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Growing green: An investigation into local government planning for agriculture in North Carolina

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Abstract

Community planning has long grappled with how to effectively integrate food and agriculture systems alongside community development (Pothukuchi & Kaufman, 2000). Despite this, localized food systems are becoming increasingly recognized as a strategy for addressing social, sustainability, and resilience goals surrounding climate change, public health, and local economies (Brinkmeyer et al., 2023; Enthoven & Van den Broeck, 2021; Hunter et al., 2022). With the loss of farmland to urban expansion, there is a clear need to incorporate agriculture into land-use planning. This study assesses how local government planners in North Carolina, a state with deep agricultural ties and experiencing significant urban growth, perceive food and agriculture's role in their communities. A convergent mixed-method questionnaire was distributed to local government planners across the state to explore how planners perceive and interact with both local food and agricultural systems. Findings show that planners interact with these systems a "moderate amount" and generally perceive agriculture as a net benefit for their communities by acknowledging the social, economic, and environmental functions of these systems. While participants acknowledged the value of food and agriculture, participants reported needing resources and partnerships to better plan for food and agricultural systems in their communities. While focused on North Carolina, this study offers several takeaways for practicing planners more widely. Partici-

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Declaration of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships.

pants shared strategies on how local governments can actively develop and implement policies that embed food and agriculture systems into developments such as through subdivisions and other methods. By exploring different strategies, planners can bridge the gap between their understanding of the importance of food and agriculture and tangible outcomes for their communities.

Keywords
agriculture, land use, food systems, planning, resilience, North Carolina

Introduction and Literature Review

The history among agriculture, food systems, and community planning has run separate tracks until fairly recently. Early urban planning rarely addressed food access or supply, viewing food and agriculture as an antithesis to the developing urban identity (Pothukuchi & Kaufman, 1999). This disconnect grew as longer supply chains developed, and as planners began to view food systems supplied by the global food supply chains as a private commodity, rather than an essential community system (Pothukuchi & Kaufman, 2000).

Recently, relationships between these fields began to realign as consumer demand for local foods surged in the early 2000s, with sales nearly doubling between 2008 and 2020 (Pothukuchi & Kaufman, 2000; U.S. Department of Agriculture, National Agricultural Statistics Service [USDA NASS], 2020; Vilsack, 2015). Food began to be recognized as an urban issue affecting the local economy, environment, and public health (Pothukuchi & Kaufman, 1999). Pressures from climate change and social disparities have since challenged cities to further reconsider this relationship, recognizing food and agriculture as essential for resilience, which David Godschalk (2003) defined as "a sustainable network of physical systems and human communities" (p. 137). These systems are also critical for sustainable development, a dynamic process in which communities "anticipate and accommodate the needs of current and future generations in ways that reproduce and balance local social, economic, and ecological systems, and link local actions to global concerns" (Berke & Conroy, 2000, p. 23). In this context, food and agriculture are seen as offering social, economic, and environmental benefits that support these goals (Brinkley, 2013).

Despite this realignment, planning for farmland preservation needs specific attention. Farmland loss is happening at a rapid rate throughout the U.S., with 18.4 million acres estimated to be permanently lost by 2040 (Hunter et al., 2022). Protecting farmland along the urban fringe is crucial for strong local food systems as most U.S. food is produced in "urban influenced" counties (Freedgood et al., 2020). Agricultural landscapes also offer important environmental functions such as lower greenhouse gas emissions compared to developed land, wildfire and flood protection, and wildlife habitat (Arjomand & Haight, 2017; Blann, 2006; Greenway Alliance, 2021; Hovis et al., 2021; Shaffer & Thompson, 2015). As impacts from extreme weather and low-density residential development reduce the availability of farmland, states such as North Carolina are threatened with significant losses that can have permanent impacts on their landscape functions (Hunter et al., 2022).

