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# Multi-Party Agroforestry: Emergent Approaches to Trees and Tenure on Farms in the Midwest USA

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**Abstract:** Agroforestry represents a solution to land degradation by agriculture, but social barriers to wider application of agroforestry persist. More than half of all cropland in the USA is leased rather than owner-operated, and the short terms of most leases preclude agroforestry. Given insufficient research on tenure models appropriate for agroforestry in the USA, the primary objective of this study was to identify examples of farmers practicing agroforestry on land they do not own. We conducted interviews with these farmers, and, in several cases, with landowners, in order to document their tenure arrangements. In some cases, additional parties also played a role, such as farmland investors, a farmer operating an integrated enterprise, and non-profit organizations or public agencies. Our findings include eleven case studies involving diverse entities and forms of cooperation in multi-party agroforestry (MA). MA generally emerged from shared objectives and intensive planning. MA appears to be adaptable to private, investor, institutional, and public landowners, as well as beginning farmers and others seeking land access without ownership. We identify limitations and strategies for further research and development of MA.

**Keywords:** land tenure; land-use change; beginning farmers; private land conservation; case study; alley cropping; silvoarable; silvopasture; windbreak; human dimensions

## 1. Introduction

Agriculture plays a major role in local land degradation as well as global pressures on natural system boundaries [1–4]. Most efforts to make agriculture more sustainable focus on mitigating negative environmental impacts through marginal improvements such as increasing resource use efficiency of existing systems or curtailing destructive practices [5–8]. Relative to most incremental approaches, agroforestry—the intentional combination of trees with crops or livestock—represents a potentially more transformative approach to enhancing crop production and other ecosystem functions in agricultural landscapes, including overyielding relative to component monocultures, carbon sequestration; promoting biodiversity; improving soil and water quality; and increasing resiliency to social and environmental perturbations [9–15].

Substantial constraints to the wider application of agroforestry persist [14,16,17]. For established farmers, limited time and knowledge constrain agroforestry adoption, as do prevalent perceptions that

trees do not belong in farming systems [18–20]. Farms often also have substantial sunk costs in existing enterprises, which, along with the advanced average age of farmers, disincentivize investment in new enterprises featuring crops with long-term returns on investment [21]. Beginning farmers, on the other hand, are, in some ways, better positioned to practice agroforestry, but face a different set of constraints. Beginning farmers are more inclined toward agroforestry and less likely to specialize in row crops and grains [22,23]. Access to land, however, represents a major barrier for beginning farmers [24]. Because beginning farmers often lack capital for land purchase, leasing can be a more accessible option.

Thirty-nine percent of all farmland in the USA is leased rather than owner-operated, including 54% of all cropland and even greater proportions in regions where intensive grain production is concentrated [25]. However, most agriculture lease terms are one-year cash rent, which lacks the security of tenure necessary to invest in long-term value added to that land [19]. Investments in trees, soil health, infrastructure such as fencing, and other elements of agroforestry systems are not reasonable financial investments when there is risk of lease non-renewal prior to sufficient return on investment [26]. Given these factors, tenure models outside of land ownership and short-term leases are needed to facilitate agroforestry (Table 1).

**Table 1.** Potential benefits of agroforestry for landowners and farmers *.

| For the Landowner | For the Farmer |
|---|---|
| Receive consistent income | Gain affordable long-term tenure of land |
| Have a caretaker of the property | Build skills and experience |
| Gain improvements to the property | Establish a profitable business |
| Realize increased property value | Share in innovation of agroforestry practices |
| Receive conservation funding | Develop a model to be replicated elsewhere |
| Option to share profits | Create a rewarding and enjoyable livelihood |
| Attain a legacy of revitalizing the land | Attain a legacy of revitalizing the land |

* Adapted from [27].

The implications of various forms of tenure for integrating trees and agricultural landscapes have been studied in tropical countries, but rarely in temperate zones, where agroforestry is less common [18,28–31]. Given the lack of research on the topic, the primary objective of this study was to describe examples of farmers practicing agroforestry on land they do not own in the Midwest USA. We conducted interviews with these farmers and, in several cases, with landowners to learn about how these parties developed suitable tenure arrangements for agroforestry. In some cases, three or more parties played a role, including investors, another farmer operating an integrated enterprise, and/or a community stakeholder group. Given the diversity of entities and forms of cooperation, we broadly term these arrangements *multi-party agroforestry* (MA).

## 2. Methods

The primary aim of this study was an exploratory documentation of MA on farms in the Midwest USA. Because our initial observations indicated MA is uncommon, we sought to document all instances feasible. Through the social networks of the authors and farms connected with the agroforestry-focused non-profit organization Savanna Institute (savannainstitute.org; Madison, WI, USA), we identified 15 farms that potentially fit our criteria for MA: growing trees intentionally integrated with other crops or livestock on land not owned by the farmer. One case, Brix Cider, did not fully meet our criteria since it involved orchards in which apples were the only crop; we included this case in order to demonstrate a harvest access arrangement that could be applicable to MA.

We contacted one or more of the parties (e.g., landowner, farmer) from the 15 potential cases of MA and requested a one-hour interview. Four cases were unavailable or declined to be interviewed and are not included in this research. With two exceptions, we interviewed the farmer to collect data for each of the remaining 11 cases. One exception was Greg Judy, who reviewed and approved the case study of Green Pastures Farm based on information we collected from his written materials and recorded talks [32–35]. The other exception was Silverwood Park; this case study was written by an author who represented one of the parties developing the project.

We conducted phone interviews in January through March of 2019. To ensure consistency, the same researcher conducted all interviews. We employed a semi-structured interview format to ensure each conversation covered the same topics. Topics and probing included questions about the farm operation, agroforestry practices, land access, and relations with other parties (Table S1).

Each interview was recorded and used, along with publically available documents, to prepare written case studies that were subsequently reviewed and approved by interviewees. With different types of arrangements (e.g., written lease or not; number of parties involved) the amount of information among cases varied.

## 3. Results

Our findings include 11 case studies of MA in the Midwest USA involving a variety of entities and forms of cooperation (Tables 2 and 3).

