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# Barriers and opportunities to agrihood development in growing cities of the Rocky Mountain Region: A comparative case study

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## Abstract

Rapid urbanization and peri-urban development are driving land use change across the globe, resulting in lands being converted from agricultural uses to housing development. Sustainable, multifunctional land use in urban and peri-urban areas is needed to balance the requirements of producing food in a way that protects environmental resources and of providing housing to a growing population. An agrihood is a planned development model that incorporates food production within a community to help address goals of nutritious food security while providing social, economic, and environmental benefits. Agrihoods may offer an

alternative land use for integrating food production in new housing developments for the sustainable development of rapidly urbanizing cities. A comparative case study, using semi-structured, qualitative interviews with key informants from two cities (Bozeman, Montana, and Longmont, Colorado), highlighted four key barriers to agrihood development in two cities in the Rocky Mountain region of the U.S: labor; ownership and governance structures; resource availability; and land use regulation. Concerns for water and land resource availability reflect general barriers to agricultural expansion in the Rocky Mountain region, while the other identified barriers reflect the structural and legal limitations preventing agrihood development and expansion. To reduce these barriers, policy interventions

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and incentives provided at municipal, state, and federal levels, informed by community advocates in support of local food production, will be essential.

### **Keywords**

urbanization, peri-urban agriculture, food security, sustainable development, agrihood, land use planning, urban planning

### **Introduction**

In recent years, there has been an increased interest in food production within urban and peri-urban locales across the United States. From New York City to Seattle, civic leaders' goal to increase agricultural production within and around cities, however, often conflicts with other land use priorities, most specifically housing development (L. K. Campbell, 2016; Horst et al., 2017; Rothwell et al., 2015). Agrihoods are an emerging strategy for housing development used to plan communities around food or agricultural activities (Norris, 2018). Despite the growing interest in expanding and promoting urban food production through agrihoods, there has been limited research on the perceived barriers to expanding them as a food production strategy, and on opportunities to incorporate agriculture within housing developments to meet many sustainable development goals.

Urban agriculture (UA) encompasses the growing, processing, and local distribution of food within and on the fringe of an urban area (Mougeot, 2006). It has been increasingly studied for many human and environmental benefits (Lovell, 2010). These benefits include but are not limited to increased food security, improved soil health, enhanced carbon sequestration, the contribution to the environmental sustainability of cities, strengthened community resilience, economic vitality through local markets, and beautification (Clark & Nicholas, 2013; Lovell, 2010; Orsini et al., 2020). Agrihoods are a subcategory of UA. They are unique in that they are envisioned from the beginning of the urban planning process, rather than providing an "infill" opportunity after the development project is completed (Rothwell et al., 2015). Agrihoods can serve as an effective model to be implemented in emerging urban areas during

the planning phase. They commonly exist in the periurban space outside of city centers, while most UA projects are located within urban centers; the term peri-urban describes this transitional zone between rural and urban districts (Birkby, 2016; Rothwell et al., 2015). In peri-urban agriculture, farmers face urbanization pressure that affects the availability of land (Opitz et al., 2016). Agrihoods can help increase the security and stability of a local food system by combining the preservation of farmland with needed housing development (Breger, 2020). They can be planned to incorporate a variety of food production spaces including field production, greenhouses, rooftop gardens, or edible landscaping (Norris, 2018).

In 2020, 56% of the global population resided in cities. This proportion is projected to reach more than 68% by 2050 (Gu et al., 2021). Hence, planning for food production within and around urban centers to support local food security is imperative. The global rate of urbanization has driven the conversion of farmland into peri-urban areas, primarily for housing development (Choy & Buxton, 2013; Rothwell et al., 2015). This trend of losing agricultural land for housing development, coupled with supply-chain breakdowns such as those observed with the COVID-19 pandemic, has contributed to the growing interest in producing food within and around cities (Nemes et al., 2021). Growing food throughout and around cities for their residents promotes food system resilience by shortening supply chains. Producing food within an agrihood, therefore, helps shorten food supply chains, supporting community food security by ensuring adequate food availability during climatic, social, or economic shocks (Chiffolleau & Dourian, 2020; Watson, 2020).

While land in the Rocky Mountain region of the U.S. is rapidly urbanizing and agricultural land is converted to non-agricultural development, there is an opportunity to embed agrihoods as a sustainable solution within urban and peri-urban development projects. In growing small cities of the Rocky Mountains, land outside the city center, historically used for agriculture, is viewed as land-in-waiting for urban expansion. The perception of the best use of peri-urban land often differs between different stakeholder groups, with a notable conflict aris-

ing between housing and agricultural land conservation (Rothwell et al., 2015).

In this region, Boulder County, Colorado, experienced a 12.3% population increase between 2010 and 2020 (U.S. Census Bureau, 2020a), and Gallatin County, Montana, experienced a 32.9% population increase in the same period (U.S. Census Bureau, 2020). While these Rocky Mountain cities experience urbanization, land use is shifting from agriculture to housing and commercial development at a rapid rate, resulting in permanent land use changes. With the rapid growth of small urban areas like Bozeman, Montana, and Longmont, Colorado, the peri-urban space is vulnerable to housing development, ceasing the preservation of agricultural land.

