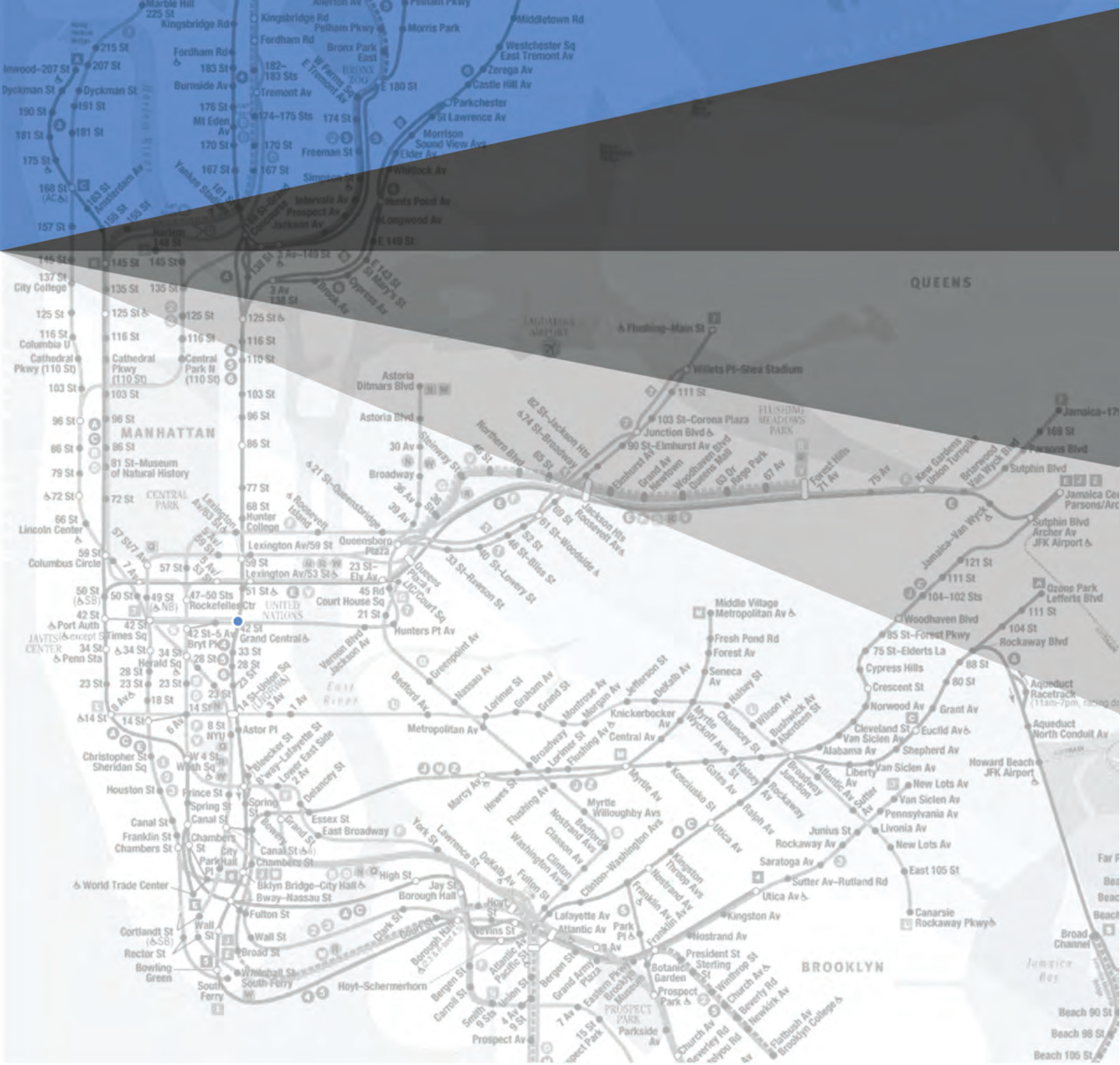

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WOMEN FARMERS AND FOOD JUSTICE

Preserving Biodiversity Through Farmer Control of Seeds

By Carolyn Sachs

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Planting Seeds for Food Sovereignty

Lead-up study to the 62nd session of the UN Commission on the Status of Women (CSW62)

While women make up close to half of the world's farmers, their access to agricultural resources and land is often severely limited. As a result, women are relegated to marginal environments (such as wild plant areas, forests, or gardens) and tasked with unpaid food-related care work (like storing, preparing, and serving), leading many researchers and policy experts to overlook women's contributions to agriculture.

Especially in small, indigenous farming communities, the feminization of agriculture positively impacts sustainable agricultural practices. Women and girls usually tend to a much greater diversity of crops than men, and many of these crops are folk varieties or resilient landraces that adapt well to climate change. Women are also more likely than men to establish informal exchange networks to save and distribute seeds. Yet small-scale farmers, and women farmers in particular, have little protection that ensures their free access to agricultural knowledge and genetic crop diversity.

Considering the increasing shift away from traditional farming methods, this study demonstrates how informal seed saving strategies, including community seed banks, are of central importance to conserving agro-biodiversity. The author argues that we need to develop policies and institutional mechanisms that go beyond restrictive measures against the patenting, proprietary breeding, and genetic modification of seed. It is equally important to develop legal frameworks and regulations that assure broader farmer control.

Carolyn Sachs is Emeritus Professor of Rural Sociology at Penn State University. In her research on food sovereignty, she pays particular attention to environmental sustainability and gender equality in rural farming communities in the global South. In this study, Sachs demonstrates how small-scale women farmers across the world are fighting for the preservation of agro-biodiversity and seed sovereignty in the face of rapid industrialization and climate change. As the progressive solutions that women farmers come up with indicate: the future of agriculture must be female.

Stefanie Ehmsen and Albert Scharenberg
Co-Directors of New York Office, February 2018

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Women Farmers and Food Justice

Preserving Biodiversity through Farmer Control of Seeds

By Carolyn Sachs

With women comprising 43% of the workforce in agriculture globally (FAO 2011), we witness the feminization of agriculture in many world regions. Women's responsibility for agriculture is increasing—especially in many developing countries where women are often key to providing food security despite their limited access to land, capital, and agricultural services (Sachs 2015).

