewhere (see Chapter 5; Maxted and Dulloo 2016), much work has gone into the collection and cataloguing of agrobiodiversity, its biogeographical distribution, and conservation status, yet more remains to be done. Nevertheless, agrobiodiversity involves more than just crop–livestock diversity per se and cannot be reduced to the number of varieties; it encompasses the dynamic processes through which varieties are gained and lost (Thomas et al. 2011). Furthermore, different knowledge systems produce different classification systems for agrobiodiversity and must be evaluated on their own terms rather than compared simply to scientific knowledge to check accuracy (Agrawal and Gibson 1999; Nazarea 2006). Both local and scientific knowledge systems require symmetrical and context-dependent evaluation (Latour 2005).

Attention to the dynamic processes and knowledge systems from which agrobiodiversity has emerged requires a *relational* understanding that extends past a genealogical explanation of diversity. In genealogical models, Ingold (2000:138) observed that "diversity is the measure of difference…that presumes a world already divided into discrete, unit-entities—'things-in-themselves'—which may then be grouped into classes of progressively higher order on the basis of perceived likeness." In contrast, a relational approach places diversity in a dynamic context. What makes things the same or different is "the shared experience of inhabiting particular places and following particular paths in an environment….The relational model, in short, *renders difference not as diversity but as positionality*" (Ingold 2000:148–149).

Different societies may use different combinations of genealogical and relational models to understand and classify agrobiodiversity (Berlin 1992; Zimmerer 2001). Furthermore, what is valued in local classification systems may not align with Western scientific taxonomic models (Caillon and Degeorges 2007). A relational approach allows us to investigate the multispecies and multiscalar networks as well as the socioecological knowledge systems that surround seeds and their domestication and exchange, and explore their significance for agrobiodiversity governance.

In this chapter, I use the term "seeds" to refer also to other types of propagating material (including roots, tubers, and cuttings of vegetatively reproduced plants) as a component of agrobiodiversity. Seeds and varieties continuously coevolve with humans, sometimes through intimate and affective relationships. Seed exchange includes transfer of seeds among farmers that need not be reciprocal and may or may not involve the transfer of other goods in return as a form of barter. In addition to seed networks among farmers, seeds may be

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

acquired through markets, extension services, or other commercial sources. For the purpose of this discussion, I will not focus on networks related to the preservation of animal breeds, but this, too, constitutes an important aspect to include in further considerations of agrobiodiversity governance.

Practices of seed saving and exchange both depend upon and create social networks around seeds. Within these, different types of farmers (e.g., subsistence, surplus, and commercial) have specific concerns in accordance with which they use or replace different varieties of plants (Bellon 1996). Diverse social connections, such as kinship structures, ethnolinguistic differentiation, coresidency patterns, and other factors influence exchange (Labeyrie et al. 2016; Leclerc and d'Eeckenbrugge 2012). In my analysis of social networks, I follow scholars of actor–network theory and science and technology studies who insist that nonhuman actors (e.g., plants, seeds, pollinators, and soil) also mediate human social relations and thus may be seen as exhibiting a form of agency (Haraway 2008; Latour 2005). Following Tim Ingold (2011), connections among actors in a network (which he calls a "meshwork") are made through specific practices (such as seed exchange), just as a landscape or place is made by "dwelling" in it (Ingold 2000). Thus, the landscape itself can also be understood as a process, of which we can only perceive a momentary glimpse (Hirsch 1995; Ingold 2000), and places may also be "global" (Massey 2005). Seeds and agrobiodiversity are crucial components of these landscapes cocreated by farmers in conjunction with other species.

Thus, farmer seed networks function as a means of placemaking; that is, a "set of social, political, and material processes by which people iteratively create and recreate the experienced geographies in which they live" (Pierce et al. 2011:54). How these multiple relationships interact at different levels and across scales is very important for understanding the motivations to use and protect agrobiodiversity amid changing socioeconomic and environmental circumstances. I follow scholars such as Doreen Massey (2005), Arturo Escobar, and Wendy Harcourt (2002) to capture the multiple cultural, social, and ecological relationships that farmers craft to their seeds and environments as a means of placemaking. Through such practices, farmers' cultural memories, current economic situations, and ecological futures become embodied in their landscapes in what I have called "networked diversities of place" (Aistara 2018). Let us now explore how farmers position themselves in relation to seeds through their practices, social networks, and broader political contestations, and what this implies for agrobiodiversity governance.