The city of Bozeman (in Gallatin County, Montana) released a climate plan in 2020 that included six focal areas for reducing greenhouse gas emissions and transitioning to sustainable development and enterprise (City of Bozeman, 2020). Similarly, the city of Longmont (Boulder County, Colorado) released a revised sustainability plan in 2018 to focus governance efforts on promoting environmental stewardship, social equity, and economic vitality for its residents and businesses (City of Longmont, 2018). Embedded in these municipal sustainability plans are goals for addressing community food security and local food system resilience during a changing climate. These plans clearly state that goals for local food production and agrihoods could be viable options to help these growing cities meet their listed sustainability goals. However, research is needed to gather the perspectives of the key stakeholders involved in local food systems, city planning, and development to meet the dual goals of resilient, localized food systems and sustainable land use in the face of rapid urbanization. Input from stakeholders is integral for understanding the factors threatening community food security in these urbanizing communities within or surrounding Rocky Mountain cities. Until now, no research has examined the barriers and opportunities for urban agricultural production through agrihoods in the region, which is characterized by important particularities related to agrihood development that include a short growing season and rapid urbanization.

This research sought to answer the question, “*What are the barriers and opportunities to agrihood development in the Rocky Mountain region of the United States?*” and examine the role of agrihoods in the future of local food production in urbanizing small cities (>50,000 people according to the 2010 U.S. Census), specifically in Colorado and Montana. This is because the food systems of this region have become increasingly dependent on long supply chains. Additionally, the long distances between urban centers in this region reflect longer food distribution routes than in other parts of the U.S. Our study compares the cases of two cities, Bozeman and Longmont, based on interviews with core stakeholders.

## Literature Review

A literature review was conducted to establish a definition and understanding of agrihoods in the United States.

### *Background: Agrihoods*

The methods for conducting a literature review on agrihoods began with searching key terms in the Web of Science database. Search terms included “urban agriculture,” “peri-urban agriculture,” “planning,” “urban horticulture,” “housing,” and “sustainability,” to explore research involving agriculture within and around city limits as well as the role of governance in a city’s food system. The term “agrihood” was also searched through the Web of Science, but it did not return any results. As agrihood is a relatively new concept in the food systems literature, other sources and literature on agrihoods were found elsewhere. Publications through the Urban Land Institute and the American Planning Association (APA) have presented background information on agrihoods, including definitions, benefits, opportunities, and recommendations for agrihood use in planned communities. These sources provided a foundation for defining agrihoods. Subsequent searches using Google Scholar with the same search terms were used to find articles exploring the intersections of food production and housing.

An agrihood is typically defined as a form of agriculture in peri-urban areas that is incorporated into residential areas. Agrihoods are an emerging

housing development strategy used to plan communities around agricultural activities (Norris, 2018). As intentionally planned communities typically conceived by developers, agrihoods integrate agricultural production systems such as farms, gardens, and orchards into residential or mixed-use communities (Breger, 2020). The agricultural activities involved are varied and may include traditional greenfield farms and community gardens; greenhouse or hoophouse production of vegetables, fruits, and herbs; beekeeping; raising animals such as chickens, goats, and pigs; and producing fish through aquaculture (Breger, 2020; Norris, 2018). The Urban Land Institute defines agrihoods as “single-family, multi-family, or mixed-use communities built with a working farm or community garden as a focus” (Norris, 2018, p. 3). Although most agrihoods in the U.S. are planned and developed communities built around greenfield farms, often referred to as “traditional” or “working” farms (Breger, 2020), they can also take on infill development strategies, in which food is produced on previously developed commercial land within an urban boundary (Birkby, 2016).

Agrihoods range in scale, production system, and organizational structure, but all share the characteristics of integration of food production and housing components of the community, and engagement of residents with agricultural amenities (Breger, 2020). This engagement can be active, through volunteering in garden or farm production activities or participation in educational events, or more passive consumption of produce at farm-to-table restaurants or through community supported agriculture (CSA) programs (Breger, 2020). In most cases, the farmer in the agrihood is not the owner of the land, but rather is an employee of the developer or landowner, overseeing the farm for the first few years of development (Norris, 2018). The land ownership of the farm and organizational operation of an agrihood can take on many different models: frequently, the agrihood is set up as a nonprofit entity centered on the community services provided related to education, nutrition, and

land conservation (Norris, 2018). The ownership may remain in the developer’s hands, transition to a homeowners association (HOA),<sup>1</sup> be set up to be publicly owned and operated, or, in some cases, owned by the farmer, who in turn has an operating agreement with the HOA (Norris, 2018).

Previous research that included interviews conducted with existing agrihood residents has found that these individuals were motivated to move to an agrihood primarily for the agrarian aesthetic and the overall character and feel of the community, with access to local food also being a notable motivation (Breger, 2020). Residents’ involvement with their community agrihood farm can widely vary, but the majority of existing agrihood models utilize residential fees to supplement the cash flow needed to support the farm (Breger, 2020).

Through the late 2010s, there was limited research on agrihoods as a land-use alternative for housing developments. In 2020, a baseline study evaluated and characterized agrihood developments in the U.S. and found the major perceived contributions of agrihoods to be related to the social and educational engagement of residents with the farm (Breger, 2020). The economic value of agrihoods was also reported as important to developers as the farm lifestyle has greater market appeal to young home seekers compared to more common suburban development models, such as those near golf courses. This market trend translates to increased property values related to the preserved green space of the farm (Breger, 2020).