The feminization of agriculture takes multiple forms and generally results from four distinct phenomena (De Schutter 2014). First, women take over farming when male adults migrate or take on alternative employment leaving women to provide for household food security or the subsistence needs of the family. In the second instance, women take over farming of family land to produce primarily for the market rather than for the immediate subsistence needs of their household. The third type of feminization of agriculture involves women's employment as farmworkers, typically in large-scale corporate agriculture enterprises. A fourth form of feminization of agriculture occurs predominantly in the US and Europe, but is found less frequently in "developing" countries (Sachs et al. 2016). Especially on small-scale farms that practice sustainable agriculture, women often hold managerial positions

Food-Related Care Work

While each of these forms of feminization of agriculture brings about different sets of gender relations and has varying impacts on agrarian change and agro-biodiversity, the focus of this study is not women's paid employment in the agricultural sector. Rather than female wage labor, I discuss the significance of women's non-commodified labor, including food-related care work. As I show, valuing female care work as well as confronting women's heavy and unequal responsibilities in agricultural production has broad ethical as well as policy implications for women's empowerment (Kidder et al. 2014).

Food-related work—including obtaining and saving seeds, growing plants, collecting firewood, planning meals, acquiring and processing food, cooking and serving food, cleaning kitchens, and washing dishes—comprises much of the care work performed by women and girls in rural households (Allen and Sachs 2007). This work does not merely pertain to caring for dependents, however. It is broad and transformative work that extends to people, objects, and the environment in order "to maintain, continue, and repair our 'world' so we can live in it as well as possible" (Fisher and Tronto 1990: 40). This broad understanding does not only chal-

lenge the idea that care work is exclusively the domain of women; it also points to the fact that care work is not any less important than productive or paid work (Elson 2008).

Yet, gender inequities in many countries restrict women's access to resources and knowledge. While this limits women's ability to produce commodities for the market, which is typically the domain of men, women still usually contribute the bulk of the labor in the production of food crops and small livestock (chicken, goats, and sheep) for home consumption. The significance of women's food-related care work to a community's subsistence is also indicated by the fact that changes in livelihood strategies—including outmigration of men and market integration—do not necessarily result in the decline of crop diversity. In 135 subsistence societies across the world, it is predominantly women who do the gardening, gathering of wild plants, and seed saving.

Just as the value of women's activities in providing diverse diets and meeting food needs in difficult times has long gone unrecognized, so have women's specific contributions to the preservation of biodiversity and food sovereignty. Coming from a feminist political ecology perspective, this study considers the importance of gendered knowledge of complex survival strategies, gendered rights and responsibilities, and women's leadership in grassroots environmental efforts (Rocheleau et al. 1996). Providing a wealth of examples from across the world, the study takes a look at the role that small-scale women farmers play in battling the decline in agro-biodiversity and seed loss, and in strengthening a global food justice movement.

The Decline in Agro-Biodiversity

The decline in biological diversity is occurring at an alarming rate. As a subset of biodiversity, agro-biodiversity loss results in multiple risks and problems for farming systems, with a particular negative impact on the activities of women farmers.

Since 1900, three quarters of the genetic diversity of domestic crops have been lost. By 2025, scientists estimate, another 60,000 plant species will be lost (Moreta et al. 2013) and the next quarter century will experience a loss of 1-10% of the world's species (Gaston and Fuller 2007). This decline in biodiversity is partly owed to changes in global food trends as human diets have grown 36% more similar in composition over the past five decades (Massawe et al. 2016). In addition, although people consume about 7,000 species of plants worldwide, only a mere 20 plant species comprise 90% of the world's caloric intake and the majority of these calories is derived from only three crops—corn, beans, and rice (Thrupp 2000).

Once hailed as a novel or modern way of ensuring global food security, the "Green Revolution" has massively contributed to the decline in biodiversity through the introduction of uniform monocultures. As reduced species diversity increases the risk of diseases and insects, this farming system depends heavily on fossil-fuels through the use of herbicides, insecticides, fungicides, and commercial fertilizers. The result is an energy-intensive form of agriculture that generates about 25% of greenhouse gas emissions (McMichael 2014).

The introduction of transgenic plant varieties is another factor contributing to agro-biodiversity loss. The commercialization of these varieties is

a driving force not only in the displacement of local food production, but also in intellectual property rights over plants and the restrictions on farmers' right to save seeds (Kloppenburg 2004). By redefining plants as human inventions rather than products of nature, genetic engineering opened the door to the introduction of patents on plants. Stronger intellectual property rights legislation encouraged the consolidation of the multinational seed and agricultural biotechnology corporations, which then further pushed for stronger global intellectual property rights (IPR) regimes over plant varieties (Peschard 2017).

Replacement of traditional plant breeding with transgenic methods and the weakening of public agricultural research institutions has resulted in a focus on genetically modified crops (Kloppenburg 2010). Despite billions of dollars of investments in transgenic crops, genetic modifications in crops incorporate only two traits—one of which is herbicide resistance—and they are used in only four crops: maize, soybeans, cotton, and canola. These crop varieties do not meet the needs of most farmers, especially small-scale farmers, as they cannot be legally saved and result in unsustainable monocultures (Kloppenburg 2010).

Most current agricultural development efforts are designed to encourage farmers, including small-scale farmers, to enter the agricultural value chain and sell their crops commercially. As more and more farmers shift from growing crops for home consumption and local communities to growing crops for the market, we can witness a decline in the overall variety of crops grown. This switch, which is often profitable for farmers, is twofold—from a variety of local crops to a narrower selection of cash crops, and from indigenous crops to high yielding varieties. With this decline in locally specific crops and varieties demand for these crops disappears as well; people become more assimilated into national and global consumption patterns, now often preferring western style diets (Cannon 2002).