Practicing Agrobiodiversity

For generations, agrobiodiversity has been created and maintained by farmers according to a dynamic interplay between culturally and ecologically embedded practices and knowledge systems. Farmers select plants with desirable

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

characteristics and save seeds to plant the next cropping season. Sometimes they purposely cross plants with distinct traits; they exchange seeds with relatives, friends, and neighbors, and acquire new seeds from other sources outside of their immediate social networks (e.g., through trade networks). Farmers may also practice staggered planting or make use of microclimates to take advantage of diversity in space and time across the farm, in an effort to manage pests and diseases as well as to provide insurance against loss of one or more varieties (Altieri 1999; Cleveland et al. 1994).

Conceptualizing farms as agroecosystems helps us understand how farmer practices create ecological relationships through the maintenance of agrobiodiversity and expands our view of diversity from one simply focused on more species or varieties (Jackson et al. 2007). Instead, farmer seed practices are embedded in their cultivation systems. Agroecological, traditional, and Indigenous agricultural models are often more beneficial for maintaining agrobiodiversity than industrialized agricultural systems (Altieri 1999). On-farm diversity assists in the management of pests, diseases, and soil fertility; it also helps a farmer avoid the need to use external inputs, conserve ecosystem structure, and maintain nutritional diets (Bianchi et al. 2006; Brussaard et al. 2007; Thrupp 2000). Particularly under marginal conditions, farmer seed practices help plants adapt to local conditions over time (Coomes 2010; Perreault 2005). Such practices serve not only to provide food, fuel, and fodder but also support ecological functions and help regulate the climate (Jackson et al. 2007). In addition, agroecology and agroecosystems enable a better understanding of how farmer practices contribute to creating and managing diverse landscapes that allow for more interactions between human-managed and wild landscapes (Altieri 1999; Jackson et al. 2007; Zimmerer 2010).

Farmer practices have tangible effects on agrobiodiversity, although further research is needed to expand our understanding of these processes (Alvarez et al. 2005). Farmer choices and trade-offs affect plant population structure and diversity through seed selection, how plants are distributed spatially during planting, and what proportion of seed is saved and sown from one season to the next (Alvarez et al. 2005). To analyze how farmers decide which varieties to save, incorporate, or discard from their crop repertoire, Bellon (1996) proposed a conceptual framework which predicted that surplus-oriented farmers who produce both for subsistence and the market would exhibit the highest levels of diversity because they must balance a great number of concerns that can only be met by choosing to cultivate various plants. When they choose to include a new crop in their repertoire, it may or may not replace other varieties, depending on which needs the variety is able to satisfy (Bellon 1996). Indeed, farmers often maintain both modern varieties and landraces; one-on-one replacement does not necessarily occur (Brush et al. 1992).

Despite widespread fears of diversity loss, farmers in many regions of the world continue to manage a high level of crop diversity (e.g., Perales and Golicher 2014; Roy et al. 2016). In Peru, for instance, de Haan (2009) studied

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

farmer-driven cultivation practices (as distinguished from externally driven projects aimed at *in situ* conservation) in potato diversity and found that farmers from eight villages in the Huancavelica area preserved high levels of species, morphological, and molecular diversity. The highest rates of diversity were found within, rather than between, genetically isolated farmer populations, and there was no evidence of genetic erosion. Farmers managed multiple fields with a high diversity of cultivars in each to manage gene–environment interactions for yield stability rather than as a specific adaptation to environmental niches.

Indeed, conservation of agrobiodiversity may not be the explicit goal of farmer practices: it can be an outcome or beneficial side effect of more immediate goals, such as food security and risk management (Zeven 1999). The regeneration of agrobiodiversity by farmers is also driven by a variety of economic, cultural, and social reasons and is, to a certain extent, the result of unconscious social pressures on selection. For instance, dishes that are typical of a certain culture, prestige, and identity or family tradition are typical cultural drivers. However, several studies in Mexico have found that belonging to different ethnolinguistic groups may create barriers for movement of seeds and gene flow (Perales et al. 2005).