Losing farmland jeopardizes U.S. agriculture and food security. Addressing this requires integrating land-use and food system planning. Farmland preservation tools must move beyond simplistic metrics such as the number of acres in production and toward incorporating social, environmental, and economic dimensions of agriculture and sustainability (Perrin et al., 2020). This allows food and agriculture to be balanced with other community systems in planning practice (Brinkley, 2013). Planning researchers advocate for adding food and agriculture elements to comprehensive plans to help balance these systems with other community systems such as transportation, housing, water, and energy (Brinkley et al., 2023). To do this, local government planners need frameworks and data tools to capture these impacts.

The planning field has gained momentum in integrating food and agriculture systems into practice over the past decade. A 2014 survey showed that only 1% of local government planners prioritized local food systems (Raja, 2020), but by 2017, over 200 food-related plans were adopted in the U.S., with many cities signing the Milan Urban Food Policy Pact (Raja et al., 2017). The American

Planning Association (APA) formalized its Food Interest Group in 2020 (APA Food Systems Division, n.d.). These points suggest a growing commitment to food system planning, but more research is needed on planner engagement and the best practices for integrating agriculture and food into planning practice.

The purpose of this study is to assess how local government planners in North Carolina perceive the role of food and agriculture systems in addressing sustainable community development and resilience to better understand how these systems align with planning practice. To achieve this, the study is guided by three primary objectives: (1) to assess how local government planners perceive food and agricultural systems in relation to overall community sustainability and resilience; (2) to identify the specific economic, social, and environmental contributions that local government planners attribute to local farms; and (3) to determine the primary structural challenges and professional development needs that local government planners face when integrating these systems into their practice.

Importantly, this study broadly groups food and agriculture to encompass urban agriculture, local and regional food systems, and local farms regardless of their scale or production method. While these sectors represent distinct operational scales, economic structures, and community impacts, local governments often interact with them through a common lens and shared regulatory frameworks, such as zoning ordinances and comprehensive planning goals (Freedgood, 2024). Collectively evaluating planners' perceptions of these systems allows this study to address a gap in current research by capturing a holistic snapshot of how the planning profession values the agrarian landscape before differentiating such systems by community and commodity types. This helps to illuminate the space between the valuation by local government planning of local agricultural space and food systems relative to other community systems and priorities. North Carolina was selected due to its strong agricultural economy and rapid farmland loss (Hunter et al., 2022; U.S. Department of Agriculture, Economic Research Service [USDA ERS], 2023). By focusing on North Carolina, the findings offer pragmatic insights for regions facing similar dynamics. Findings from this study contribute to our understanding of the interactions between food, agriculture, and planning practice, while supporting practicing planners by exploring the multidimensionality of food and agriculture systems in planning practice.

Methods

Creswell and Plano Clark (2018) characterized mixed-method research as collecting and rigorously analyzing both qualitative and quantitative data, integrating the two forms of data and their results in a coherent research design and framing these procedures through a theoretical framework. They note that integrating qualitative and quantitative methods and data can produce more robust findings by leveraging the strengths of each method to offset weaknesses in the other. The purpose of using mixed methods for this study is to elicit responses from practitioners based on previous research and theories, while also leaving space for participants to volunteer ideas to allow for unanticipated themes to emerge. In this way, this study will gain a deeper understanding of the ways that planning and agriculture intersect in practice and to shed light on potential opportunities to further integrate agriculture into planning practice.

To address the purpose and objectives of research, this study used a questionnaire variant of a convergent mixed-method research design, combining closed- and open-ended questions within a questionnaire instrument which can provide a richer data set compared to using only one question type (Creswell & Plano Clark, 2018, pp. 73–74). This design allows quantitative and qualitative data to be simultaneously and independently collected through a single measurement tool. Descriptive statistics for closed-ended questions and thematic coding for open-ended questions were conducted separately before the datasets were integrated during analysis to identify areas of convergence and divergence (Creswell & Plano Clark, 2018). Quantitative data were analyzed in a secure Google Sheet, while qualitative data were analyzed using a hybrid thematic approach that balanced deductive frameworks with inductive code generation. To ground the analysis in sustainability theory