### *Potential of and Barriers to Agrihood Development*

Although the benefits of urban agriculture for food security, through increased access to healthy foods, are well identified in the literature (Lovell, 2010; Siegner et al., 2018), there is limited research on the role that agrihoods can play in food security in peri-urban areas. Being a type of UA, agrihoods share many of the challenges of urban agricultural systems. The historical barriers to expanding UA include land use considerations, land tenure insecurity,

<sup>1</sup> Homeowners association (HOA): “An organization in a subdivision, planned community, or condominium building that makes and enforces rules for the properties and residents. Those who purchase property within an HOA’s jurisdiction automatically become members and are required to pay dues, which are known as HOA fees.” (Chen, 2024, para. 1–2).

city, lack of support through governance bodies and city planning, insufficient labor, and site-related considerations, such as contaminated soils from industrial activities (Breger, 2020; Horst et al., 2017; Siegner et al., 2018; Soma & Wakefield, 2011; Taylor & Lovell, 2015). Competition for land use in urbanizing locales has been identified as the key barrier to agrihood development and highlights the significant role that policy and governance can play relative to agricultural land protection or the inclusion of agrihoods in urban land-use planning (Choy & Buxton, 2013; Moragues-Faus & Battersby, 2021; Soma & Wakefield, 2011). Previous studies shed light on the importance of city planners collaborating with food systems professionals to promote urban and peri-urban agricultural efforts (Horst et al., 2017; Soma & Wakefield, 2011). As noted by Horst et al. (2017), city planners can play an important role in “long-range planning efforts; removing legal barriers; offering reduced fees and taxes; and providing staff, resources, and, in some cases, permanent access to land” (p. 291).

The current literature on agrihoods has identified barriers related to land tenure and competing land uses (Horst et al., 2017; Siegner et al., 2018; Taylor & Lovell, 2015). This is due to the rapid appreciation of land values, conversion of agricultural lands to development, and limited supplies of available land to rent or purchase (Valliant & Freedgood, 2020). There have been recommendations for policymakers to help advance urban agricultural initiatives and secure land for beginning farmers and new-entrant farmers by reevaluating urban agriculture as a public good similar to public education, health, and transportation (Carlisle et al., 2019; Siegner et al., 2018). Another theme that emerges regarding barriers to urban agriculture expansion is a lack of support and policy through city governments. Although many cities have sustainability goals that align with agrihood development and/or urban agriculture, policy is often insufficient to help individuals secure land tenure and ensure the protection of land for agricultural activities (Horst et al., 2017).

### **Applied Research Methods**

This exploratory study used data collected from semi-structured interviews with key informants.

### ***Current Study***

To determine the perceived barriers to agrihood development in two urbanizing Rocky Mountain Region communities in the U.S., we conducted a double exploratory comparative case study built on qualitative research. Specifically, we conducted semi-structured, open-ended, in-depth interviews with key informants from two cities in the region of interest: Bozeman, Montana, and Longmont, Colorado. This method was chosen as case studies support the understanding of complex social phenomena and organizational processes (Yin, 1994). The exploratory case study model was selected because no single set of outcomes was anticipated, and this model allowed for an in-depth exploration of the perspectives of food system stakeholders as key informants in the study areas (Seaton & Schwier, 2014). The dual case-study approach served to compare agrihood developments in two similar-sized, rapidly urbanizing communities in the Rocky Mountain region to explore emerging themes. Synthesizing the analysis of both cases allows us to develop a baseline for understanding agrihood potential and barriers in similar-sized cities of the U.S. Rocky Mountain region and beyond, where population growth and land use change are contemporary pressures. These areas do not represent the patterns of land use change in the entire Rocky Mountain region, but provide two examples of cities trying to keep up with housing demands while also trying to meet stated municipal sustainability goals related to localizing their food production.

Both cities share an environment historically shaped by agriculture and have experienced recent rapid population growth. Between 2010 and 2020, Bozeman and Longmont experienced population growth rates of 42.95% and 14.62%, respectively (U.S. Census, 2020a, 2020b) (Table 1). Since both cities have a strong need for increased housing, there is a high potential for agrihood development. Additionally, both cities have articulated their intention to reduce carbon emissions and to develop robust, resilient, and localized food systems. Specifically, Longmont has committed to “support a locally based, environmentally responsible and healthy food system that is available to all residents” (City of Longmont, 2018, p. 8). Simi-

larly, Bozeman has outlined in its climate plan a need to “cultivate a robust local food system” (City of Bozeman, 2020, p. 11).

### Key Informants

We identified key informants through nonprobability sampling. Specifically, we used purposive and snowball sampling to identify specific types of stakeholders who could yield relevant information (Bourgeault et al., 2013). The purposive sampling technique was used to identify people who hold important perspectives on the research topic and, therefore, needed to be specifically identified and included in the study (S. Campbell et al., 2020). Snowball sampling, which is a technique where existing study subjects recruit future subjects from among their colleagues (Sharma, 2017), was a secondary approach: In some cases, interview subjects suggested other key informants who would have knowledgeable perspectives and insights into barriers and opportunities to agrihood development.

For each city, we aimed to identify at least one

stakeholder for each of the following categories: city sustainability coordinators, city planners, housing developers, and farmers. The city sustainability coordinators and planners were required as key informants to speak on behalf of their city about sustainability goals and city policies, since current literature has identified policy as a barrier to the expansion of urban agriculture. We found them through each city’s employee directories. Developers were identified using purposive sampling through each city’s active development log, as well as through snowball sampling in which other key informants suggested local developers. Farmers were identified through each city’s farmers market vendor listings. The farmers and farm managers who participated in this study all operate organic, small-scale operations (fewer than 10 acres or 4 hectares). In total, 16 farmers were contacted, with four respondents. Altogether, one city planner, one sustainability coordinator, and two farmers from each city were interviewed. A developer from Bozeman participated in an interview, but no developers from Longmont were available to participate in this study. Therefore, a total of nine semi-structured, in-depth interviews were conducted (Table 2).