The interplay of conscious and unconscious effects on diversity raises important questions about the role of farmer knowledge systems in preserving agrobiodiversity. Almekinders and Louwaars (2002) noted a wide variation in farmer knowledge about seed practices. Traditional knowledge is not a static set of information passed down from one generation to the next; it is actively learned in local contexts (Ingold and Kurttila 2000). Farmers develop their knowledge systems through experimentation and evaluation of different management practices, including species and varieties, according to particular needs or demands. For example, Caillon and Lanouguère-Bruneau (2004) found that farmers in Vanuatu cultivate 96 different varieties of their staple crop taro on the west coast of Vanua Lava. Men possess specific cultivation skills but guard their knowledge with secrecy, as it is central to their identity and a source of competition. On average farmers grow about twenty different varieties; the top six make up over 80% of the cultivated area and the forty rarest ones constitute less than 1% of taros raised by each farmer. Each taro is valued for different characteristics. The five most popular types had the best yield or agroecosystem adaptation, whereas a range of others were grown for different reasons related to social identity. Some were cultivated for particular culinary properties and their use in boiled, roasted, or raw foods. Many other varieties were maintained, however, even though they lacked desirable culinary attributes, because they had been discovered by an ancestor or were featured in a founding myth, thus providing the basis for intergenerational narratives. Some of the oldest cultivars were central to male initiation rituals or specific magic ceremonies.

Local knowledge, therefore, may or may not map onto Western scientific knowledge and classification systems. As documented by Caillon and

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

Degeorges (2007), the diversity of taro varieties in Vanuatu serves as a living index of ancestors for whom they were named. Their continued cultivation is important to maintain the cultural memories of the people. For this reason, cultivation of taro is more highly valued than, for example, coconut palms, which have higher genetic diversity but are culturally associated with white colonizers and thus not as highly valued by local people. This example illustrates how biological and cultural values associated with diversity may not always coincide, and that the cultural motivation to continue certain practices may be more powerful than biological characteristics. It also demonstrates that local knowledge about agrobiodiversity can be "sticky" (von Hippel 1994); that is, information is context specific and may be difficult to transfer from place to place because it loses meaning when abstracted from the context within which it emerged.

As Stone and Glover (2017) have shown, social embeddedness of local agrobiodiversity knowledge has given modern varieties an advantage to spread globally, because agricultural knowledge during the Green Revolution was abstracted from local knowledge systems and social networks by design. Thus, rapid intensification of agricultural systems and advancement of specialized plant breeding in the twentieth century in industrialized countries changed the role of farmers in creating and maintaining new varieties (Kloppenburg 1988). Industrialization and governmental policies increased pressure on farmers to abandon "traditional" agricultural practices related to the selection and saving of seeds, which were perceived as backward (Escobar 1995; Stone and Glover 2017). With its focus on monocultures of high-yielding varieties reliant on external inputs, industrialized agriculture is usually much less diverse and provides fewer ecosystem functions. At the same time, since the beginning of the twenty-first century, the number of breeding companies has diminished, often as a consequence of privatization, and investment in public breeding has declined (Chapter 6).

There is, however, an ever greater intermingling of knowledge and seed systems. The introduction of modern high-yield varieties does not always exert negative effects on diversity, as modern varieties are often incorporated into existing seed networks (Bellon and Brush 1994). Instead of precipitating a loss in previous forms of knowledge regarding seed saving, hybrid forms of knowledge have evolved along with hybrid plants (Coomes 2010). For instance, many farmers create creolized hybrids of old and new varieties (Salazar et al. 2007), thus making the desired characteristics of modern varieties available to poor farmers (Bellon and Risopoulos 2001). Farmers continue to experiment and use what is most advantageous at a particular time, and their knowledge base grows at times or becomes more limited. For instance, maize diversity has been reduced in Mexico through the introduction of modern varieties, particularly in lowland elevations, making *in situ* conservation even more important in highland environments with specific environmental adaptations and higher sensitivity to mid- or low-level elevation conditions (Bellon and Brush 1994;

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

Louette et al. 1997; Mercer et al. 2008). This raises questions about how seed networks can facilitate such adaptations.

We cannot, therefore, assume that "modern and scientific knowledge" will simply replace traditional farmer knowledge systems or that farmer knowledge systems themselves are unscientific. Instead, it is imperative that we investigate how farmer knowledge is valued, how such knowledge networks are transformed, and how they are likely to change in the future (Perreault 2005). An increasing number of farmers in nonindustrialized contexts cultivate crops both for subsistence purposes and for the market; they also rely on a variety of wage labor and other nonfarm activities (Zimmerer 2010), and the changing migration and livelihood options of people must be taken into account in our understandings of seed networks and agrobiodiversity governance (Zimmerer 2014; Zimmerer et al. 2015). In some cases, farmers with greater access to markets (i.e., those who migrate or live closer to cities) also cultivate more varieties and have higher rates of diversity (Perreault 2005).