**Table 2.** Select cases of multi-party agroforestry and farm characteristics in the Midwest USA.

| Farm | Location | Primary Products | Acres | Farming Entity |
|---|---|---|---|---|
| Feral Farm | Jefferson, WI | Chestnut, small fruits, hay | 10 | Sole proprietorship |
| Vulcan Farm | Sidney, IL | Perennial polycultures, nursery | 10 | LLC |
| Saturn Farm | Ogden, IL | Chestnut, hazelnut, currant | 21 | LLC |
| Humble Hands Harvest | Decorah, IA | Livestock, vegetables, nuts | 22 | Worker-owned cooperative |
| Green Pastures Farm | Rucker, MO | Livestock, timber, mushrooms | 1600 | LLC |
| Aspen Farm | Soldiers Grove, WI | Livestock | 110 | LLC |
| Silverwood County Park | Edgerton, WI | Chestnuts, timber, small grains, fruit | 18 | Non-profit organization |
| Main Street Project Research Farm | Northfield, MN | Poultry, hazelnuts, elderberry | 100 | Non-profit organization |
| Farley Center Farm Incubator | Verona, WI | Vegetables, perennial polyculture | 43 | Beginning farmers |
| Community Groundworks | Madison, WI | Vegetables, small fruits, nuts | 15 | Community gardeners |
| Brix Cider | Mt. Horeb, WI | Apple cider | ~50 | LLC |

**Table 3.** Key attributes of multi-party agroforestry for select cases in the Midwest USA.

| Farm | Parties | Lease (Years) | Payment | Tree Ownership | Landowner Rights | Right of First Refusal | Distinctive Attributes |
|---|---|---|---|---|---|---|---|
| Feral Farm | Landowner & farmer | 15 | Cash rent | Farmer | Use of alleys for hay or livestock | Yes | Communication clause; future alley use for pasture |
| Vulcan Farm | Landowner & farmer | 99 | Cash rent | Landowner: trees as trees; Farmer: trees as crops | Alley grazing, trees as trees, personal harvest | Yes | Landowner enrolled in CRP; market adjusted lease rate |
| Saturn Farm | Landowner, investor & farmer | 30 | Cash rent | Farmer | None | Yes | Farmer enrolled in CRP; absentee landowner |
| Humble Hands Harvest | Cooperative, LLC landowner, and donors | 1 | Custom cash rent | Cooperative | None | Yes | Coop manages commons; neighborhood farmland investors |
| Green Pastures Farm | Landowners & farmer | >7 | Custom cash rent | Landowner | Access; hunting | Preferred | Infrastructure in leases |
| Aspen Farm | Farm owner, landowner, herd owner, herd manager | 1 | Cash rent | Landowner | Access; hunting | No | Lessee converted forest silvopasture |
| Silverwood County Park | Municipality, 2 non-profits, 2 farmers | Varies | Varies | Landowner | Designated public access | N/A | Municipal landowner |
| Main Street Project Research Farm | Non-profit, landowners, farmers, LLC, investor | Varies | Varies | Non-profit | House site | Yes | Multiple landowners |
| Farley Center Farm Incubator | Non-profit, farmers | 1 | Cash | Landowner | USDA organic standards | N/A | Informal security of long-term tenure |
| Community Groundworks | Land trusts, non-profit, public | 50 | None | Non-profit; public access | None | N/A | Public harvests at will |
| Brix Cider | 18 landowners & value-added business | None | Varies | Landowner | All except agreed harvest | None | No formal or legal contracts |

### *3.1. Feral Farm*

Feral Farm is a 10-acre chestnut alley cropping operation located on land leased from a 290-acre grass-based grazing farm in Wisconsin. Casey Dahl ("the farmer") planted the farm in 2014 as a perennial polyculture operation that included small fruits and other plantings. The operation and business model shifted since to focus on chestnuts to accommodate changes in the farmer's lifestyle, including moving over 200 miles away. Despite the challenges of distance, the farmer and landowner have worked closely to keep their arrangement mutually beneficial. The landowner has continued to operate the grazing farm and communicates with the farmer when the chestnut operation requires attention.

Before founding Feral Farm, the farmer previously grew annual vegetables and managed established orchards on leased land without written agreements. These handshake agreements worked well, but the farmer wanted to establish his own tree crops. Lacking the capital to buy land, he sought out the possibility of a longer-term land lease. He found an opportunity through a casual conversation with a landowner who was familiar with agroforestry through speakers at conferences and wanted trees on her farm. However, she did not want to make the investment and lacked the time or expertise. Recognizing a good match of skill and opportunity, she offered to let the farmer plant trees on her land. The farmer and the landowner signed a lease within a year.

The Feral Farm lease has held strong over the first five years, despite some changes in circumstances and objectives, because of the inclusion of these elements:

- Cash rent, long-term lease: Feral Farm has a 15-year lease, which is the maximum permitted length of an agricultural lease in the state of Wisconsin (Table 4). The lease does not include any provisions for renewal, due to state law. The farmer expects 15 years will provide sufficient time to establish his business value as collateral for a loan for further expansion. The farmer pays annual rent at a rate that fluctuates based on the average county farmland lease price.
- Reserved landowner rights: Although the farmer's lease includes use of 10 acres, he pays a reduced rental price attributable to rent on the equivalent of the two acres occupied by his widely spaced rows of chestnut and fruit plantings. The landowner reserves the right to manage and harvest hay in the alleys between the tree rows, and the farmer must keep the alleys clear for landowner use.
- First right of refusal: If the landowner chooses to sell, the farmer has the right of first refusal to purchase his 10 acres of land. If the land is sold to another party, the lease is designed so his 10 acres goes with the land, not the landowner, and the buyer would have to honor the lease.
- Tree, infrastructure, and equipment cost: The farmer pays all costs associated with the orchard's establishment and maintenance. The landowner waived rent for the first two years, which allowed the farmer to invest more money into establishing the farm. If the farmer needs help from the landowner, he must hire her to do custom work. They share a strong commitment to keep everything above board and professional, but also help each other with small tasks.
- Liability: The Feral Farm lease includes clear language about who is legally responsible if something goes wrong. This includes loss or damages to equipment and infrastructure as well as injuries to people. For example, there is a clause regarding parties and visitor groups.
- Communication schedule: Several provisions in the lease detail requirements for communications between the farmer and the landowner. One requirement is an annual meeting between the farmer and the landowner. This has ensured dedicated space to talk about any issues that have arisen, such as when the farmer started making plans to relocate his residence to over 200 miles away. Another communication provision relates to the expectation of future grazing in the leased area. If the landowner decides she would like to incorporate her cattle into the leased area, she must submit a grazing plan and have it approved by the farmer.

**Table 4.** Term limits in states with laws specifying maximum length of agricultural leases *.

| State | Years |
|---|---|
| Alabama | 99 |
| California | 51 |
| Colorado | 99 |
| Connecticut | 99 |
| Iowa | 20 |
| Massachusetts | 99 |
| Michigan | 34 |
| Minnesota | 21 |
| Mississippi | 99 |
| Montana | 10 |
| Nevada | 25 |
| New Hampshire | 99 |
| New Jersey | 99 |
| North Dakota | 10 |
| South Dakota | 20 |
| Vermont | 52 |
| Wisconsin | 15 |
| Wyoming | 10 |

* Adapted from [27].

### 3.2. *Vulcan Farm*

Midwest Agroforestry Solutions, founded by Kevin Wolz ("the farmer") in 2013, establishes agroforestry-focused farms in the Midwest USA. The company currently has two farms, Vulcan Farm and Saturn Farm, both under long-term leases. Both farms are located in Central Illinois but have distinct lease structures, operations, and goals.