### The Interviews

We developed questionnaires based on an instrument from the APA, written for urban planners regarding urban agriculture (Hodgson et al., 2011) and approved by an expert panel. Montana State University’s institutional review board (IRB)

**Table 1. Demographics of Case Study Locations**

	Bozeman	Longmont
Population, 2010	37,280	86,270
Population, 2020	53,293	98,885
Population % increase, 2010–2020	42.95%	14.62%
Median household income, 2020	US\$59,695	US\$79,140

Sources: U.S. Census Bureau, 2019, 2020a, 2020b

**Table 2. Interviewed Key Informants (N = 9)**

Job Title	Location	Questionnaire
City Sustainability Program Administrator	Longmont	Standard (Appendix A); city sustainability goals (Appendix B); organizational
City Sustainability Program Administrator	Bozeman	
City Planner	Longmont	Standard; food system planning (Appendix C)
City Planner	Bozeman	
Farmer 1	Bozeman	Standard; farm operation; farm economy (Appendix D)
Farmer 2	Bozeman	
Farmer 3	Longmont	
Farmer 4	Longmont	
Developer	Bozeman	Standard; motives; design (Appendix E)

\*All farm managers consider their production organic, only farmer 2 operates a certified organic farm. Only farm manager 4 owns their farmland, while farm managers 1-3 operate on leased land.

granted IRB exemption (IRB #AS071522-EX). Questionnaires varied according to the profession of each interview subject and were aligned with the subject’s area of expertise. All questions were centered on the themes “What are the barriers (if any) that are preventing your city from expanding local food production?” and “What kind of support is needed to ensure successful agrihood development and management?” (see Appendices A–E for detailed questionnaires).

Nine semi-structured, in-depth, remote interviews were conducted between May and September of 2022 using the video conference platform Zoom. Interviews lasted from 30 minutes to one hour. Completed interviews were transcribed.

### *Data Processing*

For the analysis of the open-ended, semi-structured interview question responses, we conducted inductive content analysis to identify common themes in the responses (Kuckartz, 2014; Saldaña 2015). The coding process was facilitated by the qualitative software NVivo (QSR International, Doncaster, Australia). Codes were developed in an iterative and emergent process throughout the data collection period. We applied inductive coding, determined the condensed meaning units, and calculated the frequency of meaning units per code as a percentage of total meaning units per survey (Leech & Onwuegbuzie, 2011; Saldaña, 2015).

### **Results and Discussion**

The key stakeholders identified a wide variety of barriers to agrihood development in the Rocky Mountain region (Table 3). Among the diversity of

responses in each interview, the following key themes emerged: labor, ownership and governance structures, resource availability, and land use regulation.

### *Labor*

All informants noted quality management and labor as barriers to the development of an agrihood. There was consensus among the informants that the management of an agrihood’s agricultural area should not rely on a volunteer labor force. However, uncertain ownership of these areas raised concerns about who should oversee hiring and managing professional support. A Bozeman developer with an expressed interest in integrating agriculture into a new housing development suggested that the HOA of the prospective agrihood should “hire a passionate individual to ... organize a community garden [on the prospective agrihood] as well as outreach and education ... for the community.”

This developer also indicated that agrihood farm managers should receive a salary, but that this salary may vary depending on their tasks. Such a salary may not be sufficient to afford living in often expensive urban environments. Further, all farmers interviewed articulated that an agrihood farm manager needed to possess a wide variety of skills, ranging from technical knowledge of farming to the social skills required for outreach and volunteer coordination. One farmer suggested that most agrihoods should involve diversified, multicrop production systems. According to this farmer, these agrobiodiverse systems imply a limited potential for mechanization, and consequently high manual labor demand. Additionally, a farm manager in

**Table 3. Summary of Barriers and Opportunities for Agrihoods (as Perceived by Key Informants)**

Themes	Opportunities	Barriers
Labor	Land access for beginning farmers	Reliance on engaged community volunteers
Ownership and Governance Structures	Diversity in farm ownership and management	Lack of clarity on ownership and management
Resource Availability	Alternative, sustainable, agrobiodiverse production indoor growing; edible landscaping; vertical farming	High cost of land; competing ideas for best land use; limited water availability
Land Use Regulation	Land use codes can be changed and adapted to the needs of a community	Existing or current zoning and land use codes prohibit agricultural activities within city limits

Longmont mentioned the common reliance on immigrant labor of many small-scale, organic farms.

Most respondents indicated that operating the farm within an agrihood requires a farm manager who would be content with not owning the farmland. This may present opportunities to engage with beginning farmers who aim to develop skills and experience with small-scale agriculture before acquiring their own land and operation. For example, one Bozeman farmer stated the following:

There could be lots of potential in having those spaces geared to first-generation farmers who don't have all the up-front capital, or experience growing. But then, what are the proceeding steppingstones for those growers if they don't want to ultimately be in that space? (Bozeman Farm Manager)

Our study identified labor as one of the crucial entry barriers to the development of an agrihood. Interviewees raised various questions about the person who would be in charge of technically managing and operating the agricultural component of the agrihood. Concerns included the recruitment of a farm manager and the affordability of the labor needed for small-scale, diversified production.