and to follow the quantitative inquiry, researchers began with a high-level deductive framework consisting of parent codes: Economic, Social, and Environmental dimensions. Utilizing this structural framework, researchers then used an inductive coding process to explore how local government planners describe food and agriculture systems (detailed in the codebook in Appendix B) before being analyzed by a single researcher using the qualitative data analysis software Dedoose (version 10.0.25). While this simultaneous mixed-method approach does not yield the deep, highly localized context typical of purely qualitative designs, it does provide emergent themes and supporting quotes to validate and elaborate upon the quantitative findings (Creswell & Plano Clark, 2018). Face validity was established by an in-state practitioner who assisted researchers by reviewing the questionnaire tool and codebook, and the instrument was further refined through a pilot test with out-of-state practitioners whose responses were excluded from the final analysis.

Participants and Sampling

This study took place in North Carolina because the state is one of the top agricultural-producing states in the U.S. and is losing farmland to urbanization at the second fastest rate in the entire nation (Hunter et al., 2022; USDA ERS, 2023). This dynamic presents a unique opportunity to learn about the intersections of planning and agriculture. For this study, participants responded to a mixed-method questionnaire that contained 32 closed-ended questions and eight open-ended questions. The questionnaire was given exempt status by North Carolina (NC) State University Institutional Review Board (IRB) (Protocol 27548). Screening questions were included to ensure that local government planners who are currently practicing were also included in the analysis.

A purposive sample was gathered by distributing the questionnaire through two statewide planning listservs, specifically targeting the American Planning Association North Carolina Chapter (APA-NC) network, which includes approximately 1,300 members across public and private practice and other categories such as retirees or students. A higher number, 2,800 people, received the newsletter which the recruitment email was sent through (J. Morck, personal communication, November 9, 2023; J. Garner, personal communication, March 17, 2025), the ncplan listserv, as well as directly emailing the directors of North Carolina's 16 Councils of Government to reach regional planners. Follow-up reminders were sent monthly in November and biweekly throughout December. Because these distribution channels overlap, duplicate addresses, inactive members, and private-sector practitioners, a precise response rate cannot be calculated with confidence. The sample of 93 responses represents a purposive cohort of actively engaged practitioners rather than a statistically generalized population baseline and may also contain some response bias of practitioners who are interested and engaged with these topics. To be included in the results, participants must be local government planners in North Carolina, be over 18 years of age, and consent to participate. The questionnaire was open on Qualtrics from October 16, 2024, through December 20, 2024.

Results

A total of 93 responses from local government planners across North Carolina are included in the final analysis. It was not required to answer all the survey questions, so some questions have fewer responses than others. This sample size was deemed acceptable for this specific study, with the note that reproducing the study with a larger sample size in the future will generate more generalizable results. It is important to acknowledge that the 93 participants may not be fully representative of all local government planners in North Carolina, and that it is likely that planners who are more interested in this specific topic were more likely to respond to this questionnaire. Of the total sample, 87 participants responded to the question asking which county they are employed in; of 100 counties in North Carolina, 42 counties are represented in the results. Some counties have more than one response. The 2023 USDA Rural-Urban Continuum Codes (USDA ERS, 2025), which categorize counties into typologies based on population density and metropolitan proximity, were used to describe responses across the rural-urban continuum. As shown in Table 1, responses largely come

from urban, metropolitan, and metropolitan-adjacent counties. While this represents a skewed sample, it provides a valuable look into a state that is rapidly urbanizing and a snapshot into the exact metropolitan and peri-urban environments where rapid conversion pressure and farmland loss are accelerating (Hunter et al., 2022). Future research may be interested in exploring this topic within specific areas of the urban-rural continuum.