Vulcan Farm, a 10-acre farm in Illinois, was established in 2015. The landowner currently lives on the property and runs a small livestock business with sheep for fiber, as well as broiler chickens, laying hens, and turkeys. She was looking for a way to incorporate trees into her grazing practices for shade, fodder, and biodiversity, but knew she did not have the skills to take on such a project. The farmer was looking to lease land and was attracted to the benefits of incorporating livestock into his agroforestry operation. The farmer and the landowner met through a network of local farmers but did not begin long-term lease discussions right away. They began a relationship by helping each other with small projects, building trust over time, and generally getting to know how each other lived, farmed, and communicated. The initial lease discussion came up organically, and they moved forward to find an arrangement that could be mutually beneficial.

Vulcan Farm is designed and managed as an agroforestry farm and nursery, incorporating intensive perennial polyculture, windbreaks, alley cropping, and silvopasture. Trees and shrubs are planted in rows 25 feet apart.

The Vulcan Farm lease includes several important characteristics that facilitate a long-term, stable relationship between the farmer and landowner:

- Cash rent, long-term lease: Vulcan Farm is leased by Midwest Agroforestry Solutions via a 99-year, cash rent lease, which is the maximum permitted length of an agricultural lease in the state of Illinois.
- Reserved landowner rights: Since the landowner is the livestock farmer in the partnership, she reserves the right to hay or graze the alleys between tree rows. At the beginning of the lease, the landowner cut hay between the rows but has since installed a fence around the area and grazes sheep in the alleys.
- Market-adjusted lease rate: The annual lease payment is below-market; the price reflects the value of the landowner's reserved rights. To ensure that neither party is caught in an unfavorable economic situation, the lease price adjusts every 5 years in accordance to standard market metrics.

- First right of refusal: The farmer has first refusal rights similar to Feral Farm's. In addition, the lease is attached to the deed of the property and is recorded with the county so that any potential buyers are aware of the existence of the lease. There is also detailed language that determines how the property is appraised if the farmer were to purchase it.
- Splitting tree value: Recognizing the potential for mutual benefit, the farmer and the landowner have also partnered in the investment of trees on the property (Figure 1). The landowner paid for the cost of wild-type trees for the habitat and shade value they provide, since she and her sheep reap the benefit from the ecosystem services provided by the trees regardless of their productivity. The farmer paid for the cost difference of using improved genetics for fruit and nut production, i.e., trees as crops. He benefits from the crop yield that comes from particular cultivars over and above their value as wild-type trees. This unique investment structure is also tied to appreciation of the property; when/if the farm sells, it will be appraised considering only the value of trees as trees, so that the farmer does not pay twice for value of productive trees.
- USDA Conservation Reserve Program (CRP): The landowner enrolled in CRP, paid and was reimbursed for establishment of a CRP windbreak and pollinator strip, and she receives all related incentive payments. She contracted the leasing farmer to establish both practices.

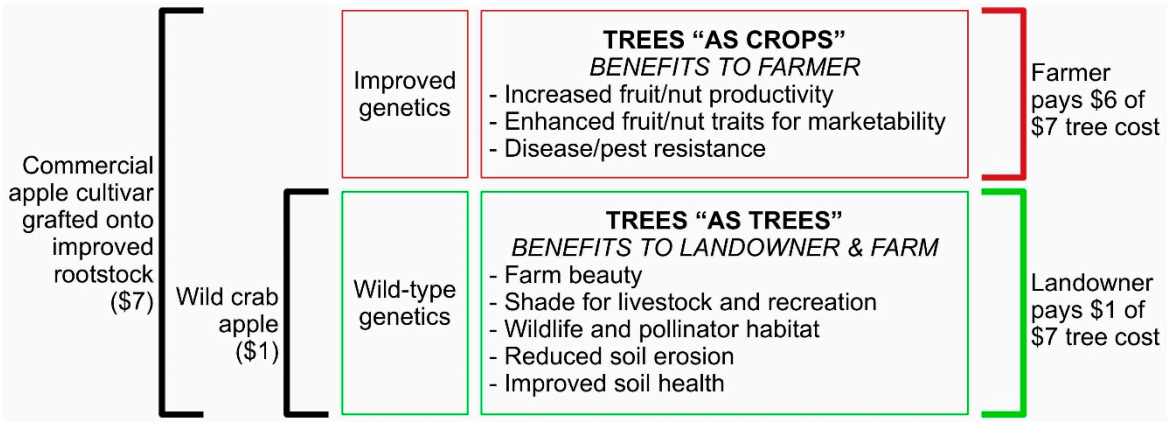


**Figure 1.** Tree cost at establishment of an agroforestry planting can be split between farmer and landowner based on the value of trees as wild-type trees versus trees as crops, as was done at Vulcan Farm. An illustrative example for apple is included.

The farmer and the landowner worked with the non-profit organization Farm Commons (farmcommons.org; Duluth, MN, USA) to draft this unique agreement, which addresses many of the key hurdles that prevent new agroforestry farmers from getting started. Additional mutual benefits in their relationship include the farmer renting equipment, like a tractor, from the landowner, and the farmer benefits from the landowner living on the property and keeping an eye on the farm.

This year will be the fourth year of the lease, and there have been no major issues to date. The farmer feels that he has the support of the landowner, both legally and personally.

### *3.3. Saturn Farm*

Saturn Farm, established in 2016–2017 in Illinois, shares some similarities with Vulcan Farm (long-term, cash-rent lease for an agroforestry operation with alley cropping and windbreaks), but there are also important differences. This property is 21 acres and is designed as a commercial chestnut, hazelnut, and currant operation, rather than a germplasm repository and nursery. Just like at Vulcan Farm, the farmer and the landowner at Saturn Farm knew each other for several years prior to signing the lease. When the landowner decided to move out of state, they worked together to negotiate a long-term lease that would support her desire for agroforestry on the farm.

The landowner was uncomfortable with a 99-year agreement, so they settled on a 30-year term with the option to renew at the end of the term. Both parties thought the duration was long enough

to see a return on investment. The farmer worked with outside investors to provide capital for tree establishment and maintenance. There are some restrictions delineated by the lease (e.g., no use of genetically modified crops and no aerial spray applications), but there are no use or access rights reserved by the landowner. Unlike at Vulcan Farm, the farmer enrolled in CRP and receives the incentive payments for establishing windbreaks and pollinator habitat. The farmer and outside investors paid for, own, and will reap the profits from the trees, the well, and the irrigation system established on the farm.

The farmer says that working with an absentee landowner has worked well. The landowner gets a rent payment every year and knows the land use aligns with her values and future goals. The farmer gets autonomy on the land and is able to make his own business decisions, as long as they align with the lease terms.

- Cash rent, long-term lease: Saturn Farm is leased by the farmer via a 30-year, cash rent lease, which both parties thought was long enough to see a return on investment.
- No reserved landowner rights: While there are some restrictions delineated by the lease (e.g., no use of genetically modified crops and no aerial spray applications), but there are no rights reserved by the landowner (such as alley grazing rights).
- Market-adjusted lease rate: The lease price adjusts every 5 years in accordance to standard market metrics.
- First right of refusal: If the landowner chooses to sell, the farmer has the right of first refusal to purchase the land. The terms are the same as the Vulcan Farm lease.
- Tree, infrastructure, and equipment costs: The farmer has invested in extensive infrastructure on the land, including installation of a well and an irrigation system. At Saturn Farm, the farmer and outside investors paid for, own, and will reap the profits from the trees.
- USDA Conservation Reserve Program (CRP): The farmer enrolled in CRP (windbreaks and pollinator habitat) and receives the incentive payments.
- Establishment Financing: The farmer worked with outside investors to finance the establishment costs of the operation.