To summarize, farmer practices of seed saving and selection have resulted in high levels of varietal diversity for different purposes (e.g., livelihood, culinary, ritual), thus creating and maintaining agrobiodiversity. Knowledge systems have emerged out of and are embedded in local contexts. Industrialized agriculture risks disembedding such knowledge (Stone and Glover 2017), and has allowed for the quicker spread of modern seed varieties, which may not fulfill all of the same needs as landraces. Farmers have, in turn, appropriated and integrated modern varieties and in many cases "creolized" them, embedding them in their local contexts. Therefore, farmer knowledge and cultural rationales for maintaining diversity need to be understood as dynamic processes within the place-based contexts where they emerge.

Networking Agrobiodiversity

Farmer practices are impacted by the wider social relations out of which they emerge and which they help create in the form of seed networks. Leclerc and d'Eeckenbrugge (2012) have shown that we need a better understanding of how social organization affects crop diversity beyond individual farmer decisions or the interaction between genetic and environmental factors. Seed movement, and ultimately seed diversity, is influenced by rules for marriage, residence, inheritance, and other aspects of social life. In many agricultural societies, farmer seed exchange networks among members of kin groups or neighbors provide not only access to seed; they are a demonstration of trust, reciprocity, and solidarity as well as an extension of cultural values (Coomes 2010; Nazarea 2005a; Thomas et al. 2011).

As Thomas et al. (2011:338) note, "seed exchange cannot be reduced to only its biological or economic dimensions" but must take into account its important social and cultural role. Many seed exchanges still surround marriage rituals

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

with prescribed inheritance patterns. For example, Delêtre et al. (2011) found that seed exchange patterns in Gabon differed in matrilineal versus (virilocal) patrilineal societies. In matrilineal societies, seeds are passed from mother to daughter, whereas in patrilineal ones they are transferred mother-in-law to daughter-in-law. The education of the daughter-in-law in the cultivation of the inherited varieties also serves to initiate her into her new familial responsibilities. Thus, seed diversity and social reproduction are mutually constituted. In many cases, these site-specific social relations have also been shown to directly influence the genetic diversity of seeds (Delêtre et al. 2011).

The scale and range of actors included in farmer seed exchange networks, however, varies greatly. Zimmerer (2003a) found that Andean potato and ulluco seed networks are socially differentiated at multiple scales, but that this is often not taken into account in *in situ* conservation and participatory plant breeding projects, which tend to focus on narrower agroecological ranges than those useful to farmers. In Guatemala and Mesomerica, van Etten (2006) noted that seed exchange historically took place among preexisting social contacts, though not necessarily only locally. In Oaxaca, Mexico, exchange was more likely between people who already knew each other than through a broader form of collective social action (Badstue et al. 2006).

Seed exchange networks extend beyond family and kin ties; class, social differences, and social tensions can also influence exchange relations. For example, in India, networks of reciprocity challenge caste boundaries (Pionetti 2006). Yet seed exchange networks may also create and perpetuate local power dynamics and hierarchies. In Ethiopia, for example, some farmers would rather purchase seeds in a more anonymous market setting to avoid complicated social entanglements (McGuire 2008). Monetary wealth and wealth in seeds are not always correlated: status in seed exchange networks and relations to other farmers also fluctuates with age, gender, and intrahousehold relations (Coomes 2010; Perreault 2005). Furthermore, in addition to farmers, seed networks involve myriad other actors: local breeders, researchers, extension agents, traders, consumers, and others (McGuire and Sperling 2016).

At times, seed exchange networks may also facilitate new social relations, particularly when farmers and organizations create new networks. There has been a revival of seed exchange networks among gardeners and farmers interested in conserving agrobiodiversity in industrialized countries (Balázs and Aistara 2018; Da Vià 2012). Although in many industrialized countries *in situ* conservation of agrobiodiversity is considered nearly extinct, having been replaced by high-yielding and industrialized agriculture, specialized seed saver networks began to form with the awareness of the ecological consequences of industrialized agriculture and fear of genetic erosion. In the United States and Australia, such networks began forming in the 1970s (Balázs et al. 2015). In Western Europe, many seed saver networks emerged during the 1990s and 2000s to protest the rise of genetically modified organisms and defend a model of small-scale diversified agriculture based on the production of local

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

and quality products valorized within short supply chains (Da Vià 2012). These new networks are not necessarily organized only in local communities, but also in national networks that are spread over large territories. The governance of seeds brings such people together into new social networks, coordinated by formalized seed exchange fairs and festivals and often run by nongovernmental organizations or farmer organizations, sometimes with external funding (Balázs and Aistara 2018). Biodiversity seed fairs have also become successful new events in many centers of crop origin (Shen et al. 2017; Tapia 2000). While these new networks often focus on preserving already named heirloom varieties, little research exists on how such national-level networks affect conservation and the continued evolution of plant varieties (Thomas et al. 2012).