Beyond geography, the dataset captures a diverse cross-section of professional experiences in local government. Most participants, 64 (69%), reported being employed by a municipality. Across the remainder, 21 (23%) reported being employed by a county and the remaining 8 (8%) reported being employed by a regional government. The majority, 50 (54%) of participants have less than 11 years of planning experience. A quarter (23) of participants reported having between 11 and 22 years of planning experience, while the remaining 20 (22%) reported 23 to over 30 years of planning experience. When asked about their primary areas of planning practice, participants were allowed to select multiple areas. Land use was the most popular response, with 71 counts (39%) across 93 participants providing a response to this question. Transportation and environmental planning each received 30 counts (16% each), housing received 23 counts (13%), and economic had 22 counts (12%). Other responses included health, long-range, parks, and food systems. These demographics capture the diverse geographic and professional experiences of planning and agriculture in North Carolina.

Long-Term Planning for Sustainability and Resilience

To explore how food and agriculture align with the wider interests of local government in planning for sustainability and resilience, practitioners were asked to evaluate their community's overarching 10-year sustainability and resilience priorities. As

Table 1. Respondent Demographic Profiles

Demographic Metric	Category Group	Response Frequency *n* (%)	NC Totals
County Typology (*n* = 87)	**Metropolitan** (USDA Codes 1-3)	70 (80%)	45
	Non-Metro, Adjacent (USDA Codes 4, 6, 8)	15 (17%)	39
	Non-Metro, Non-Adjacent (USDA 5, 7, 9)	*Too small to report	16
Employer Type (*n* = 93)	**Municipality**	64 (69%)	552 total municipalities; not all have planners on staff
	County	21 (22%)	100
	Regional Government	8 (9%)	16
Professional Experience (*n* = 93)	**<10 years**	50 (54%)	Unknown
	11–22 years	23 (25%)	Unknown
	>23 years	20 (22%)	Unknown
Primary Areas of Practice (*n* = 92; participants could select all that apply)	**Land Use**	71 (39%)	Unknown
	Transportation	30 (16%)	Unknown
	Environmental	30 (16%)	Unknown
	Housing	23 (13%)	Unknown
	Economic Development	22 (12%)	Unknown
	Other (health, long range, parks and recreation, and animal and food systems)	8 (4%)	Unknown

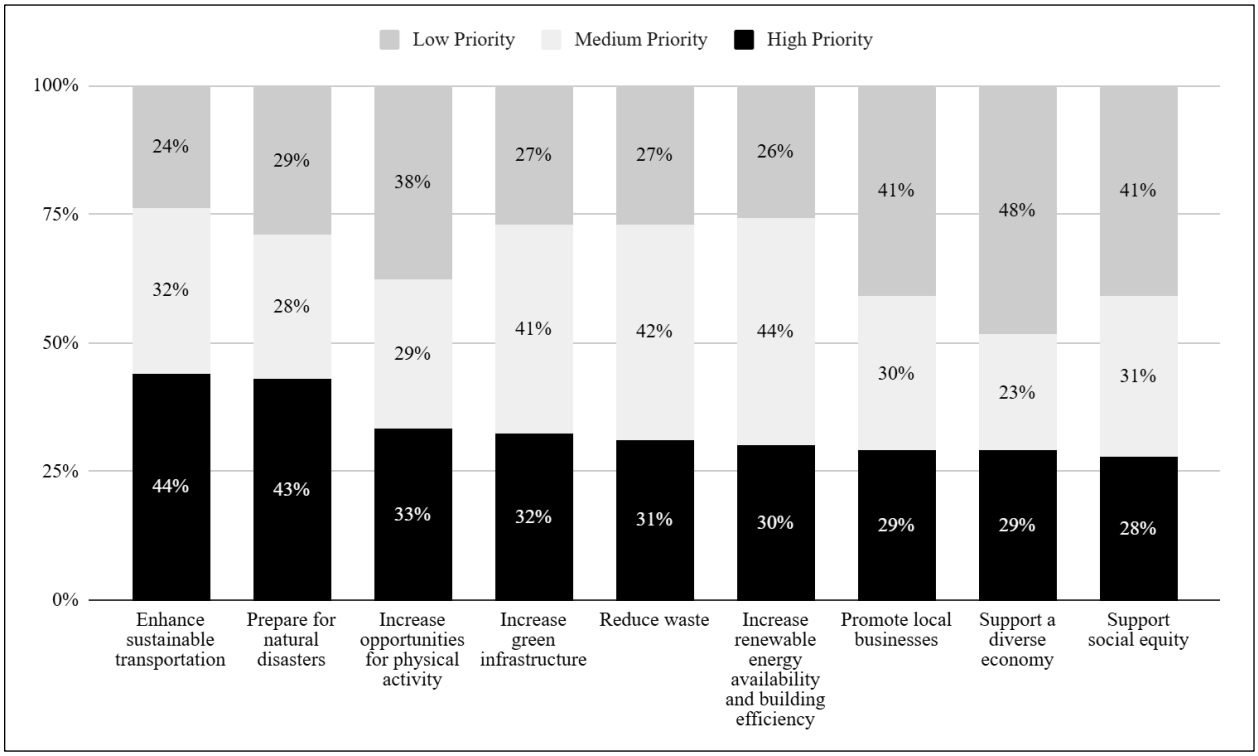
shown in Figure 1, participants ranked nine development objectives. The top three choices were categorized as high-priorities, and the lowest three as low-priorities. Efforts related to the built and natural environment, including enhancing sustainable transportation, preparing for natural hazards, and increasing opportunity for physical activity, were found to be high priority. Efforts related to social and economic environments, including promoting local businesses, supporting social equity, and cultivating a diverse economy, ranked much lower. This result reinforces planning's emphasis on built and natural environments as a discipline. The high-priority efforts are tied to traditional and legally mandated built-environment frameworks. Agriculture and food systems are often not mandated and therefore, must compete for administrative resources and attention against other institutionalized priorities.