In some regions, male outmigration has also contributed to higher consumption of cash crops. Men migrating to take on jobs in bigger towns or cities results in increased remittances, so that people have cash to purchase food, including processed foods, and therefore grow less of their own. But the outmigration of men can lead to labor shortages in rural areas as well. Even where this has increased women's power in decision-making processes, as is the case in many villages in Nepal (Giri and Darnhofer 2010), for example, it often means that women farmers resort to external technical knowledge to manage local agro-biodiversity, which does not necessarily address women's livelihood needs (Leduc et al. 2008; Onta and Resurreccion 2011).

Another significant factor contributing to the loss of agro-biodiversity is, of course, climate change, which is already affecting agricultural productivity and food security, and projections suggest that more is soon to follow. With higher temperatures, erratic and unpredictable rainfall, droughts, and increased flooding many farmers change their agricultural practices. In a village in Nepal, for example, farmers faced with longer dry seasons and delayed rainfall have largely abandoned growing upland rice and millet in favor of paddy rice cultivation (Bhattarai et al. 2015). This did not only result in a decline in biodiversity and less diverse diets, but it has also changed labor patterns. As farmers began adopting rice varieties that have higher yields, a shorter growing season, and greater drought tolerance, women's labor in the fields was reduced considerably compared to the more arduous task of growing upland rice and millet. At the same time, however, these high yielding varieties produce less straw, which results in less fodder available for animals. Because women are responsible for managing livestock, they now travel farther and spend more time on procuring animal fodder.

While the overall variety of crops is declining, the number of crops used for bioenergy to re-

place fossil fuels is growing. These crops are often grown in vast monocultures and replace more diverse food crops grown on marginal lands or in areas that were previously forests or uncultivated. As a result, biodiversity is significantly lower in biofuel crop areas than in the non-crop areas that they replace (Fletcher et al. 2011). Many of these marginal lands are those that women use to grow crops or harvest wild plants, but the significant value of these marginal areas to biodiversity and food security for rural communities is often overlooked by policy makers. While maize, sugar cane, and palm oil are the most common sources of bioenergy, there are indications that other perennial bioenergy crops have the potential to be better for biodiversity. Perennial grass crops, for example, such as switch grass, can provide bioenergy while also enhancing biodiversity and providing ecosystem services (Werling et al. 2014).

Agro-Biodiversity and Gender

Agricultural biodiversity, or agro-biodiversity, is a key feature of farming systems across the globe that is intimately tied to cultural diversity and local knowledge (Brookfield et al. 2002). Defined by the Food and Agriculture Organization (FAO 1999) as "the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries," agro-biodiversity comprises wide array of life forms, knowledge, and practices. It relates to the wider environment and ecosystems (pastoral, forest, and aquatic) that surround and support the agricultural ecosystem, including genetic resources of plants and animals; edible plants and crops developed by farmers and breeders, livestock, fresh water fish, and soil organisms; insects, bacteria, and fungi that control insect pests and diseases of crops and animals; and other "wild resources" of the natural landscape (Thrupp 2000). In this sense, agro-biodiversity does not only extend to domesticated plants and animals, but also includes wild flora and fauna from uncultivated areas near agro-ecosystems. These "wild" or marginal areas provide important harvestable resources and perform valuable indirect services to agro-ecosystems (Brookfield et al. 2002).

Agro-biodiversity loss has three particularly negative impacts: It diminishes livelihoods and adaptation strategies for farmers, undermines the stability of agriculture and food security for consumers, and leaves communities vulnerability to climate change and other stresses. The decrease in food varieties also lowers nutritional values, in particular when a wide variety of legumes and traditional grains are replaced by a narrow choice of wheat, rice, and maize, highly processed foods, or transgenic plants (Thrupp 2000). Inadequate nutritional status often has a bigger impact on women and children than on other family members given that men might restrict women's access to food in a household, and women's nutritional status directly impacts children's nutritional status.

Agro-biodiversity loss also constitutes a particular risk in the face of climate change. As farmers, scientists, plant breeders, and development planners are faced with new environmental conditions as a result of climate change —including drought, increased precipitation, insect problems, and plant diseases—access to a wide array of plant genetic resources is especially critical. Knowledge of how to sustain local crop varieties and save resilient landraces that adapt to climate change is often preserved by women and small-scale farmers. Similarly, women farmers usually have a deep understanding of agro-biodiversity, because

they do not only work with domesticated crops and livestock but also utilize uncultivated areas, for example, when collecting wild plants for fodder. In this sense, gendered local knowledge is essential to the work of saving seeds and providing diverse diets.

Responses to Agro-Biodiversity Loss

Responses to the decline in agro-biodiversity involve various strategies, but they can broadly be distinguished along the lines of *in situ* and *ex situ* conservation. While the former involves a variety of practices—such as using plant genetic resources that are more resistant to stress from climate change, diversification at species and variety levels, paying attention to plant species that are underutilized or neglected, and intensifying the use and collection of wild crop relatives—the latter is more narrowly defined.

Ex Situ Conservation

Ex situ conservation for plants is commonly done in seed banks under sterile and strictly controlled environmental conditions and protocols (Li and Pritchard 2009). Seed banks are operated and maintained by many governments, multilateral organizations, and CGIAR institutions. Over 1,300 gene banks hold samples of about 6 million accessions (Rajasekharan 2015). Considerable financial investment has recently occurred in facilities hosting wide germplasm collections, such as the Kew Gardens' Millennium Seed Bank Partnership in the UK or the Svalbard Global Seed Vault in Norway.[1] Many national governments also maintain seed collections with varying degrees of success and access. The Bangladesh Rice Research Institute, for example, has over 7,000 varieties of rice, however farmers do not have access to these varieties, which are kept in cold storage and are not regularly regenerated.