### *3.4. Humble Hands Harvest*

Humble Hands Harvest is a 22-acre farm in Iowa raising livestock in alley pastures (mostly pigs and sometimes sheep) between rows of young nut trees, as well as annual vegetables on other parts of the farm. The farm business structure is a worker-owned cooperative with a mix of owned and leased land under operation.

The founders of the cooperative selected this model in part to facilitate the social and environmental justice mission of the farm. This model provides room for members to build equity, has an exit strategy, and intends to provide a pathway to land access for beginning farmers.

- Multiple landowner leases: The cooperative leases some land at a below-market rate from an LLC formed by community members to hold the land until the cooperative can purchase it. The cooperative also leases some land owned by individual members of the cooperative.
- Business structure: The worker-owned cooperative is governed by a written agreement.
- Cooperative land ownership: Two farmers are currently owner-members of the cooperative. The business structure is designed so additional farmers can join the business and build equity in the cooperative. In addition to the leased land, some of the farm is land is owned by the cooperative.
- Commons as member of cooperative: Some of the land, and the trees planted there, were donated. These parts of the farm are accounted for as a community-owned commons. The cooperative's charter includes the commons as a member, in the sense that the wider community also has equity in the business. If the farm were dissolved or a member of the cooperative exited, the equity associated with the commons would either remain with the farm or be distributed elsewhere in the community rather than being recovered by individual members of the cooperative.

- Infrastructure ownership: The buildings and infrastructure (e.g., a well) on the farm are owned by the cooperative, in some cases with financing from the cooperative's members. The land with trees and infrastructure are owned by the cooperative or its members.
- Path to ownership: The LLC that currently leases land to the cooperative was formed to provide secure tenure while the cooperative develops capacity to purchase the leased land. This structure is designed to build equity.
- Tree, infrastructure, and equipment cost: Ownership and investment in tree, infrastructure, and equipment costs varies based on who owns the land (external landowners, member landowners, or the cooperative itself).

### *3.5. Green Pastures Farm*

Greg and Jan Judy ("the farmers") own Green Pastures Farm, a grazing operation in Missouri that includes sixteen 16 separate properties; twelve of these properties are leased. Green Pastures Farm's primary products are grass fed and finished beef, hair sheep, timber, and log-grown mushrooms. They also work with two other farmers on their land who raise and manage hogs and pastured laying hens. Their animal management strategy focuses on keeping inputs low by working in balance with the natural landscapes of their properties. Green Pastures Farm currently manages 1600 acres, with 700 acres in grass and 900 acres in woodland.

Since the mid-1990s, on their land and land leased from nearby landowners, the farmers have worked to increase the beauty and value of the land through infrastructure improvements, forest management, and targeted multi-species grazing to manage understory and open pasture vegetation. They have established silvopasture areas on several of the farms, both owned and leased. The goals for the silvopastures are to improve the forage availability, livestock access to shade, timber quality, and aesthetic aspects of the property. Culled logs are used as much as possible for timber and mushroom production.

Each of the farmers' lease agreements is unique to the property and the landowner. The farmers emphasize that leasing land rather than purchasing it frees up equity to invest directly into the animals and other aspects of growing the business. Key characteristics of his leases include:

- Written, long-term lease: All Green Pastures Farm leases are legally binding, written leases lasting at least seven years. For the farmers, this duration ensures a return on investment.
- Custom rent: Leases range from $0 to $25 an acre. The price reflects the infrastructure and land improvements the land needs to support grazing (e.g., installing ponds for water access, building permanent fencing, restoring overworked or poor land, etc.). This custom rent price recognizes the regenerative and beautification work Green Pastures conducts on the land.
- Infrastructure cost: In general, the farmers plan for two years of infrastructure and land improvements, followed by five years of good production through sustainable grazing. Costs for fencing and materials are also written clearly into each lease to designate responsibilities for purchase, maintenance, and whether accounted for separately or in the rent price.
- Landowner communication: The key to successful leases is in the relationship Green Pastures builds with the landowners. They invite landowners to experience how the cattle move and improve their land and update them monthly with a picture-rich email. As a gesture of the farmers' goodwill, landowners also receive meat from cattle raised on their land. The farmer says it is the responsibility of the farmer to maintain clear lines of communication. These strong relationships lead to long-term lease agreements and lease renewals.
- Connected lease properties: Most of the farmer's leased properties are adjacent to each other so they can share resources, such as electricity and fencing. For example, one of his leased farms has the capacity to charge fences on five others.

### *3.6. Aspen Farm*

Aspen Farm is an 80-acre home farm plus an adjacent 30 leased acres in Wisconsin. Dairy heifers, beef steer seasonal stockers, and sheep raised on pasture are the primary farm enterprises. The parties involved include:

- Farmer: Owns the home farm and manages the farm business.
- Herd manager: Paid for his labor involved in cattle management, pasture improvement, fence construction, and silvopasture establishment. He also seasonally grazes his own flock of feeder lambs on the home farm.
- Livestock owners: Hire the farm to raise cattle on pasture during the 6–7 months of the grazing season.
- Landowner: Leases land to Aspen Farm that is adjacent to the home farm on a one-year renewable lease.

The leased acreage includes open pasture as well as woodlands that have been degraded by overgrazing and logging. Parts of the leased land and the home farm were converted to silvopasture by the herd manager thinning the overstory and shrub canopy and establishing improved forages. The sheep have also been used to assist in vegetation management on the home farm.

The farmer and herd manager are pleased with the silvopasture because it increases the amount of forage available on the leased acreage. Both the farmer and landowner report enjoying the aesthetic and recreational aspects of a more open woodland pasture. The herd manager values the benefits of having forage available for animals to continue to graze where they seek shade, as well as the benefits of nutritional diversity via woody browse in silvopastures.

- Cash rent, short-term lease: Aspen Farm leases 30 acres on a one-year renewable lease.
- Reserved landowner rights: The landowner of the leased acreage has access for recreation and hunting. The landowner also specified that no saleable timber should be removed in the silvopasture establishment without his approval.
- Lease rate: Negotiated periodically based on typical local rates for pasture rental.
- Forest management: Farmer and herd manager decide how to use the woodlands for silvopasture, with the approval of the landowner.

### *3.7. Silverwood County Park Agroforestry Demonstration*

Silverwood Park was donated to Dane County, Wisconsin with stipulations that the land continue to be actively farmed and used for agricultural education. Silverwood Park currently leases land to five farmers who grow a variety of annual crops. With the purpose of demonstrating agroforestry at the park, the Savanna Institute partnered with Friends of Silverwood Park (FOSP), the citizen-advisory group that manages the park.