This balancing act is further highlighted by how planners perceive their contribution to long-term sustainability. When asked to rate how much their day-to-day planning practice contributes to long-term sustainability and resilience (Figure 1), a notable split emerged. A plurality of participants (n = 41, 43%) reported that their practice contributes "a moderate amount" to the sustainability and resilience of their community. Planning decisions have long-term impacts on community landscapes, and this distribution of responses demonstrates a diversity of perceptions about whether planners believe their current professional practice is supporting long-term sustainability and resilience in their communities.

Assessing Local Food and Agriculture in Planning Practice

When asked specifically about food and agriculture, local government planners reported a multidimensional understanding of how working lands can support their jurisdictions. When asked to describe agriculture in their communities in an open-ended question, participants (n = 86) primarily focused on the connection to regional economic development, market generation, and agritourism. Secondary themes highlighted visible agrarian heritage, cultural preservation, and the structural value of farms in maintaining community character. From a regu-

Figure 1. Ranking of 10-Year Sustainability Goals (*N* = 93)



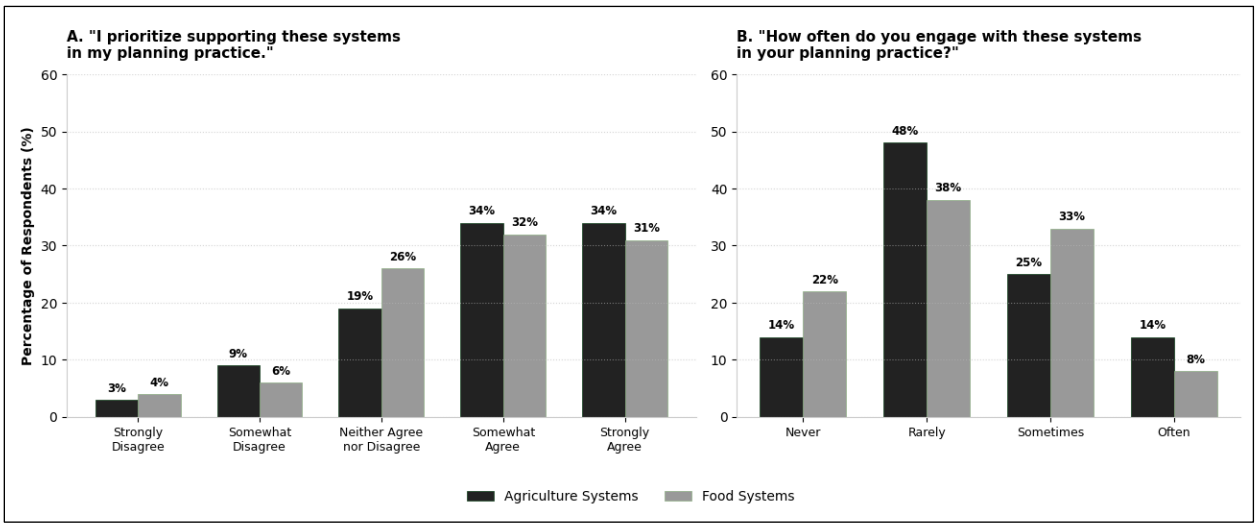
latory standpoint, several participants described agriculture through the lens of zoning codes, noting that farming is permitted both within municipal boundaries and as a traditional rural enterprise. Building on this question, participants were asked to describe how they would like to see food and agriculture used to meet sustainability and resilience goals for their community over the next 10 years (n = 74). Participants provided broad responses, describing the social-ecological functions of local food and agriculture, specifically hoping to leverage these systems to address food security and access, natural resource conservation, and diverse markets for local agricultural products, such as farmers markets, farm-to-institution programs, and commercial retail opportunities.