Seed banks are parts of formal seed systems and regulations. The regulatory frameworks for seed conservation practices vary by country and world region. In Europe, for example, seed production and marketing are strictly regulated. The regulatory framework supports a formal seed system that is dominated by genetically uniform varieties bred to maximize yields in homogenous landscapes that rely heavily on pesticides, fertilizer, and irrigation, and meet the demands of industrialized agriculture (Veteläinen et al. 2009). Seed legislation originally implemented to increase agricultural productivity in the post-war period has become constrictive of the conservation and development of local varieties and small-seed companies (Visser 2002). Quality intellectual property standards—that is, laws applied to seeds that recognize a person or an entity, most often a seed company, as the exclusive owner of seeds with specific characteristics—leave little room for biodiversity based on farmers' varieties. The owners of seeds have the legal right to prevent others from using, producing, exchanging, or selling their property.

Property rights over seeds are reinforced by regulations—such as seed certification, marketing, and sanitary rules—that are supposed to ensure seed quality and market transparency. In reality, however, they often make it mandatory for farmers to exclusively purchase or use commercial seeds. Some regulations even make it a crime to give away or exchange seeds.

1 See www.kew.org/science-conservation/save-seed-prosper/millennium-seed-bank/index.htm and www.regjeringen.no/en/dep/lmd/campain/svalbard-global-seed-vault.html?id=462220.

As a result, seed fairs and seed exchanges, which constitute a growing form of resistance to monopolized control over seeds, are becoming illegal in some countries (GRAIN 2015).

Policies to protect intellectual property are based on the concept of individual and corporate ownership, with "no or little recognition of and support for community seed banks" (Vernooy et al. 2017; Vernooy et al. 2015). However, many peasants, farmers, and communities, who are organizing to save and conserve seeds, view seeds as communal property, belonging to the people living in a given area. Whether we look at communities with territorial bonds (as is the case for many groups living in the global South) or with ethical ones (as for many people who are part of the organic movement in the global North), all of these communities consider seeds "a gift." In the case of peasant varieties, the value system of individual ownership has to be reversed in order to protect and promote innovation. We have to start speaking of collective rights (GRAIN 2005; Salazar et al. 2006) and move from the concept of ownership to that of the recognition of communities' and farmers' rights to seeds (Bocci and Chable 2009).

In Situ Conservation

While *ex situ* strategies are considered critical for conserving genetic diversity, there is a growing consensus that *in situ* or on-farm strategies are the most efficient way to preserve resources for climate smart agriculture. Unlike *ex situ* strategies, such as gene banks, *in situ* strategies are dynamic. By securing access to diverse and locally adapted germplasm, they allow for processes of microevolution and the continuous adaptation of crops to changing environments. What is more, on-farm conservation of genetic resources not only maintains crop diversity, but it also preserves traits that are unknown to conventional plant breeders (Moreta et al. 2013).

In situ methods can be particularly important in agro-ecologically and socioeconomically marginal areas, where farmers face uncertain and high risk production conditions. In these areas, cereal and cash crop production have not been able to significantly improve agricultural production for small scale farmers (Lipton and Longhurst 1989). With its focus on high-input and favorable environmental conditions, there is little spillover of conventional plant breeding into farming systems in more marginal environments (the exceptions being maize in eastern and southern Africa, irrigated rice in Southeast Asia, and wheat in other areas) (Almekinders and Elings 2001).

Specific strategies that have been implemented to address the needs of farmers in marginal areas involve methods of mixed cropping as well as growing multiple varieties of the same crop, sometimes by adding modern varieties to local ones. This is possible, because small scale farmers often manage different plots, in which they cultivate different varieties. Under these conditions, varieties are competitive with improved varieties (Brush 1995). Such methods ultimately reduce the risk of food insecurities by obtaining a more stable yield in fluctuating agro-ecological conditions, and they allow farmers to meet a wide range of needs, including food, beverages, marketing, construction, fodder, and medicine.

In addition, small-scale farmers usually have multiple uses for the same crops. They might, for example, use young leaves or shoots as vegetables, fully-grown grains for food, and stalks for fodder. Given these multiple uses, yield must be defined broadly and not just as the amount of grain produced. In fact, varieties that are high yielding but have few other uses may not be attractive to small farmers, especially if they do not have stable yields, lack resistance to diseases and pests, are difficult to store, or do not adapt well to low soil fertility (Almekinders and Elings 2001).

In situ practices also preserve farmer knowledge about how to produce these crops (Brush 2000). A series of studies conducted in various smallholder farmer regions of the world shows that community seeds banks help farmers enhance local knowledge in seed selection, treatment, storage, and multiplication (Bàrberi 2013). As farmers introduce new plant material from their family and neighbors into their systems and select for different preferences, they are directly involved in the selection and maintenance processes (Altieri and Merrick 1987). As a result, *in situ* methods make conservation of genetic agro-biodiversity accessible to developing countries: They do not require large investments in infrastructure, but enable small farmers to save their own seeds (Jarvis et al. 2011). In doing so, they can also strengthen traditional social seed networks through a combination of practices including seed saving, seed exchanges, seed giving, seed bartering, and seed purchase.

Promoting Farmer Control of Seed

While the formal seed sector, including government-controlled or privately owned seed banks, dominates the seed system in developed countries, in developing countries formal seed systems exist but rarely provide seeds for small farmers. In fact, 90 to 95% of small farmers obtain seed from informal sources, usually from other farmers or community seed banks (Ravinder et al. 2007; Mudege and Torres 2017). These informal seed systems are key to agro-biodiversity and, unlike farming with improved varieties, guarantee food sovereignty as farmers maintain their control of seed. As a Dagomba male farmer in Northern Ghana, who works with local varieties, puts it, "We have all been created by God and we, the illiterate ones, have our seeds that do not need spraying, but any seed that you, the learned ones, come out with needs some spraying." (Padmanabhan 2007: 63)

The Food and Seed Sovereignty Movement

Maintaining control of seeds as well as seed saving are particularly crucial strategies in light of the growing food and climate crises, with their markers of "chronic hunger, dispossession of food providers and workers, commodity and land speculation, and global warming." (International Planning Committee for Food Sovereignty 2008) Against the neoliberal concept of food security, which emerged in the mid-1990s, farmers across the world organize in order to guarantee the food sovereignty of small-scale farming communities (McMichael 2010).