Through a series of meetings over several months beginning in 2018, a plan was developed to establish an 18-acre alley cropping and windbreak demonstration area. The area is currently leased to an organic row crop farmer, who has been involved in all planning discussions and is very supportive of the project. He will continue to farm row crops on his regular rotations in the alleys between tree rows. The landowner, Dane County Parks, contributed initial funds to the tree purchase, installation, protection, and maintenance, but is not involved with any other aspect of management, product ownership, or research and education. The Savanna Institute has sought external funding from governmental and private grant-makers.

The primary project objectives are education, research on agroforestry crops and best practices, and demonstration of the profitability of such a system. Maximizing crop diversity while also demonstrating the feasibility of large-scale alley cropping drove the design. Alley cropping systems in the project include (1) timber trees (black walnut alternated with hybrid poplar) to showcase the potential for growing valuable timber species with minimal inputs while still maintaining cropland,

and (2) interplanted chestnut and elderberry to demonstrate the integration of fruit and nut crops into alley cropping. In both systems, 80-foot between-row spacing accommodates the row crop farmer's widest equipment. Additionally, plantings of aronia and black currant were designed for mechanical harvest and to demonstrate the potential of fruiting shrubs in lieu of, or adjacent to, row crop agriculture. Finally, a windbreak on the edge of the field will protect the tree crops from wind and potential pesticide drift from the neighboring conventional row crop field.

The designation of roles and responsibilities was a key outcome of the extensive meetings to build relationships and plan the operation (Table 5). These respective roles reflect the relative interest in involvement by each party. A memorandum of understanding is in place between the Savanna Institute and FOSP. Written lease agreements have also been negotiated among all parties.

**Table 5.** Roles and responsibilities of parties cooperating in agroforestry demonstration at Silverwood Park, Wisconsin USA.

| Roles & Responsibilities | Friends of Silverwood Park | Savanna Institute | Mark Doudlah/External Contractor | Dane County Parks |
|---|---|---|---|---|
| Land tenure | Long-term lessee | Long-term sub-lessee | Sub-lessee | Landowner |
| Fundraising | Some responsibility for fundraising | Main responsibility for fundraising | May contribute cash or labor to costs | Capital expenses |
| Planning/design/stakeholder engagement | Equal role | Equal role | Equal role | None |
| Installation | Contribute labor | Lead responsibility | Secondary responsibility | None |
| Ongoing management | Contribute labor | Oversee | Contribute labor | None |
| Ownership of products | Shared based on initial agreement | Shared based on initial agreement | Shared based on initial agreement | None |
| Research | Assist as appropriate | Lead responsibility | Assist as appropriate | None |
| Public programs | Shared responsibility | Shared responsibility | Assist as appropriate | None |

### *3.8. Main Street Project Research Farm*

Main Street Project (MSP) is a 501(c)(3) non-profit organization focused on developing programs to increase skills, income, and job access for Latinx immigrants working in the low-wage agricultural and food industries. Since 2010, MSP has piloted an innovative poultry agroforestry production system. Their related programs cover business planning, hands-on training, mentorship, and best practices for land stewardship, expansion, and replication. After almost a decade of developing and testing this model, MSP was ready to scale up and expand beyond their existing half-acre units.

Established in 2018, the MSP Research Farm sits on 100 acres outside of Northfield, Minnesota. The purchase, lease, and management of the land is a unique and community-informed partnership among the original landowners, investors, and the non-profit. Key features of the partnership include:

- Innovative land ownership: The 100 acres where the Research Farm is located was originally owned by conventional farmers that lived next door to MSP Chief Strategy Officer Reginaldo Haslett-Marroquín. After a long period of relationship building, the landowners agreed to sell their tillable land for the MSP Research Farm. MSP owns 40 of the 100 acres, which is the most a non-profit organization can own in the state of Minnesota. An investor-landowner committed to

the mission of MSP purchased 60 additional acres. The original landowners retain ownership of their farmstead site and some existing wetlands.

- Land purchase financing: The 40 acres purchased by MSP was financed through a partnership with Iroquois Valley Farmland REIT, a certified B-Corporation that operates a Real Estate Investment Trust focused on organic farmland. Two key mechanisms facilitated by Iroquois Valley allowed Main Street Project to own the land:
    - Iroquois Valley's soil restoration notes waive land payments during the first two years allowing farmers to invest in soil and business building.
    - Iroquois Valley's commitment to financing small acreage purchases is uncommon for farmland investors.
- Lease structure: The farm is managed by an LLC. The LLC holds a 21-year lease with each of the landowners. The partners, led by Main Street Project Chief Operations Officer Julie Ristau, tried many different models and worked with multiple legal advisors. A challenge was finding people who could work outside of existing legal frameworks to create a new, legally protected way of viewing community land ownership and access.
- Landowner responsibility: The two other landowners (the investor-landowner and the original landowners) are full partners in the development of the Research Farm. They all have a seat at the table and help make decisions in the plan for the land. The original landowners still live on the land and are working towards regenerative land management, something they were not interested in before being approached by Main Street Project. The investor-landowner is currently building a 2-acre homestead on their land.

### *3.9. Farley Center Farm Incubator*

The Farley Center is a non-profit organization that owns 43 acres of farm and woodlands in Wisconsin with the intertwined missions of social, progressive change, community building, sustainability, and ecological justice. The center hosts a farm incubator program focused on providing education and access to beginning farmers, with the outlook that the farmers help the center care for the land. While each incubator farmer initially has access to a one-year lease, the Farley Center and the farmers work to build a community of trust and mutual support that has allowed farmers to invest in the land and their farm businesses long-term. The farm incubator is USDA certified organic, so every farmer is key to the center's commitment to soil building and ecological farming.

Ian Aley (the farmer) began leasing land and farming at the Farley Center seven years ago. At the time he ran a small vegetable-focused market garden with a small CSA and wholesale sales through a local marketing cooperative. After a few years of vegetable farming, the farmer decided to stop growing vegetables at scale and shifted his focus to perennial production. Because of the support of the Farley Center, he felt comfortable investing in fruit production (including apple, pear, peach, serviceberry, elderberry, cherry, paw paw, and others). He hopes to be able to offer fruit to the CSA programs of other farmers on the land. Even though the lease the farmer holds is not long-term, his plans for his land are.

- Lease structure: While the individual parcels of land can only be leased in one-year increments, the non-profit welcomes farmers for the long term. There is an understanding that farmers are welcome to stay as long as they need. The farmer stresses the lease is more about relationship than contractual agreement. Because the land is owned by the Farley Center and governed by a board, there is stability. The farmers and non-profit view the land not as private property, but a common resource. He values the trust he has in the personal relationships at the center; if this was different, he would want a more stable lease.
- Shared resources: Incubator farmers enjoy access to shared infrastructure (including water and cooler space), access to staff expertise and assistance, participation in bulk buying of supplies

like potting mix and soil amendments, tractor rental, high tunnel space rental, and shared tools. Farmers also can participate in a marketing cooperative that sells farm goods wholesale to local restaurants and food outlets.