This support is reinforced by a clear consensus regarding the macro-level impacts of working lands with 82 (88%) participants reported that agriculture provides a net benefit to their community. When asked to explain their previous answer in a follow-up open-ended question (n = 88), those who viewed agriculture as an asset provided detailed descriptions of social, economic, and environmental benefits. Specifically, participants emphasized various cultural and well-being advantages tied to open space and community character, economic development, and open space or natural resource conservation. While notes regarding the negative externalities of agriculture and a desire to mitigate those friction points surfaced throughout the questionnaire, participants still overwhelmingly reported a net benefit. The minority of respondents who did not report a net benefit (n = 12) indicated they were uncertain about the structural impacts of agriculture or simply acknowledged that there is minimal active agricultural footprint in their jurisdiction.

To explore how these perceptions translate into practice, participants rated their level of priority of food and agricultural systems alongside the frequency with which they engage with these networks in daily operations. Figure 2 exposes an interesting contrast, showing that while a substantial majority of planners explicitly prioritize supporting local food systems (n = 59, 63%) and agricultural landscapes (n = 64, 69%) in their professional frameworks, actual operational interaction is substantially lower. In fact, 58 (62%) reported that they rarely or never engage with agriculture in their daily workflows, while 55 (59%) reported an identical lack of engagement with local food systems infrastructure.

Next, participants were asked an open-ended question to detail exactly how they interact with food and agriculture in their current planning workflows. In alignment with the quantitative data, a prominent theme across the responses (n = 67) was that participants engage with agriculture on a limited basis, constrained by competing community leadership priorities or a baseline lack of agricultural land. Those who do interact with these sys-

Figure 2. The Priority-Engagement Paradox: Conceptual Support vs. Daily Workflow (N = 93)