The most severe barrier for beginning farmers entering and remaining in agriculture is land access (Ackoff et al., 2017). Agrihoods can serve as an access point for beginning farmers to have land for farming, without the need to raise start-up capital. By providing access to land for beginning farmers, agrihoods may support the development of skills for new-entrant farmers, while contributing to local food production. Furthermore, if an agrihood model allowed farm operators to live on the property for free, this could make the positions more appealing to skilled, beginning farmers, and would guarantee consistent monitoring of the farm and regular interactions with residents. This model would decrease the financial burden on the farm operator of living in the city where the agrihood is located (Norris, 2018). Therefore, agrihood developers must address housing affordability for farm operators to ensure that the farmers can live nearby (Norris, 2018). Although agrihoods may serve as an

access point for beginning farmers, if the farmland ownership remains in the hands of the developer, this may serve as a barrier to advancing sustainability and community food security. Tenant farmers in an agrihood model may not be in a position to invest in sustainable improvements to the land via improvements to soil health or use of perennial crops, because they have no guarantee of recouping the value of these sustainable improvements (Carlisle et al., 2019).

### *Ownership and Governance Structures*

Due to the open-ended and not clearly defined organizational structure of an agrihood, many stakeholders were concerned about who would be responsible for running its agricultural component. Not only may the ownership of the land and farm be ill-defined, but the ownership of farm infrastructure may not be well understood, such as ownership of tractors, high tunnels, or other necessary farm equipment.

The management of that agrihood is nebulous to me. And I think ... there has to be either a volunteer champion or some kind of organized HOA where they are proactively supporting that [the management of an agrihood] and organizing that. (City of Bozeman Sustainability Administrator)

The organizational structure and management of farmland in an agrihood can vary widely, ranging from the farm being owned by an HOA, a land trust lease arrangement with the farmers and developers, public ownership with operations done by partnering nonprofit organizations, and many others (Norris, 2018). One example of an existing agrihood farm ownership and operational model is from South Village, an agrihood located in South Burlington, Vermont. In this agrihood, a neighborhood conservancy owns the farmland and a local nonprofit manages it, with residents in the community paying fees to support the farm (Breger, 2020). Another agrihood, Agritopia in Gilbert, Arizona, has its farmland owned and managed by an affiliated nonprofit (Breger, 2020).

Agrihoods can enhance a community's food security by improving accessibility to nutritious,

fresh produce. An agrihood’s potential to contribute to food security is largely dependent on the chosen organizational structure of each development (Siegener et al., 2018). There are many different models of organizational structures used to support the necessary infrastructure and maintenance of a farm in existing agrihoods (see Table 4) (Norris, 2018). Cited by most informants, the organizational and governance structure of an agrihood will need to be identified ahead of time to understand where different organizational and financial support will come from, whether that be from the agrihood residents themselves, the developer, or nonprofit partnerships.

### *Resource Availability*

Two limiting resources were identified in nearly all interviews: land and water. Eight of the nine stakeholders cited water as a barrier to expanding food production through agrihoods in the Rocky Mountain region of the U.S. One farmer stated that he sees water becoming an increasingly troubling input over the next 20 years, especially in this region. A city planner noted that the amount of water needed for a given food production space is unknown to them, and with concerns for water already on the minds of city governments in the Rocky Mountain region, this unknown quantity of

water might be a barrier to approving more local agricultural production.

How much water is required for these spaces [agricultural land within an agrihood], and do we have that amount of water? So, you [the agrihood developers] might then need more water rights that are readily available. (City of Bozeman Planner)

Given these perspectives, interviewees shared concerns about water needed for future food production. Climate change and its impact on water availability throughout the growing season were concerns cited by most respondents.

There are different technical strategies to decrease the dependence of agrihood developments on the core resources of land and water. These strategies involve incorporating diverse, local plant species into the design, as their adaptation to the semi-arid and arid regions of the Rocky Mountains enables them to require much lower inputs of water (Shelef et al., 2017). In addition, utilizing year-round growing systems, including high-tunnel greenhouses, for food production could minimize the need for land and water (Benke & Tomkins, 2017). Indoor, controlled environment production systems may also be necessitated by increasing pol-

**Table 4. Ownership and Governance Structures of Agrihoods**

Type of Governance Structure	Potential Advantages
Developer-owned and -operated	Centralized governance, economic risk associated with farming is absorbed by developers
Land trust ownership with nonprofit or for-profit farm management entity	Land trusts work to protect lands from further development while remaining productive
Land trust ownership with lease or management agreement with farmer	Land trusts work to protect lands from further development while remaining productive and in private ownership
HOA-owned and operated by nonprofit or for-profit farm management entity	HOA fees contribute directly to farm operation and help subsidize farm earnings
Public ownership and operated by nonprofit or for-profit farm management entity	Residential community surrounding the farm is actively involved in farm decision-making
Publicly owned and operated	Public ownership of the farm supports community engagement and social benefits
Farmer-owned with operating agreement and ability to sell or transfer ownership or lease	Opportunity for new entrant farmers to secure land for farming
Nonprofit-owned or leased with operating agreement and ability to sell or transfer ownership or lease.	Nonprofit structure ensures that community benefits are maintained as the central function of the agrihood; community benefits through education, food donations, and land preservation

lution and climate change driving extreme weather patterns (Eigenbrod & Gruda, 2015). Furthermore, utilizing other urban agricultural practices, like edible landscaping, green roofs, and vertical farming, incorporates food production around the community and decreases land requirements for greenfield farming.