New seed networks can challenge assumptions about scientific knowledge and foster new types of collaboration. In France, scientists found that their models of breeding innovation were not applicable to new peasant seed networks, and that they had to rethink selection and production at the population level (Demeulenaere 2014). This dynamic management approach fostered collaboration between scientists and other stakeholders, both in terms of research and political mobilization (Chable et al. 2014; Goldringer et al. 2001). Indeed, there are increasing efforts to create collaborative networks that go beyond farmers to link producers and consumers, farmers and scientists, social and natural scientists, as well as *in situ* and *ex situ* conservation (Demeulenaere 2014; Jackson et al. 2007). Within such collaborations, one must also be attentive to the power dynamics and processes that structure cooperation. As Graddy (2014) has shown, efforts such as those to repatriate potatoes from *ex situ* collections for *in situ* cultivation in the Potato Park in the Peruvian Andes have the potential to reverse or intensify previous contentious power dynamics between *in situ* and *ex situ* conservation. Seed networks are also an important part of ensuring food security and food sovereignty in post-conflict areas, where local and adapted seeds can provide a means of returning to previous land and building resilience against climate change, and often work better in the long-run than hastily developed seed aid programs (McGuire and Sperling 2013; Zimmerer 2017a; see also Chapter 8).

Finally, seed networks are also a way of governing relations with nonhumans. In Costa Rica, for example, organic farmers used seed exchange as a means of creating new types of relationality with other farmers when previous kin-based exchange systems broke down. They created new networks not only with other organic farmers but also with the seeds, pollinators, and other species in the landscape with which they collaborated (Aistara 2011). These affective relations between humans and nonhumans serve as a foundation for the creation of agrobiodiversity and can be studied through multispecies ethnography (Mueller 2014; Tsing 2012). Farmers involved in social networks often see themselves as cooperating and "becoming with" other farmers as well as with other species (Aistara 2011, 2018; Demeulenaere 2014; Nazarea 2005a; van

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

Dooren 2008). These connections with other species are part of what embed such networks into cultural and ecological landscapes.

To date, the genetic impacts of seed exchange networks are not well understood. Social and seed exchange networks may directly or indirectly influence the genetic diversity of plant populations. Empaire and Peroni (2007) found that manioc diversity in Brazil was the result of an interaction between farmer knowledge, practices, and their social networks. In sorghum cultivation in Cameroon, Alvarez et al. (2005) observed that a small number of more mature farmers serve as seed sources whereas younger farmers serve as sinks, but this status changes as farmers mature. Changes in seed exchange networks could thus alter the migration–drift equilibrium and diminish genetic diversity (Alvarez et al. 2005). Orozco-Ramírez et al. (2016) have shown that, in some cases, ethnolinguistic differences can hinder seed exchange and influence genetic diversity more than altitude. They suggest that further study of seed networks is necessary to detail the links between social and genetic patterns in diversity.

In summary, it is important to avoid oversimplification, romanticization, or unnecessary dichotomization of seed networks and other complex social relations that are intertwined with much of agrobiodiversity governance, such as markets or migration (see Chapters 8 and 15). Coomes et al. (2015) discredit four common, longstanding misconceptions about seed networks: farmer seed networks are not necessarily inefficient; they are not closed and conservative; they are not necessarily egalitarian; and they are not likely to disappear. Instead, seed exchange networks are constantly being reformed and, in the process, they undergo important transformations which must be studied carefully. This will necessitate a range of methodological approaches from various disciplines, such as network science, microbiomics, or others (Pautasso et al. 2013; Poudel et al. 2016).