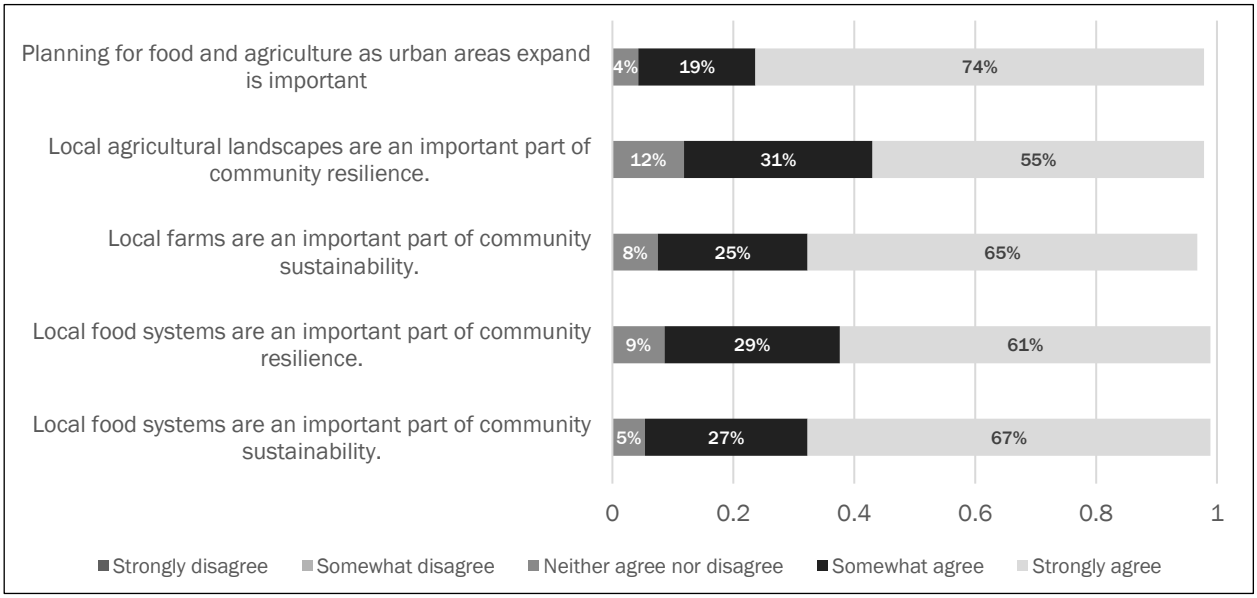
tems detailed where agriculture intersects with land-use policies, noting that these conversations occur almost exclusively during long-range comprehensive planning initiatives rather than within current development administration or daily code enforcement. This highlights a bottleneck for practice, while local government planners strongly believe planning for food and agriculture is important, they lack opportunities to actively engage with these systems in daily practice.

Despite these structural constraints, planners hold a firm conviction that these networks are tied to wider community strategies. As illustrated in Figure 3, a majority of respondents believe that both general agriculture and localized food systems can actively contribute to long-term sustainability and resilience goals, while also agreeing with how planning for these systems is important as urban environments expand. While strong agreement remained high regarding the role of food systems and localized farms in community sustainability, support dipped when assessing "agricultural landscapes" as active tools for community resilience. The higher ratings of local food systems relating to community sustainability and resilience compared to farms and agricultural landscapes shows a conceptual split between the two systems, possibly warranting further study. Overall, these results show interest in food and agriculture systems even though participants reported engaging with these systems a moderate amount.

Food, Agriculture, and Sustainability

A section of the questionnaire included a series of Likert scale matrices asking participants how farms in and around their communities contribute to economic, social, and environmental dimensions and overall sustainability and resiliency of their community. This was done to gain a deeper understanding of how planners perceive the contributions of local agriculture to their community and other community systems. The quantitative results are integrated with qualitative responses from their description of agriculture in their community (n = 86) and how they would like to see food and agriculture used to meet sustainability and resilience goals in the next 10 years (n = 74). The mixed-method approach provides a deeper understanding of how local government planners relate to local agriculture. Rather than simply describing how they rate its contributions, it also explains why they hold their perceptions based on their lived experience and how they

Figure 3. Practitioner Perception of Local Food and Agriculture Systems in Relation to Sustainability and Resilience (*N* = 93)