- Peer support: Many Farley Center farmers are new Americans who both benefit and greatly contribute to the culture of mutual support. More established farmers often work closely with beginning farmers on the land.
- Funding structure: Initial funding for the incubator farm program was mostly sourced through USDA grants, which provided for technical assistance, infrastructure and equipment, and operating support. But there was a need for more reliable funding. To address this, the Farley Center operates a green cemetery in woodlands that are not farmed on the property to generate income for staff and support of the farm program. While this revenue does not cover all costs, it provides stability for the farm and the farmers.

### *3.10. Community Groundworks*

In Madison Wisconsin, on 15 acres owned by a community land trust, the 501(c)(3) non-profit organization Community Groundworks runs a 5-acre, certified organic community farm focused on annual vegetable production. Community Groundworks also manages the Troy Community Garden (comprised of over 300 individual 400-square-foot garden plots). In addition to managing the farm, gardens, tree crops, and natural areas, along with an edible forest that includes fruit, berries, and nut trees, Community Groundworks coordinates closely with a 30-unit mixed-income housing development on the property. The non-profit also runs education and outreach programs for adults and youth, with the aim to connect the greater Madison area to farming, gardening, and the importance of human, land, and social health.

The history of the land and how this tenure arrangement evolved is complex. In 1995, 15 acres owned by the State of Wisconsin was planned for commercial development until community members banded together with local non-profits to devise a way to maintain public use of the site. In 1998, the state granted a 50-year lease to the 15 acres plus an adjacent 16 acres to Community Groundworks. The lease included a provision, executed in 2001, allowing Madison Area Community Land Trust to fully acquire the land title.

- Land ownership and management: The land is owned by Madison Area Community Land Trust with a conservation easement held by Center for Resilient Cities.
- Long-term lease: 50-year lease of 15 acres to Community Groundworks.
- Infrastructure ownership: All infrastructure managed by Community Groundworks is owned by the non-profit.
- Tree cost and maintenance: Edible perennials on land leased by Community Groundworks were planned and planted with grant funding that is no longer available. These edible perennials are in need of greater management.
- Access: The harvests from this area are communal on a first come, first served basis.
- Communication: Clear communication and planning is key to this arrangement that includes multiple nonprofits and organizations with differing missions.

### *3.11. Brix Cider*

Marie and Matt Raboin ("the cider makers") began making cider commercially in 2016, two years after planting apple trees on the land they own in Wisconsin. They initially planned to establish a large enough orchard to grow their own apples for the cider operation, but the startup cost was ultimately greater than they could afford. This meant they would either need to buy apples or juice from large, out-of-state orchards or devise a more local, creative solution.

Through Marie's work for NRCS with farmers across the region she came across many farms with small orchards, operations with abandoned apple trees, and numerous aging growers who

could no longer manage their trees. Matt and Marie devised a plan to work with these orchards by harvesting and making cider from surplus and less-than-perfect apples that would normally never reach consumers. They received a grant to test this idea by helping them establish strong relationships with the 18 different orchards they work with today.

The cider makers do not have any legal contracts with the landowners they work with. These casual agreements are often set up by calling the landowner, proposing to harvesting their trees, and setting a price. Most are very happy to allow them to pick, especially older people who have orchards. Many of these orchards have long been for sale but have not sold; partnership with Brix Cider has allowed them to avoid the undesirable alternative of cutting their trees down to sell or rent the land for row crops. These unique partnerships allow Brix Cider to source a large variety of local apples (within 30 miles) for the same price as buying them from outside of the community, with the added benefit of building connections to the land and people.

Since their own orchard will never produce more than 10% of the apples needed for the cider business, the cider makers are looking to harvest more apples each year. They are exploring many options, including more directly managing the orchards they currently work with. This would mean yearly pruning and maintenance, leading to larger yields and better apples. It also brings up the possibility of needing more formal agreements that would protect the cider makers' investment of time, labor, and travel. However, they emphasize that the smaller orchards like that they do not have to sign anything, and it allows all parties to be a flexible.

## 4. Discussion

In this section, we discuss (1) key features of multi-party agroforestry (MA), (2) land access and tenure in MA, strategies for further development of MA through (3) policy and programs and through (4) direct interventions, and (5) future research directions.

### *4.1. Key Features of MA*

In contrast to independent landowner-operators as the archetype of agroforestry practitioners, this study describes 11 diverse cases of farmers practicing agroforestry on land they do not own in the Midwest USA. As with many other forms of agriculture, partnerships of landowners, operators, and investors can be adapted to agroforestry. We use the term partnership in the general sense; landowners did not have formal business partnerships with farmers in the cases we documented. Most of the agreements in this study developed from initial contact either via social networks or solicitation by one of the parties. To our knowledge, none of these arrangements were initiated through intentional match-making efforts of a third party. Most of the interviewees emphasized the value of developing personal and professional relationships at the outset of the partnership. This connection was important to build a sense of shared values and broad-scale objectives as a basis for then developing more specific arrangements. The case at Silverwood Park, for example, involved a series of meetings over the course of several months involving the municipal landowner, the citizen advisory group, the non-profit organization, and the collaborating farmer. Efforts to link beginning farmers with landowners are becoming more common; if such programs extend to MA, a continued emphasis on building relationships will be essential to their success [24].

A written agreement governed most, but not all, of the partnerships. One exception was Brix Cider; in that case the extent of agreements were one-time harvest payments and did not require capital investment to establish perennial crops. In most cases, farmers who established and maintained perennial crops and agroforestry on land they do not own required security of tenure extending for a sufficient period of time to recoup their investments. The landowners also faced a heightened stake in the success of an agroforestry venture since trees will remain on their property longer than annual crops.

A long-term lease was the most common vehicle for formalizing agreements between farmers and landowners, though other mechanisms were also explored (Table 6). The process of creating a long-term

lease involved all parties cooperatively developing specific terms to meet their respective goals and putting the lease agreement in writing. A comprehensive account of this process is beyond the scope of this study (but see [27]). A number of features of long-term lease agreements for agroforestry require attention during their development: the length term of the lease; process for renewing or exiting the lease; the rent payment amount and schedule; conditions of selling or transferring the land, including right of first refusal; conditions of subleasing; scope of allowed/required uses; accounting for improvements, including trees and infrastructure; basis for ongoing communication, negotiation, and dispute resolution; and allocation of appreciated assets at termination.

**Table 6.** Select non-ownership tenure arrangements for agroforestry under U.S. common law *.

| Default Characteristics of Tenure Arrangement | Lease | Easement (Appurtenant) | Easement (In Gross) | License |
|---|---|---|---|---|
| Binding to the land: Grants the farmer a property interest or legal right that attaches to the land and passes to future landowners | X | X | | |
| Possession rights: Grants the farmer the exclusive right to possess or occupy the property | X | | | |
| Usage rights: Grants the farmer a right to use the property for some purpose(s) | X | X | X | X |
| Revocability: Can generally be revoked by the landowner at any time | | | | X |
| Revocability: Can be revoked by the landowner at the time of death or when the property is sold | | | X | |
| Transferability: Can be transferred by the farmer during his lifetime or at death | | | X | |

* Adapted from [27].