City planners and sustainability professionals alike mentioned opportunities to provide funding for sustainable food production but also stated that partnerships with the private and nonprofit sector will be necessary. City employees stated that a functioning pilot agrihood project will need to be realized before city resources are allocated toward such a project. Additionally, a city planner mentioned that “there may be a time in the future when a city’s food supply and reliance on long-supply chains will prompt city governments to incentivize and provide resources to agroecological land management practices, and local food production would become more necessary.”

The statement below highlights the perspectives of municipalities that have a limited amount of funding available for sustainability initiatives competing with other needs related to the development of growing urban areas.

We need to do renewable energy. We need to do water conservation. We need to do storm-water management. We have so many imperatives and just not enough resources. So, where can we get the expertise to understand what those real obstacles are? (City of Bozeman Sustainability Administrator)

Four out of nine stakeholders indicated that competing interests for the best use of peri-urban land in rapidly developing areas are standing in the way of agrihood development. Given the high value of peri-urban land in the Rocky Mountain region, and trends toward urbanization (U.S. Census, 2020a, 2020b), there are many different and competing ideas among stakeholders regarding the best use of this land. Another large barrier cited by informants is the high cost of land, and an “open buyers’ market,” making it difficult to secure land for farming. Several stakeholders expressed

concerns that given the high value and high cost of peri-urban land, denser housing, retail, and commerce would take precedence over agriculture. A Bozeman developer stated that beyond zoning (even if they were to get special permissions to grant an urban farm in the housing development), city officials would not perceive agrihoods as the best land use for developing areas. Given the diverse and sometimes contradictory goals in the cities’ sustainability plans, these plans do not provide guidelines for the most sustainable use of undeveloped land (City of Bozeman, 2020; City of Longmont, 2018).

Land is going to get eaten up for development, and we’re very much in a housing crisis. So, from the sustainability standpoint, it’s a hard challenge to say what is the biggest need of our community, and what’s the most sustainable use of any given property. (City of Bozeman Planner)

New housing developments in Bozeman are required to incorporate some degree of open space and parkland, and agrihoods are an option that could address this requirement and provide additional community benefits in the form of healthy food and educational opportunities. Accordingly, for new developments in Gallatin County, where the City of Bozeman is located, a portion of the land is required to be dedicated to open space and parks (Gallatin County, 2021). In the state of Colorado, planned unit developments are required to preserve at least 25% of the areas as open space, unless the use is predominately commercial or industrial (Colorado Department of Local Affairs, 2015). There are opportunities to integrate agricultural amenities within these preserved open spaces and parks through edible landscaping. Currently, the city of Bozeman has an incentive program for replacing water-hungry lawns with drought-tolerant plantings (City of Bozeman, 2022). To meet multiple sustainability goals related to local food systems, there is potential for this program to shift toward incentivizing edible landscaping, as this provides additional community benefits through nutritious, diverse foods.

### *Land Use Regulation*

Regulation, especially zoning, can affect city planning and ultimately development. In the U.S., city planning and zoning legislation date back to the 1920s. According to the APA, “the basic foundation for planning and zoning in the U.S. was laid by two standard state enabling acts published by the U.S. Department of Commerce in the 1920s” (APA, n.d., para. 1). These two standard enabling acts were the Standard State Zoning Enabling Act (SZEA) and the Standard City Planning Enabling Act (SCPEA) (Advisory Committee on Zoning, 1926). All states have planning and zoning—enabling legislation that allows local authorities to regulate the built environment and control land and property markets to ensure complementary uses, while providing opportunities to stimulate or slow development in specific areas (Advisory Committee on Zoning, 1926).

While Longmont has relatively flexible zoning regulations, Bozeman permits agricultural activities principally in the M-2 zone, which is the manufacturing and industrial district, servicing the vocational and employment needs of city residents (City of Bozeman, 2016). In zones designated as residential mixed-used development (R-S zone), agricultural activities, which include conditionally permitted ownership of a few livestock animals, are permitted on less than 2.5 acres (City of Bozeman, 2023). However, crop production is not specifically outlined as a permitted activity in a mixed-used development zone. Consequently, all stakeholders from the city of Bozeman mentioned land-use zoning codes as a predominant barrier to the expansion of agriculture within city limits.

With zoning laws permitting limited agricultural activities on less than 2.5 acres in the mixed-use residential zone (R-S), it was suggested by a city planner that existing zoning laws could be interpreted with certain flexibility. For example, a high-tunnel greenhouse or vertical agriculture operation could be allowed in a non-agricultural zone. Although this potential for flexible interpretation exists, a Bozeman developer stated that a reinterpretation of zoning codes adds significant time to the planning and development process, which may hinder a proposed agrihood development from coming to fruition. Bozeman city staff indicated

that zoning laws are not always in alignment with the goals identified in the city of Bozeman’s climate plan, and still serve as a barrier to agricultural development in Bozeman’s peri-urban land.