Power and Politics in Agrobiodiversity

Accounts of farmer practices and seed networks must be contextualized within discussions of prevailing political economic systems, current legislation, and contests over resources that may either facilitate or hinder the preservation of agrobiodiversity in particular places. These are enmeshed within national, regional, and global governance structures that carry their own power dynamics. The international legal system to protect breeders' rights has followed closely on the heels of the technological specialization of breeding, increasingly criminalizing the saving and exchange of seeds by farmers through patents, plant variety protection under the Union for the Protection of New Varieties of Plants (UPOV) convention, and associated national laws that are spread throughout the world via free-trade agreements and other political means (GRAIN 1999). The most important legal regimes are the UPOV Treaty of 1961, the Convention on Biological Diversity (CBD) of 1992, and the International Treaty on Plant

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

Genetic Resources for Food and Agriculture (ITPGRFA) of 2001. The UPOV regime, which was developed in 1961, but revised in 1978 and 1991, grants breeders intellectual property rights (IPRs) on new varieties. While the "breeders' exemption" allows scientists to use protected varieties for research purposes to develop new varieties, this same right is not allowed for amateur farmer breeders; furthermore, more recent versions of the treaty restrict farmer seed exchange and increasingly limit the "farmers' privilege" (Aistara 2011, 2012, 2018). Countries are often required to harmonize their national legislation with the UPOV Treaty when joining Free Trade Agreements, previous national agreements notwithstanding (Aistara 2011, 2012, 2018). The World Trade Organization's 1995 TRIPS Agreement also requires joining members to adopt some form of plant variety protection. These agreements thus in some ways limit state sovereignty to govern their genetic resources, even though the CBD granted states sovereign rights over genetic resources in 1992. The CBD requires "fair and equitable" access and benefit sharing and "prior informed consent" in the commercialization of genetic resources, but defining the country of origin (let alone particular communities or individuals) for crops or varieties is complicated to impossible (Winge 2016). The ITPGRFA came into force in 2004, creating farmers' rights as a counterbalance to breeders' rights, and a multilateral system for access and benefit sharing for particular crops. Rabitz (2017:629) argues that while this system has facilitated access, in the form of 3.3 million transfers of plant genetic resources as of February 2017, "no corresponding payments, either mandatory or voluntary, have so far been made." He argues this is due to important differences in institutional design and the types of incentives for benefit sharing within the multilateral framework of the ITPGRFA and the bilateral approach of the CBD's Nagoya Protocol, which entered into force in 2014 (Rabitz 2017). Guidelines for access and benefit sharing in the Nagoya Protocol do not contradict the ITPGRFA, but they also do not develop specific rules for plant genetic resources for food and agriculture (Chiarolla et al. 2012). As a result, progress on access and benefit sharing has been slow because most countries have not developed the national legislation required for implementation, few successful models exist, and technological advances in gene editing are outpacing legal mechanisms to guarantee fair and equitable access and benefit sharing (Girard and Frison 2018; Roa et al. 2016). Although IPRs are meant to stimulate innovation, there is increasing concern that they may do the opposite, and fail to support food security, adaptation, and resilience (Halpert and Chappell 2017). Some seed companies engage in voluntary benefit-sharing projects or arrangements with particular communities as a means of demonstrating corporate social responsibility, but numerous conflicts still surround the implementation of seed legislation (requiring registration and testing), intellectual property rights, and access and benefit-sharing agreements for plant genetic resources.

The role of laws and international treaties in agrobiodiversity governance is discussed in more detail by Visser et al. (Chapter 14). Here I wish to emphasize

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

their potential to alter relationships farmers have established through seed practices and social networks (Aistara 2018). Intellectual property rights limit the number of people eligible to benefit from plant innovation, and thus can potentially sever or alter relationships among kin, friends, and neighbors, in what Strathern (1996) has called "cutting the network." At the farm level, seed laws and intellectual property rights threaten to transform farmers' relationships to their seeds through bureaucratization, which requires the registration, certification, or testing of all seeds and varieties. At the national level, seed laws may alter farmers' relationships to states and markets. First, they may inhibit farmers' rights to save and work with their seeds. In the worst case, legislation can criminalize farmer seed-saving practices or appropriate seeds by placing variety protection on seeds that have been selected by farmers for generations (Aistara 2011; Graddy 2014; Kloppenburg 1988). This also devalues their knowledge. There is a long history of devaluing peasant knowledge and ways of life, beginning with colonialism and extending through modern development paradigms (Escobar 1995). Farmers who protect agrobiodiversity *in situ* provide valuable ecosystem services for the future and should thus be honored for their work and perseverance throughout these contested histories. Seed laws and international treaties often prioritize new contractual bonds between parties and states over relationships between famers and their seeds and social networks (Aistara 2018). In some cases, however, national governments may make more amenable legislation or hybrid models, often as a result of pressure from farmers' and citizens' groups (Aistara 2014a; Andersen and Winge 2013; Santilli 2012).