Several case studies highlight the importance of these items within the lease agreement to build on a shared understanding of expectations and responsibilities, as well as mitigate risk in case of changed circumstances. For example, Green Pastures Farm, Vulcan Farm, and Saturn Farm emphasized including the value of improvements in the terms of the lease.

Although the complexities and nuances are significant in planning for long-term agroforestry partnerships, our study demonstrates that the success of these partnerships depends on (1) building shared values and objectives among partners, and (2) paying attention to details in the planning process. When there is commitment among the multiple parties involved to these elements, land access and tenure models adapted to long-lived and diversified systems can be developed for farmers, landowners, and society to enjoy benefits of agroforestry [24].

### *4.2. Land Access and Tenure in MA*

Land access represents a fundamental challenge for many farmers, especially for beginning farmers [36]. These case studies highlight how farmers accessed land and secured appropriate tenure for agroforestry enterprises without purchasing it. Developing relationships, articulating shared objectives, and conducting intensive planning were consistent themes in land access. Although mechanisms varied, a written agreement was common for securing tenure with a time horizon appropriate for agroforestry.

The case of Green Pastures Farm highlights how leasing land can ease the capital requirements required to begin and expand farming operations. Instead of tying up equity in land purchases, he invested in other expenses such as the trees, fencing, and animals. They also used infrastructure

improvements and vegetation management on leased land to establish silvopasture and forest farming enterprises, thereby generating revenue on land that is fallow, degraded, or unsuitable for cultivation.

Certain features of the lease agreements at Feral Farm and Vulcan Farm facilitated beginning farmer tree crop enterprises. In both cases, the landowner operator continued to farm in the alley spaces between the rows of trees, making hay in the former case and pasturing sheep in the latter. The Feral Farm arrangement further freed capital for establishing tree crops by (1) effectively limiting the lease to the area corresponding to tree rows, and (2) delaying rent payments for the first two years. While this represented a financial concession from the landowner, it was agreeable considering the value of assisting a beginning farmer and the added value to her farm of the chestnut silvopasture. Both arrangements also include rental of equipment and services such as mowing for use in their operations. This ensures appropriate landowner compensation and clear expectations around their commitment to the lessee's operation.

The lease at Vulcan Farm also included a provision to allocate the value of trees—both the cost at establishment and in case of lease termination—according to their value as trees and their value as crops (Figure 1). Although, to our knowledge, this represents a novel strategy to make agroforestry accessible to a beginning farmer in the USA, the partitioning of value and use rights of trees and forests is common in other parts of the world [37].

In the cases of Main Street Project and Farley Center Farm Incubator, these organizations exist for the express purpose of providing opportunities for aspiring farmers to gain experience and resources they need. The agroforestry systems established at these farms can be considered part of the educational infrastructure, just as are the shared tools, equipment, and buildings. Not only does the harvest and sale from mature perennial crops potentially offer more immediate income opportunities for a new farm business, but the knowledge and skill gained by managing the established crops gives beginning farmers a window into how agroforestry could be integrated when they establish their own farms. In a slightly different fashion, Brix Cider's practice of harvesting from other mature orchards while their own orchard is not yet in full production makes use of existing tree crop infrastructure to develop their business without having to wait for their own trees to mature.

Although it has not been systematically surveyed, the authors' experience suggests that there are many more landowners in the Midwest USA who would like agroforestry on their land than there are farmers who are prepared to develop agroforestry enterprises (but see [18]). Generally, the USA faces a dearth of beginning farmers [38]. This is a particular limitation to agroforestry, given that farmers early in their careers are (1) better positioned to reap the benefits of long-lived perennial crops, and (2) more interested in alternative production systems [39]. A number of financial factors besides land access often make it difficult for beginning farmers to become established: the cost of healthcare, student debt, and the uncertainty of farm income [40]. In part due to these factors, beginning farmers often lack the support necessary for long-term enterprises such as agroforestry; hence, there is a need for policies that address these factors as part of a holistic strategy to foster land access via MA [41].

Private ownership undergirds most tenure arrangements in the USA, and MA arrangements can adapt to this context. Examples include Vulcan Farm, Saturn Farm, Feral Farm, Green Pastures Farm, and Brix Cider. Land use rights held in common can also facilitate agroforestry, e.g., via easements (Main Street Project), community land trusts (Community Groundworks), and public land ownership (Silverwood Park). Ownership by land trusts and non-profit organizations (Farley Center Farm Incubator) represents a combination of public and private interests; such organizations are generally private but chartered for public benefit [42].

Investors in agroforestry partnerships can also fill a critical role in providing access to land, capital for accessing land, and financing for start-up costs and operating expenses. Because agroforestry enterprises are often unfamiliar to conventional lenders, investors familiar with agroforestry can be key partners in equity (Saturn Farm), debt financing (Main Street Project & Iroquois Valley), and blended forms of capital that include local community support (Humble Hands Harvest). Although their investment in the Main Street Project Research Farm was in the form of debt financing, in other

investments Iroquois Valley purchases farmland and leases the land to farmers who fit their criteria of positive social and environmental impacts. To this end, most farmers Iroquois Valley leases or lends to raise organic row crops or livestock; Main Street Project is their first farm featuring agroforestry. Notably, Iroquois Valley has developed financing strategies that reflect the delayed cash flow and return on investment inherent in transitioning to organic and long-lived perennial crops. As the interest in impact investing grows, MA could help counter the trend of worse environmental outcomes on leased land compared to owner-operated land [43].

Land-owning institutions are potentially well-positioned for MA [44]. Many institutions have underlying missions that support sustainable land use such as agroforestry, and also may not need to maximize short-term income from the land. This was the case for Silverwood Park, Farley Center Incubator Farm, Community Groundworks, and Main Street Project. These institutions may also have less property tax liability, reducing the cost of carrying land. Furthermore, institutions may be able to offer more stable tenure and governance than a privately owned parcel. This can lower risk to the farmer posed by potential changes in ownership, landowner priorities, and development threats. Conversely, turnover in staff and organizational complexities can add to the time needed for coordinating with institutional partners involved (Silverwood Park). If funding wanes for non-commercial plantings, management can lapse (Community Groundworks). Nevertheless, the use of land owned by municipalities, land trusts, religious groups, and other such institutions holds much potential for land access via MA.

### *4.3. Policy and Programs for Further Development of MA*

Broadly, intersections of public and private interests in land use represent fertile ground for the further development of MA. Private ownership of land predisposes use for individual benefit—and in many cases these uses can work against public interests—but the public can encourage more desirable land uses via incentives and regulation [45]. Agroforestry systems produce saleable agricultural products and a host of services of value to public interest [9,15]. These ecosystem services and amenity values include maintaining water quality, providing wildlife habitat, sequestering and storing carbon, providing spaces for recreation, and reducing the risk of fire in a landscape [10,46,47]. Thus, MA represents a potential nexus for shaping private land use to encourage these public interests, but agroforestry generally is limited by a lack of support for farmers for providing these services to society [45,48].