Although zoning and land use regulation were not identified as significant barriers to agrihood development in Longmont, one city planner expressed having little flexibility or autonomy in decision-making:

Everything I do in my job is either demanded by the residents or developers or told to me by a counselor. As government employees, we don’t get to make decisions on what our priorities are. It needs to come from an outside source. (City of Longmont Planner)

The planner said that change is largely driven by citizen comments at public meetings, and, for regulatory zoning to align better with urban agriculture solutions, citizens must speak up to advocate for policy change. Although citizen advocacy plays a formative role in shaping municipal policy, several articles suggest that city planners should take a more proactive role in engaging with food systems. These sources highlight specific strategies for planners to remove regulatory barriers, embed urban agriculture into long-term planning efforts, help to secure land for agriculture, and raise public support for urban agriculture and agrihoods (Horst et al., 2017; Soma & Wakefield, 2011).

### *Agrihoods’ Feasibility and Alternatives*

A common notion among key informants across both cities was that there are no “silver bullets” for facilitating the development of agrihoods. Effective strategies depend on city-internal factors (such as zoning laws) but also on external determinants such as climatic conditions. A major concern brought up by city employees was the short growing season in many areas of the Rocky Mountain region, meaning that traditional greenfield farming can only take place, realistically, between five and seven months of the year. Four of nine stakeholders cited a shorter growing season as a barrier to an agrihood as that land could be more productive for other uses, like dense housing, high-tunnel greenhouses, or other indoor urban agricultural meth-

ods. An opportunity to extend the growing season and support year-round production with greenhouses or vertical farming was cited as a better land use strategy compared to greenfield farming in the middle of a neighborhood.

An alternative use for food production in agrihoods was proposed by two informants, who suggested that grazing animals should be considered. Given the land and acreage requirements for regenerative ranching practices involving cows or goats, having large livestock within an agrihood would likely be challenging in a peri-urban space (Rowntree et al., 2020). However, integrating livestock like chickens that require minimal land could be a useful alternative or addition to agrihood fruit and vegetable production.

For an agrihood development's feasibility, the form that agricultural production takes matters. When describing the process of designing an agrihood, the developer mentioned that the city of Bozeman had raised concerns regarding the use of traditional greenfield farming. These concerns were related to the short growing season, the land requirement for greenfield production conflicting with the city's desire for dense housing development, and current zoning laws prohibiting agricultural activities on more than 2.5 acres in residential areas (City of Bozeman, 2016). According to this developer, the planners from the city of Bozeman communicated greater support for infill agricultural development, and "urban agricultural" approaches, such as incorporating greenhouses, edible landscaping in required park space, and rooftop gardening. Ultimately, the acceptance and subsequent zoning for greenfield farming may be more difficult to "sell" compared to a greenhouse or rooftop garden production in a new development.

Several informants, including farmers and city sustainability administrators, indicated that, although local food production is essential for the self-sufficiency and sustainability of a local food system, the agrihood model may not be the primary pathway to achieving this goal. Accordingly, two informants mentioned that initiatives focused on food waste and rescue may be more important than the expansion of local food production efforts. Additionally, three stakeholders felt that directing public resources to food processing facili-

ties is more critical for ensuring food security (as processing and cold storage facilities enable the year-round availability of food to local consumers). Specifically, three of the four farmers interviewed vocalized a need for access to shared commercial processing space and cold storage.

### *Agrihoods' Expected Benefits*

A potential economic benefit for agrihood farm managers was highlighted by a Longmont farmer. She stated that the opportunity of having agrihood residents as potential consumers available for produce right away would ensure a regular revenue stream and customer base for the agrihood farmer. This informant stated that a regular concern for her, as a beginning farmer whose products are widely varied and seasonally dependent, is finding a buyer. So, having agrihood residents as readily available consumers may alleviate some of the farm manager's stress in finding a market. This stated economic advantage of direct-to-consumer sales was echoed by a study that found that the mean and median CSA farm income substantially exceeded those for all U.S. farms (Paul, 2019). It is possible that agrihoods can perpetuate access to locally grown foods for those who already have economic access to such foods. To advance community food security, it is important to ensure that equitable access and distribution of agrihood-grown foods are prioritized (Siegener et al., 2018).

All stakeholders identified community benefits related to agrihoods, with these perceived benefits ranging from the contributions to food security, and extending to possible social and mental health benefits related to community involvement and education surrounding food production. Although the contribution to community food security was highlighted, one informant went on to say that the degree to which agrihoods could provide a community's food supply is unclear. The possibility for urban and peri-urban agricultural systems to contribute to food security is significant and should not be understated, with many studies demonstrating how urban and peri-urban agricultural systems can produce similar or greater yields of certain crops per area, relative to greenfield farms (McDougall et al., 2018; Payen et al., 2022).

The expected environmental benefits of agrihoods are vast and largely relative to the production systems used. By conserving agricultural land and producing diverse crops, an agrihood farm may contribute to landscape biodiversity by providing agroecological corridors that positively contribute to animal biodiversity and affect the ability of beneficial insects to persist in urban landscapes (Breuste et al., 2008). Ultimately, agrihoods have the potential to significantly contribute to a community's food security by increasing the accessibility of nutritious foods and shortening the food supply chain, but additional benefits related to personal resiliency, mental and social health, and landscape biodiversity may also be notable (Lovell, 2010).


### Study Limitations

The applied comparative case study method could have been strengthened by the addition of stakeholder perspectives from county and state governments. Given the opportunity for county and state governments to shape peri-urban agricultural land use, a cross-sectional survey or additional interviews involving county and state governments would have been beneficial. This limitation presents an opportunity for future research to identify opportunities for county, state, and federal policy support for agrihoods as a sustainable development strategy. Additionally, the comparison between Bozeman and Longmont would have been better supported if a developer perspective in Longmont could have been obtained. During the data-gathering period of this study, there were no responses from developers contacted in the Longmont region.