The term "food sovereignty" was first coined by La Vía Campesina at their April 1996 meeting in Tlaxcala, Mexico. The consensus at the meeting was that food security cannot be achieved without taking into consideration the people who produce food. Seeking to guarantee food as a basic human right, those gathered at the 1996 meeting defined food sovereignty as "the right of each nation to maintain and develop its own capacity to produce its basic foods respecting cultural and productive diversity." (Wittman et al. 2010: 197) They also emphasized a need for agrarian reform, demanding that landless and farming people, including women, have access to as well as ownership of land. More specifically, this call for democratic control of land implies that "rural women, in particular, must be granted direct and active decision-making on food and rural issues." (Wittman et al. 2010: 199) It also suggests that, in addition to land, women

have access to credit, technology, markets, and extension services.

La Vía Campesina is especially concerned about the privatization of seed, and views seeds and seed saving as the foundations of food sovereignty. They are worried that with the increasing corporate control of world agriculture "seed is becoming the object of exploitation of the farmers because it is being controlled and managed by big agri-business companies that have tie-up with transnational companies like Dupont, Monsanto, Syngenta, Bayer, Limagrain, Dow and Aventia." (McMichael 2010: 178) The 2008 food crisis also threw into sharp relief how governments, multilateral agencies, and financial institutions are often unable or unwilling to restrict the power of corporations, instead underwriting it with even "more dangerous versions of policies that originally triggered the current situation." (International Planning Committee for Food Sovereignty 2008)

In anticipation of an ever-deepening crisis of industrial agriculture, La Vía Campesina champions an agro-ecology project that emphasizes knowledge-intensive practices. The goal is to reduce chemical and other commercial inputs to farming and to value local ecological knowledge instead. Both are considered critical for the establishment and maintenance of democratic and sustainable food systems (Massicotte 2014; Rosset and Martinez-Torres 2012). In the words of La Vía Campesina, "To feed future populations, we must nurture the land." (Rosset and Martinez-Torres 2010)

La Vía Campesina's approach to promoting farmer control of seeds is grounded in the understanding that agro-biodiversity is essential to food sovereignty, as well as in a specific version of agro-ecology. The organization advocates for "more integrated" agro-ecological farms. An agro-ecological farm "is one that combines crops and livestock, intercrops and rotates crops, employs agroforestry, and generally exhibits a higher level of functional biodiversity." (Rosset and Martinez-Torres 2010: 10) The food sovereignty movement argues that integrated farms are not only more productive, but have overall far lower operating costs. Unlike agriculture that is intensive—in terms of energy, machinery, chemicals, and capital—agro-ecological farming is cultural, ecological, and based on restoring biological diversity (McMichael 2010).

Community Seed Banks

In line with the mission of the food and seed sovereignty movement, community seed banks represent an effective model to preserve agro-biodiversity and strengthen farmer control of seed. These seed banks, which are instituted by non-governmental organizations and community-based organizations in many regions of the world, use *in situ* strategies of conversation to combat the decline in agro-biodiversity. Through community seed banks farmers attempt to enhance genetic diversity, which in turn improves farmers' capacity to adapt to variable agro-ecological and weather conditions (Tamang and Dukpa 2015). In Bhutan, for example, where certain buckwheat varieties had almost disappeared, the National Biodiversity Centre of Bhutan managed to gather a collection of varieties that were on the verge of being lost, stored them in a community seed bank, and then multiplied and distributed seed to farmers (Vernooy et al. 2017).

Beyond placing seeds into seed banks, however, conservation efforts organized around community seed banks also often involve the training of farmers. For example, the organization Navdanya, a farmer network founded by Vandana Shiva in 1987, not only revalues traditional farming practices and indigenous seeds but also encourages farmers to share the knowledge about these seeds and varieties (Lappe and Lappe 2016). Navdanya means "nine seeds" and "new gift," which symbolizes

and celebrates biodiversity and common seed. Since its inception, the organization has established over 100 community seed banks in 17 states in India (Shiva 2016). Women farmers are often key players in the organization's efforts of preserving seed biodiversity.

Navdanya recognizes that climate change will continue to shape the need for climate resilient crops and varieties. Along coastal areas in Orissa, India, for example, farmers have developed salt and flood tolerant varieties. Today, many of these rice varieties are vanishing, because farmers increasingly resort to growing hybrid rice varieties. In Orissa, with its three community level seed banks and one central seed bank with over 700 rice varieties, Navdanya has managed to save many of the vanishing rice varieties. Navdanya also encourages farmers save and exchange varieties, and in 1995 formed "Diverse Women for Diversity," a local to global initiative that works to empower women to participate in seed saving. As a result, farmers have saved over 3,800 rice varieties as well as numerous pulses, millets, and other cereals.

Models for Seed Banks

While seed banks are run by both male and female farmers, the following examples highlight the crucial role women play when it comes to *in situ* conservation efforts. It is also important to point out that community seed banks and networks are not confined to developing countries. French, Spanish, and Italian small-scale agricultural enterprises, for example, share features with farming systems of the global South, including agro-ecological variability, diversity of species, multiple uses of crops, and emphasis on local agriculture. More emphasis on strengthening the exchange of knowledge between farmers in the north and the south could further preservation of agro-biodiversity and promote innovation in rural areas (Bocci and Chable 2009).

Africa

In **Gumbu village in Limpopo, South Africa**, a community seed bank is run entirely by women farmers. With support from South Africa's Department of Agriculture, Forestry and Fisheries as well as Bioversity International, the 40 women who operate the seed bank prioritize nutritious crops and varieties that have characteristics they value. These varieties are easy to prepare in traditional dishes, require few inputs, are often drought or disease resistant, have a short growing season, and store well (Bioversity International 2017). In order to maintain crop diversity, the women exchange seeds among farmers of different communities, often with the help of their community seed bank, which promotes and organizes these participatory exchanges (Vernooy et al. 2017). The choice to grow these varieties is the women farmers' way of coping with environmental adversity, such as changes in the rainy season, which make it harder to maintain seeds of traditional varieties and often require farming communities to consume all of their crops and seeds. Maintaining on-farm crop diversity does not only provide food for households, however, but it also allows women to earn incomes from selling seed.