At the international level, geopolitical power asymmetries historically structured the appropriation of seeds and knowledge from the Global South by the Global North (Kloppenburg 1988). While some positive examples of protecting farmers' rights or creating access and benefit-sharing regimes are beginning to be documented (Andersen and Winge 2013), on a global level, the geopolitical power dynamics regulating free-trade agreements reinforce hierarchies between the Global North and Global South, between former colonizers and colonies, between resource-rich and resource-poor countries. Seed politics must also be situated within broader rural development policies and politics, which seem to perpetuate rural poverty, despite endless attempts to eradicate it, and to dictate differentiated access of different groups to productive resources (Brush 1999; Dove 1996). As Michael Dove (1996) has observed, it is unlikely that the same systems of intellectual property rights regulations that threaten Indigenous rights and biodiversity will also save them.

Nevertheless, changes in laws that affect biodiversity have been contested in multiple ways, which may have had the effect of stimulating more active seed networks and political action in both industrialized and nonindustrialized countries. Large-scale street protests and the contestation of UPOV-related legislation (called the Monsanto laws) in many Latin American countries have temporarily halted or even reversed the adoption of such laws (Gutiérrez

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

Escobar and Fitting 2016). There have also been numerous efforts to create new laws that protect Indigenous and farmers' rights, to establish special niches in legislation. For example, several U.S. states changed legislation to prevent seed exchange after newly formed seed libraries were found to be illegal (Balázs et al. 2015). Campaigns in Europe by seed saver groups halted a comprehensive reform of EU seed legislation, which would have eliminated leeway for member states to interpret the European directives in specific ways (Balázs et al. 2015). A brief "tomato rebellion" in Latvia caused a change in national legislation to allow memories and tastes from bygone eras to be preserved alongside EU regulations in a new legal category of "collectors' varieties" (Aistara 2014a). These examples show that seed networks have the potential to defend agrobiodiversity through political mobilization. Finally, defending agrobiodiversity does not necessarily need to take the form of contestation and protest. It can also be achieved through alternative socioeconomic models of relationships between farmers, breeders, and consumers, such as with the creation of the Open Source Seed Initiative (OSSI), analogous to the open software movement (Kloppenburg 2014). This stimulation of political resistance and creative alternatives reflects the deep relationships with practices, people, and places that seeds and agrobiodiversity foster.

Placing Agrobiodiversity

The examples above can help us see how in many cultural contexts, agrobiodiversity is an important part of placemaking. Graddy (2014) has noted that paying attention to place brings into focus critical spatial dimensions of agrobiodiversity governance, and how it fits into the social reproduction of place, seeds, food, knowledge, and memory. Because seeds and foods travel across contexts, placemaking is part of constructing cultural landscapes not only at the local level but across scales (Khoury et al. 2016; Chapter 8).

Relationships between agrobiodiversity and placemaking can be historically traced. Zimmerer (2014) has observed that the concept of cultural landscapes has great analytical potential, but it has not been widely applied in understanding agrobiodiversity. Zimmerer (2015a) has explored how particular cultural landscapes in the Andes were constructed through colonial practices and continue to affect agrobiodiversity governance today, arguing that relational placemaking must be incorporated into future planning for landscape connectivity. African slaves cultivating rice in the Americas in the sixteenth century reinforced their cultural identity, transformed the landscape, transferred an Indigenous knowledge system to a new continent, and increased their negotiating power as they were able to control their own subsistence (Carney 2001; Carney and Rosomoff 2009).

Local knowledge and seed practices are intimately tied to social and cultural identities and relations to place through taste and culinary traditions. Nazarea

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

(2006) argues that the sensory embodiment of local knowledge, along with emotional memories, are what give such knowledge its power. These memories are tied to particular places and inform practice. For example, displaced persons often try to recreate an "out of place sense of place" through their gardens and kitchens, thus reconstructing shared memories of the places they left behind to share that knowledge with the next generation. Such memories offset the disappearance of older varieties and tastes brought about by the industrialization of agriculture and may become the source of counternarratives (Nazarea 2006). Memories are also often tied to particular cultural symbols. In the Ecuadorian Amazon, Perreault (2005) observed how tending diverse swidden gardens and preparing traditional foods from these gardens were part of what defined being Kichwa, which they celebrated through cultural rituals and hoped their children would continue.