### Conclusion

Rapid urbanization is causing land use change across the world. Sustainable, multifunctional land use in peri-urban areas is essential to balance the needs of local food production and provide housing to a growing population. Agrihoods are one development model that incorporates food production near consumers to help address the goals of nutritious food security while providing social,

economic, and ecological benefits. The ecological benefits of agrihoods can be maximized through agrobiodiverse production methods, but all agrihoods contribute to reduced food transportation and storage requirements, which in turn minimize greenhouse gas emissions related to long food supply chains. Given the known benefits of urban and peri-urban agriculture, this study sought to explore the barriers to the agrihood model as a style of peri-urban agriculture that is planned before development takes place. This study highlighted four key barriers to agrihood development in two cities in the Rocky Mountain region of the U.S.: labor, ownership and governance structures, resource availability, and land use regulation.

Barriers preventing agrihoods from initially developing, such as city land use codes and zoning laws, will need to be addressed by city planners and municipal government officials. Given that the extent of municipal power is shaped by citizen engagement and advocacy, community members vocalizing support for local food production will be crucial for reducing the structural and legal barriers to entry. Nonprofit organizations and universities can play an essential role in educating community members on the importance of localizing food production to ensure community food security. This education will support the community participation necessary to guide sustainable municipal development. Barriers to agrihood expansion, like land and water availability, will require coordinated policy action across local, county, state, and federal governments. Private-sector developers typically respond to the market demand of a given city, so it will likely not be individual developers driving a transition to agrihoods and other sustainable development models without greater government incentivization. Policy interventions and sustainable development incentives driven by polycentric governance structures will be essential in reducing the barriers to agrihood expansion. As climate change, urbanization, and population growth pose challenges to food systems in the Rocky Mountain region of the U.S., small, growing cities can utilize agrihoods as a proactive strategy to support their community's food security. 

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## Appendices

### Appendix A. Standard Questionnaire: All Informants

- What are the barriers (if any) that are preventing your city from expanding local food production?
- What are current challenges or threats to your community's agricultural system?
- How do you see agrihoods supporting goals outlined in your city's sustainability plan?
- What kind of support is needed to ensure successful agrihood development and management?
- What are other projects that could support a future sustainable and resilient food system in your city?

### Appendix B. Questions Asked Specifically to Sustainability Employee

- Describe your role with the city.
- Describe your professional/institutional relationship with the local food system.
- What are the current challenges facing your city's food system?
- What are existing urban agricultural projects taking place within your city?
- What support for local agriculture, food production, and/or processing is the city currently providing?
- How would you describe or define an agrihood?
- Do you have any reference projects in mind?
- What would be the most appropriate application of an agrihood for your city?
- What elements would be necessary for long-term agrihood success?
- Environmental, financial, organizational, policy, or social requirements
- Who should be responsible for maintenance?
- How can agrihoods, or planned agricultural communities, be used to meet goals for localized food systems outlined in the Sustainability Plan?
- What are other projects that could support a future sustainable and resilient food system in your city?

### Appendix C. Questions Asked Specifically to City Planner

- Describe your role and your professional relationship to the local food system.
- Describe the socio-demographic characteristics of your city.
- Is there a staff member responsible for planning for local food?
- If not, how does local food get accounted for in city planning?
  - What are the challenges (if any) that you have encountered in planning for a sustainable food system? (Soma & Wakefield, 2011)
- How can we improve opportunities to integrate food considerations in municipal or regional planning? (Soma & Wakefield, 2011)
- Who do you see as the participants/future residents of an agrihood?
- Who should be in charge of the agricultural part of an agrihood?
  - The residents, local farmers, companies?

## Appendix D. Questions Asked Specifically to Farmers and Producers

- How did you get started farming?
- What is your property situation, and what did the process of acquiring land look like?
- Describe your farm and what a typical day might look like for you?
  - What is your farm size?
  - What crops are grown?
  - Do you use any rotations?
  - Are crops grown indoors or outdoors primarily?
  - Is the farm certified organic (why or why not)?
  - How is the farm managed?
  - What kind of machinery is used?
  - Who are your customers?
  - Where is your produce sold?
  - What kinds of marketing strategies are employed?
- Are there any unique site considerations or barriers that your farm has overcome?
- Are you receiving any external support from the city/county/or state government?
- In your perception, how is an urban farmer different from a rural farmer?
- What kind of infrastructure would help developing agrihood projects in your city?
- What kind of support would you need to commit to a project involving urban agriculture in your city?

## Appendix E. Questions Asked Specifically to Housing Developer

- Describe your current professional role.
- Describe your experience with developments that involve agricultural activities.
- What are your motivations for incorporating agriculture into new housing developments?
- Are there financial or social incentives for developers to incorporate working farms, gardens, or other food production systems into housing developments?
- How are agrihoods, or communities planned with agricultural activities, different from other developments in terms of costs, planning, and design.
- Who do you see as the participants/future residents of an agrihood?
- Who should be in charge of the agricultural part of an agrihood?
  - residents, local farmers, companies?
- What matters most to developers regarding agrihood development?
  - creating a specific lifestyle that is marketable, contributing to solving the needs of local farmers, contributing to city sustainability, or other?