Notable exceptions in this region include USDA programs that pay for establishment and land rental for conservation practices such windbreaks, riparian buffers, and pollinator habitat. These practices are part of the agroforestry systems on Vulcan Farm and Saturn Farm. On Vulcan Farm, the landowner made the contract with USDA, paid for the cost of practice establishment, and receives the annual incentive payments. On Saturn Farm, the leasing farmer made the contract with USDA, paid for the cost of practice establishment, and receives the payments. Another potential mechanism for public support of MA would be to offer tax credits that favor agroforestry, especially in situations where agriculture is causing resource concerns [49,50]. For example, these credits could encourage MA on the 8.0 million ha of land with expiring CRP contracts in 2019–2030 [51]. In contrast to incentives, direct regulation also represents a strategy to protect public interest in private land use. To improve water quality, Minnesota has a new law that will require riparian buffers; MA offers a potential mechanism for maintaining agricultural production in buffers while protecting water quality [52].

Both regulation and incentives involve persuading a private landowner to act in the public interest. By contrast, when land or rights associated with land use are held in broader trust, the public potentially has more direct leverage to encourage uses compatible with its interests. For example, the State of Minnesota has an easement program in which they effectively prohibit planting maize and soybeans in areas vulnerable to erosion by purchasing the rights to cultivate these crops there. Part of Main Street Project Research Farm is under this easement. These examples demonstrate that although the private ownership is the foundation of most tenure arrangements in the USA—and MA

can adapt to this context (e.g., Vulcan, Saturn, and Feral Farms)—land use rights held in common can also facilitate agroforestry, e.g., via easements (e.g., Main Street Project), community land trusts (e.g., Community Groundworks), and public land ownership (e.g., Silverwood Park).

Beyond public support for societal benefits from agroforestry, there is growing interest in mobilizing private capital to support ecosystem services [53]. For example, in water quality trading markets such as those in the Chesapeake watershed, landowners (and farmers to whom they lease land) can be paid to plant perennial crops rather than annual crops in riparian zones to protect water quality [54]. These payments are financed through fees on development, such as roadway expansion, that have unavoidable negative water quality impacts. Likewise, if carbon storage on farmland becomes monetized, agroforestry will be well positioned to generate income through those markets or subsidies as well [10,55,56]. Investment funds seeking positive social and environmental impact are already active in forestry, and the case of Iroquois Valley's investment in Main Street Project here provides an example of how private capital could support MA [57].

### *4.4. Direct Interventions for Further Development of MA*

Although the case studies presented here demonstrate that MA can adapt to various contexts, there remain a host of broader contexts that limit agroforestry. Enumerating the limits to broader application of agroforestry is beyond the scope of this paper (but see [31]), but a number of intersecting factors represent potential intervention points for further development of MA.

Absentee landowners own much of the farmland that is leased in the United States [25]. Although these landowners may have interest in agroforestry, by virtue of lack of proximity they may be poorly positioned for the intensive planning many interviewees in this study emphasized as key to the success of a long-term agroforestry lease [18,20]. Furthermore, absentee landowners frequently contract with a land management company to oversee the use of their land, and often this company identifies the lessee farmer and manages that relationship in lieu of the landowner. Familiarity and interest in agroforestry among land management companies is unknown, but likely low. There are a limited but not insignificant number of contractors, consultants, and agency personnel in the USA available to assist landowners in establishing agroforestry, but there are few companies that offer ongoing management of agroforestry enterprises or facilitation of leases to agroforestry operators. This lack of back-stopping land management companies represents a significant limitation to the wider application of MA among non-farming landowners. One of the major risks to landowners in MA is that, if a lessee exits the lease prematurely, they risk being left with trees, fencing, and other agroforestry infrastructure, without capacity to manage the enterprise themselves or to readily identify a new operator.

Another limitation to wider application of MA is the scarcity of technical service providers (TSPs) qualified to develop plans that qualify for certain government subsidies. Beyond accessing financial assistance for establishment of agroforestry practices, plans prepared with the assistance of a professional third party have inherent value for multiple parties seeking agreement on land uses. The USDA NRCS offers a certification for TSPs to become qualified to write agroforestry plans, but there are few to none available in the most states (e.g., among the states represented by MA cases here: 15 total agroforestry TSPs in MO, IL, and IA; none in MN and WI [58].)

Other third parties that could aid in the development of MA are matchmakers and brokers to facilitate the parties identifying each other and assisting them in developing their arrangement. This strategy has been pursued by non-profit organizations and academic collaborators to form multi-party livestock grazing arrangements on private and public lands [59]. This match-making strategy has also been pursued by organizations seeking to facilitate farmland access for beginning farmers and could be customized for agroforestry [38,60].

### *4.5. Further Research Needs*

To our knowledge, MA in the USA has not been previously described in the literature. Further development of MA could be aided by further study of the phenomenon. The limitations of this

study suggest several directions for future research. For instance, the cases profiled were selected opportunistically based on the authors' awareness of their existence and the willingness of those involved to be interviewed. Future research could add to this base of knowledge via broader selection criteria. Critically, studies that include MA that did not result in outcomes desired by partners, or that were attempted but did not manifest, could provide insight into limitations and potential pitfalls.

Similarly, the MA case studies were primarily developed from the perspective of a single point in time. Although there was some reflection on the process that led to the present state, many of the cases are relatively early-stage partnerships. Longitudinal studies that track success of MA over time are needed [61,62]. Systematic assessment of factors influencing how well MA enables partners to achieve their objectives could be performed with more attention to progress over time. Beyond direct assessment of MA, research on factors that determine interest and ability to adopt could inform further development of the approach [20,63].

The geographic and topical breadth of this study was also limited. Research to apply multi-party models from related fields such as grazing and forestry could aid similar efforts in agroforestry [57,59]. We aware of examples in other parts of the USA, particularly forested landscapes, with multi-party forest farming arrangements for ginseng and other medicinal herbs. Documentation of MA in other places could also provide insight, especially in the tropics where agroforestry is much more common than most temperate landscapes, and the relationships between trees and land tenure has been the subject of more research [28].

## 5. Conclusions

This study documented a diversity of forms of cooperation in MA. MA generally emerged from shared objectives, intensive planning, and ongoing coordination. MA appears to be adaptable to private, investor, institutional, and public landowners, as well as beginning farmers and others seeking land access without ownership. MA represents a social mechanism for conservation in agricultural landscapes with the potential to enhance crop production and broader public benefits, including carbon sequestration; biodiversity; soil and water quality; and resiliency.

Potential limitations to wider application of MA include a lack of appropriate land management companies, technical service providers, and third-party match-makers and facilitators. Further research is needed to document and assess MA in other regions. There is also a need to evaluate outcomes of MA over time.

**Supplementary Materials:** The following are available online at http://www.mdpi.com/2071-1050/11/8/2449/s1, Table S1: Semi-structured interview instrument.

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