Another community seed bank project in **Kiziba, Uganda**, focuses on conserving a diversity of common bean (Nankya et al. 2017). At the beginning of the project in 2008, 27 bean varieties were grown in Kiziba. By 2016, the seed bank had expanded to include 69 landraces

and improved varieties. While women are the primary producers of beans, especially for household consumption, both women and men participate in the seed bank with half of the 12-person management committee comprised of women. The activities the men and women share in include hosting on-farm trials and participating in community meetings as well as attending workshops, demonstration trials, and diversity fairs. Joy Mugisha, the seed quality assurance manager of Kiziba seed bank, was named "Best Farmer in South Western Uganda" and was also named "Common Bean Encyclopedia" for her knowledge of common bean diversity and management.

Europe

In the global North, Europe offers a number of examples of grassroots efforts focused on seed saving and the exchange of local seeds. The first seed networks emerged in Spain in 1999, followed by Italy in 2001, and France in 2003. Today we can find similar initiatives all across Europe (Da Via 2012). These networks usually include famers, farmer collectives, researchers, agronomists, and non-governmental organizations that save seeds on-farm.

The Spanish seed network **Red de Semillas** holds seed fairs, conducts training workshops, and organizes participatory plant breeding events. The network includes small farmers, farmers' organizations, researchers, and consumers committed to selecting and conserving local varieties of seeds. In France, the seed network **Réseau Semences Paysannes** is comprised of more than 50 farmer organizations, who select, breed, and multiply local varieties. They conduct *in situ* conservation practices of corn, wheat, vegetables, fruit, and fodder using both farmer knowledge and innovative scientific approaches (Da Via 2012). In addition to saving and exchanging seeds, these networks push for changes in European policies regulating seeds.

Smaller innovative groups of farmers include *La Verde*, a cooperative of six families in Andalucia committed to organic agriculture through the use of local resources. Seed saving is at the heart of their system. They have developed a systematic method of seed selection and multiplication by selecting and testing cultivars from farmer exchanges as well as from public seed banks. Through their efforts, they have preserved and renewed hundreds of varieties of crops. In Genoa, Italy, the *Quarantina Consortium* formed in 2000 to preserve the Quarantina potato and other traditional varieties. They hold an annual event, Mandillo dei Simi, during which farmers exchange seeds, plants, and knowledge. These efforts to conserve and produce local seeds directly challenge corporate agriculture and standardization, and promote farmer-driven biodiversity.

Informal Seed Systems

The informal seed system of small-scale farmers constitutes another strategy to resist the reach of corporate agriculture and fight agro-biodiversity loss. While formal seed systems usually control seed multiplication in order to assure sufficient quantities of seed as well as certified seed of guaranteed quality (Biemond et al. 2012), informal seed systems center on growing and exchanging "folk varieties," also known as "landraces," which are essential to traditional

agro-biodiversity. These geographically or ecologically distinctive populations of plants and animals, which are diverse in their genetic composition, are selected by local farmers over long periods of time (Thrupp 2000). In this selection process, informal seed networks within farming communities play a critical role (Badstue et al. 2007). These networks, which are deployed to save, exchange, and distribute seeds, are often tied to specific social relationships (Niñez 1987).

In Malawi, for example, seeds circulating within communities are important sources of reciprocal exchange, which contributes to the conservation of indigenous varieties and knowledge. In a survey among 300 farmers, Kerr (2010) found that 35% of farmers saved their own local maize seeds, while 16% received seeds from neighbors or friends and another 16% from relatives. Seeds are given as gifts to friends and relatives prior to planting season, and women provide their daughters-in-law with a start-up seed supply as a wedding present. Such seed gifts reinforce social bonds and often serve as an informal source of credit as well. Some farmers give seeds to relatives who live further away in areas with different rainfall patterns, so that if their crop fails in one year they may be able to exchange for seeds from another area.

Informal seed systems are not only tied to broader social or kin relationships but are also gendered in specific ways. Practices of seed selection and exchange are often found to move along gender lines, as farmers prefer to exchange seed and information with other farmers of the same gender (Galiè 2013). What is more, for women—whose access to public spaces can be more limited than that of men—farmer-to-farmer seed exchange can be an important source of new varieties as well as information. In Malawi, for example, it is usually older women who do the seed selection after harvest with the help of their daughters or daughter-in-laws. Similarly, in Syria the older women are in charge of seed selection and preservation. They select seeds (mainly from wheat and barley but also from certain vegetables) by keeping part of the harvest aside in a special part of the granary; during the next planting season, they then sow the seed they have retained from their own harvest. A participatory plant breeding program instituted in some Syrian villages recognizes the gendered nature of agriculture by providing women and men farmers with varieties that are consistent with their gender-based agronomic interests, activities, and knowledge.

Despite the gendered nature of informal seed systems, some crops have received minimal attention by plant breeders and agronomists, precisely because they are associated with women. Sweet potato, for example, was long considered a women's and a poor people's crop in Tanzania, and as a consequence it has not been subjected to the kind of research it deserves (Ogero et al. 2016). Yet, as the examples from Malawi and Syria show, women—and especially older women—play critical roles in seed exchanges and seed conservation efforts. In order to understand women farmers' significant contributions to preserving agro-biodiversity, we need to understand how women farmers are embedded in informal seed systems, who saves seed in a household, and who has knowledge about or controls what type of seed (Kerr et al. 2008).

Women's Seed Saving Strategies

While women in many rural societies lack access to improved varieties, inputs, and extension information, women's knowledge is crucial to preserving agro-biodiversity, saving seed,

and maintaining food sovereignty. However, because women's knowledge is not heavily influenced by the commercial market, but remains for the most part local, traditional, subsistence-oriented, contextual, and communal, it is often considered marginal. Much like indigenous knowledge, which is passed on informally between generations, their knowledge is easily undermined by globalization and the spread of western science and technology (Gururani 2002).