Taste, as a sensory experience, can also be an important driver of memory and motivation for conservation. In Latvia I have shown that the tastes of tomato varieties cultivated during the Soviet era, now illegal because they are not listed in the European Common catalogue, served as motivation to protect the varieties, to protest EU legislation, and to critique current EU policies (Aistara 2014a).

Examples from Nazarea, Graddy, Zimmerer, Carney, and others remind us that the revitalization of place is in direct reaction to previous denigration and marginalization of the very same knowledge systems, people, and places. Early taxonomic projects decontextualized plants and privileged certain types of knowledge over others. As Foucault (1994/1996) noted, plants entered into collections were reduced to "nontemporal rectangles," stripping them of all but their individual names. More recent taxonomic projects try to valorize ancestral knowledge, memories, and local practices (de Haan and Salazar 2006; de Haan and Villanueva 2015) or facilitate a multispecies sense of "care of the species" (Hartigan 2017). Thus, viewing seed practices, networks, and politics as forms of placemaking is a means of recuperating and recontextualizing knowledge and memories associated with particular plants and places. As Graddy (2014) shows, these projects involve a relearning of cultivation as well as culinary and medicinal traditions; they are also ways of creating novel, innovative economies. This is as much about reinventing places in the midst of changed and changing circumstances as it is about preserving old varieties. Because agrobiodiversity is intimately linked with histories, memories, and places, its preservation or maintenance is a deeply political issue. Placemaking is a fundamentally political project, involving political contestation and recreating political subjectivities.

Conclusion: Networked Relational Diversities

My purpose in this chapter has been to highlight how the practices, knowledge, and social networks through which farmers manage seeds are anchored within

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

cultural memories and future imaginaries of place. These places are further embedded in interlinked ecological, social, and political processes across scales. Thus, I propose that agrobiodiversity governance be studied as a set of nested and networked relationships of people to their seeds, practices, and knowledge systems; to other people and species in their landscapes; to the broader politics of rural development; and to the cultural imaginary of place and landscape.

Place-based networks for agrobiodiversity governance have multiple outcomes:

- *Ecologically*, they promote functional relationships at the farm level, ensure gene flow and diversity, control pests and diseases, promote the creation of mosaic landscapes, and facilitate resilience to withstand shocks and adapt to marginal environments and to climate change.
- *Economically*, they provide access to seeds, subsistence, food security, income, and a means to diversify economies, create market niches, provide insurance against unforeseen events, and at times even facilitate economic innovations such as the Potato Park, OSSI, or others (Bellon et al. 2016; Kahane et al. 2013).
- *Socially*, they facilitate sharing of information and knowledge, social networks among kin, neighbors, friends, or other potential sources of seeds, and promote social innovation through, for example, the creation of new seed exchange networks in industrialized countries (Balázs and Aistara 2018).
- *Culturally*, because seeds, plants, and tastes embody cultural memories of people, practices, cuisines, places, and times, seed networks facilitate the cultivation and reinventions of these pasts as futures and as cultural landscapes.
- *Politically*, they promote the mobilization of political subjectivities of resistance and push for legal changes to protect farmers' rights and mobilization for more sustainable food systems.
- *Scientifically*, they promote interaction and links between farmers and scientists and between *in situ* and *ex situ* conservation.

Utilizing a placemaking lens allows us to study these nested social, cultural, and ecological relations and their associated power dynamics and explore the various processes through which farmers create, protect, or perpetuate diversity on their farms as well as the historical and cultural rationale for doing so. Relationships are formed between farmers and their land, seeds, pollinators, and other species in their landscapes; with other farmers, stakeholders, and institutions; and within the broader political–economic contexts and legislative frameworks in which they operate. A nested and relational approach is essential if we are to understand the drivers and potential for preserving agrobiodiversity in the future.

From "Agrobiodiversity: Integrating Knowledge for a Sustainable Future,"
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

From “Agrobiodiversity: Integrating Knowledge for a Sustainable Future,”
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.

From “Agrobiodiversity: Integrating Knowledge for a Sustainable Future,”
Karl S. Zimmerer and Stef de Haan, eds. 2019. Strüngmann Forum Reports, vol. 24, series ed. Julia R. Lupp.
Cambridge, MA: MIT Press. ISBN 9780262038683.