In light of a tendency to undervalue women farmers' knowledge, Raj Patel (2010) challenges the food sovereignty movement to take a stronger feminist, egalitarian approach to address and transform uneven social relations. In order for women's rights to be respected, every household and culture must confront patriarchal traditions, recognize how essential women's knowledge and labor is to household reproduction, and honor women's contributions to preserving agro-biodiversity.

Although women's access to land for crop cultivation is often more restricted than that of men, their agricultural activities are usually more varied. As many women tend to work in environmentally and agro-economically marginal environments, they do not simply cultivate crops, but also spend time as plant gatherers, home gardeners, herbalists, seed custodians, and plant breeders (Howard 2003). When it comes to the use of seed, women tend to have a broader set of varietal selection criteria than men, because they use plant materials in a wider range of ways as well. Through seed management, they ensure that available varieties are in line with culinary traditions, that they are tasty and nutritious, and that they meet production, processing, storing, cooking, taste, and nutrition requirements (Momsen 2007).

It is crucial to note that traditional varieties of crops tend to perform better than modern crops in the more marginal areas in which women are prone to work (Howard 2003; Momsen 2007). As a result, women are able to grow crops for subsistence as well as for cash and, given that there is high demand for traditional varieties on local markets, they may be more likely than men to sell their crops. This shows that women's trading and kin networks are essential not only to saving seeds of traditional varieties; they also maintain the market for landrace crops and serve as the main channels for the acquisition and exchange of germplasm (Momsen 2007).

Home Gardens

Across the world, the agricultural areas managed by women often contain particularly high levels of biodiversity. Of importance in this respect are home gardens, which are mostly the province of women and serve various functions at once. They produce plentiful supplies of food with relatively little labor on small plots of land. In addition, "home gardens provide a 'genetic backstop' during periods of crop failure or disruption, and are places for experimentation with new species or varieties." (Lope-Alzina 2004: 5) As such, home gardens play a crucial role in food security and in preserving biodiversity.

In many areas of southern Asia, for example, men wield greater authority over field activities, so that home garden production is the exclusive domain of women. A study of the gendered division of agricultural tasks in two villages in the Tangail District in Bangladesh shows that seed management is viewed as an extension of women's domestic duties: Women are responsible for all seed management practices and techniques, from seed processing and storage to the exchange of seeds, for both field and home garden crops (Oakley and Momsen 2007). The vast majority of seeds sown are saved on-farm by women, revealing important cultural,

economic, and environmental implications for agro-biodiversity conservation.

Home gardens do not only exist in rural areas, but also in many cities in the global South, such as in India, the Philippines, Ghana, Kenya, and Peru (Hovorka et al. 2009). Although women grow vegetables and raise livestock in kitchen gardens and small plots of land in urban and semi-urban areas, relatively few efforts have been made to systematically record and catalogue the existing agro-biodiversity in these spaces. As a result, women's contributions to urban biodiversity often go unrecognized, and women farmers lack support when it comes to accessing land and resources for activities in urban agriculture (Sachs and Patel-Campillo 2014).

Kitchens

Another important sphere in which women's labor is essential to both social reproduction and the preservation of agro-biodiversity concerns their work in home kitchens (Howard 2003). While this work is often undervalued within households and rarely considered by researchers or policy makers, many examples show how women's cooking preferences may increase (or decrease) agro-biodiversity. In other words, there exists a direct link between production diversity and household dietary diversity (Jones et al. 2014). This also means that the use of a variety of crops is not usually the result of fluctuating agronomic and environmental conditions, but a direct outcome of women's hard work to preserve the agro-biodiversity of their traditional crops. While both men and women are guardians of biodiversity who may preserve crops across multiple generations, it is crucial to recognize that it is often women who function as gatekeepers of varietal selection and agro-biodiversity (Lope-Alzina 2007).

A good example of women preserving agro-biodiversity for their kitchen and cooking needs can be found among female Mayan migrants to Quintana Roo. These women rely primarily on cash they earn working in the tourist industry and only minimally depend on subsistence production for their livelihood strategies (Greenberg 2003). Yet, they grow and conserve traditional crops in their house lots, which are not available commercially. Growing a total of 140 plant species with up to 38 different species in each lot, most of these species are used for food. Of the 17 most common species grown all but one were crops used in the traditional Yucatec cuisine, which also indicates that Yucatec immigrants maintain their ethnic identity through growing traditional plants and preparing traditional foods (Greenberg 2003).

In many societies, we can see dietary preferences and practices change and modern or Western-style diets replace traditional food. A study of Swazi diets, for example, found that people no longer grow or eat the traditional diet of sorghum and millet, but that they have switched to maize. They explain their preference with the higher yield of maize and the lower labor requirements compared to growing sorghum, which is particularly arduous to harvest and process (Malaza 2003). In addition, women from both rural and urban areas point out that many of the traditional foods required too much time to prepare. As white maize is now considered a higher status food item and a sign of "civilization," eating sorghum has become "something from the past," with the result that knowledge of how to prepare traditional dishes from sorghum is disappearing.

Faced with this loss of traditional crops and knowledge of how to process them, some communities make an effort to preserve traditional plants and food practices. In India and Nepal, for example, where millet used to be an important component of diets, women have largely stopped growing millet due to the demanding work of processing the crop. In response, Biodiversity International has developed appro-

priately scaled millet processing machines. The organization has also addressed institutional barriers to growing millet by providing financial services and encouraging the formation of self-help groups. These groups farm six varieties of millet and sell eleven different organic products across India. They also share seeds, have a steady income, and consume nutritious grains (Biodiversity International 2017).

Despite women's major contributions to preserving agro-biodiversity through their work in the kitchen, in many regions of the world women's decision-making power on the household level is severely constrained. At the same time, women's food-related care work (such as preparing and cooking meals) is labor intensive, placing more strain on women than men in households. In order to change household labor patters, it is important to note that gender roles are fluid and can be reframed in such ways that not just women but men and boys too will partake in food preparation and other food-related tasks. In light of the existence of food inequality between and within households in many rural areas of the world, we also need to begin envisioning entirely new kitchen models, including community kitchens where cooking and food preparation tasks are shared across households (Sachs and Patel-Campillo 2014). This might ultimately shake up household divisions of labor in ways that forefront the joys and pleasures of food provision and preparation.

Wild Plants

In addition to cultivated plants in fields and gardens, many societies in Africa, Asia, and Latin America rely on wild plant foods. Wild plants grow in fields, fallows, field boundaries, along roads, and in gardens (Price 2003). The gathering of wild plants is often overlooked as an important aspect of agricultural activity, because it is usually the work of women and children and these plants tend to be used for domestic consumption only. In South Africa's Western Cape, for example, where women have developed strategies to preserve and use indigenous vegetables which they refer to as *imifino* (Tavenner 2016), many men consider wild plants and vegetables to be women's or children's food, and they are not particularly interested in eating or preserving these plants.

Yet, wild plant foods can provide significant nutritional value and cultivating them may contribute to agro-biodiversity in rural areas. In Nepal, for example, wild food from uncultivated areas, referred to as *jangal*, are extremely important for food security. Rai and Sherpa people recognize over 75 plants that they use for food, fodder, medicine, household implements, and ceremonial purposes. These plants include wild leafy greens, fruits, spices, condiments, bamboo shoots, seeds, nuts, roots, and tubers. Nutritional analysis of these wild foods find high levels of Vitamin A, C, K, iron, and beta carotene, which are all much needed nutrients for poor households (Daniggelis 2003). Unsurprisingly, it is mainly women who possess the knowledge of where these plants can be found, which parts of them to use, the months during which the plants are available, how to store them, and how to process them for times of scarcity.

In northeast Thailand, too, women are the ones who collect wild plants from paddy fields, upland fields, swamps, and wooded areas, having identified 159 plants that could be used as food. Social relationships play a pivotal role in preserving biodiversity, as women share wild plant material with other women through matrilineal kinship lines. Oftentimes, women who have gained access to wild plant materials through access to public land collect wild herbs, trees, and vines from paddy fields and transplant them onto their own farmland. Thus, development policies designed to promote food security should recognize the importance of conserving "wild" areas.

Food Justice for the Future: Policy Recommendations

As women play a central role in conserving agro-biodiversity—which is crucial not only to food security but also to food sovereignty—discussions about food justice need to integrate a transformational feminist vision. We must move beyond strategies of female empowerment that echo neoliberal notions of entrepreneurship and individualistic pull-yourself-up-by-your-bootstraps approaches. Considering that neoliberal policies and agendas are behind the growing reach of industrial agriculture and Western food systems, results-based management strategies are not sustainable—especially in the economically highly vulnerable and ecologically marginal areas in which many small-scale and women farmers work.

While women across the world are embedded in collective struggles for food justice that highlight the centrality of female knowledge to productive as well as reproductive work, a key issue remains that women are often disadvantaged when it comes to decision-making on the household and community levels. If we wish to truly empower women farmers, we therefore need to develop women farmers' leadership and organizational capacities to enhance their participation in policy making (Song and Jiggins 2002). In order to achieve this, it is necessary to improve collaboration between women farmers and plant breeders using participatory plant breeding approaches that recognize and value women's knowledge and preferences for different traits, varieties, and crops.

In addition, because women continue to bear the brunt of food-related work at the household and community levels, unburdening women requires reframing the traditional gendered division of labor. This might be possible by bringing into the public eye the gendered "private" sphere of home cooking and conserving traditional cuisines. Holding communal cook-outs, competitions, and celebrations, for example, may encourage the valuation of activities that have been undervalued and traditionally been associated with women, while at the same time reinforcing, instilling, and encouraging a love of diverse, fresh food, local cuisine, and social ties (Sachs and Patel-Campillo 2014). In addition, men and boys should also be involved in food preparation on a regular basis in order to incentivize them to learn cooking skills and preserve culinary diversity.

Appreciating and supporting the connection between cultural diversity, culinary practices, and agro-biodiversity also requires the conservation of wild and uncultivated plants for human consumption. In addition to the implementation of policies in support of *in situ* and on-farm conservation (Jarvis et al. 2011), the conservation and recovery of local plant species and varieties can be achieved through community seed banks and similar mechanisms. While numerous community seed banks exist across the world, efforts must be made to enhance the capacity of these seed banks through strengthening their technical expertise (Vernooy et al. 2017). In addition, institutional support must be made available to encourage the up-scaling and development of more community seed banks.

The development of policies, regulations, and institutional mechanisms that allow farmers to grow, exchange, and sell seeds freely are crucial here (Almekinders and Elings 2001). Kloppenburg (2010) calls for an open source model for genetic resources in the form of a general public license for plant germplasm (GPLPG). This type of model is based on several principles that will assure farmers' access to crop genetic diversity by (1) preventing patenting of plant genetic material; (2) impeding bio-prospecting; (3) preventing use of farmer genetic resources in proprietary breeding programs; (4) stopping the development of GMOs; (5) developing a legal framework that recognizes farmers' rights over seeds; (6) allowing farmers to freely ex-

change, save, and improve seeds; (7) developing an institutional framework for collaboration between farmers and plant scientists; (8) and developing a framework for marketing seed that is not patented.

All of these agro-biodiversity efforts must involve collaboration on various levels—be it local, national, or international (Vernooy et al. 2017). Internationally, for example, we need to work toward transforming agricultural, food, and development institutions—including UN agencies, ministries of agriculture, and national as well as international agricultural research institutions—to recognize and support women's and small-scale farmers efforts to preserve agro-biodiversity with particular attention being paid to climate change. Outside of these institutional frameworks, we also need to promote the exchange of knowledge between farmers in the global North and the global South (Bocci and Chable 2009). Encouraging participatory plant breeding efforts that link researchers and farmers can take place on both the national and international level. Finally, on the local or regional level, it is crucial that the results realized by community seed banks are disseminated and promoted—not only between smallholder farmers and their communities but also, and especially, between men and women farmers.

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