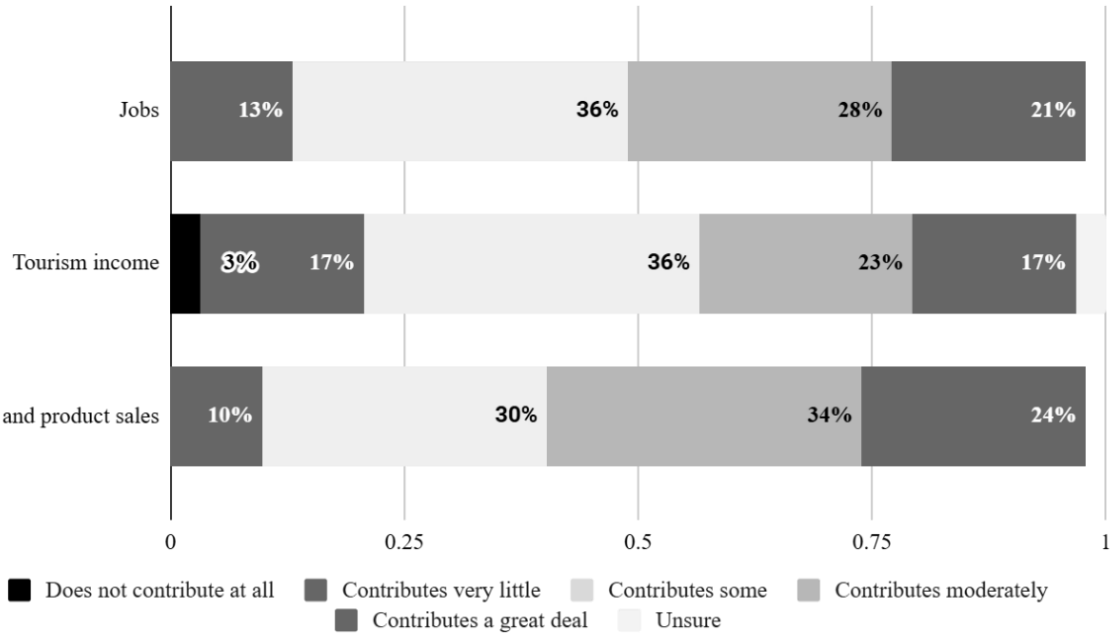


Note: To protect participant confidentiality in accordance with IRB protocols, specific frequencies for "Strongly Disagree" and "Somewhat Disagree" categories are omitted from individual reporting due to cell counts falling below the minimum reporting threshold (n < 3).

envision the role of agriculture in building more sustainable and resilient communities. These insights can help identify strategies for building connections between food, agriculture, and community resilience.

First, economic development was a significant theme across responses, although it was not a highly ranked theme in the initial question that ranked resiliency priorities for the next 10 years. Figure 4 represents how planners ranked the extent

Figure 4. Description of How Agriculture Currently Contributes to Local Economies, and How It Can Contribute in the Future (*n* = 92)



Topic	Current Description of Agriculture	How Food and Agriculture Can Address Sustainability and Resilience Over the Next 10 Years
Jobs	"A portion of our industrial base (employment) within city limits is agricultural (primarily feed mills). The surrounding community (outside city limits) has a decent amount of ag related activity (some manufacturing, some farming)."	"Providing greater resources for locally-produced urban foods has the opportunity to provide healthy foods to the community, opportunities for employment, opportunities for social engagement as well as physical activity."
Tourism Income	"Apple orchards play a large rol[e] in the economy and tourism." "Rural areas outside of city center along with urban agriculture (backyard chickens, farmers markets, produce stands, community gardens, etc.) opportunities in the city limits. Farming (livestock and crop) operations in the rural areas along with some agritourism (wineries, hayrides, etc.)."	"By being seen as a viable part of the solution for addressing food deserts/food insecurity, local economic diversity, stormwater management, wildlife habitat, and ensuring quality of life for residents. Having a high quality of life in turn spurs economic opportunities and tourism dollars."
Food and Product Sales	"There is limited agriculture within my community. We have an active Farmer's Market to promote local providers." "[Redacted] County has a diverse farming community and an active farmer's market, but there is a disconnect between the agriculture in the county and the schools and businesses and retail options."	"ANYTHING that can be produced locally is required to be available in local schools … maybe even restaurants."

to which local farms currently contribute to elements of economic sustainability, here operationalized as jobs, tourism income, and food and product sales–alongside representative quotes of how participants described agriculture in their community now, and how it can be leveraged to meet sustainability and resiliency goals over the next 10 years. The importance of agriculture in the local economy was a major theme across participants describing agriculture in their community. Specifically, food markets and sales were a major theme of participants describing how local food and agriculture can contribute to sustainability and resilience over the next 10 years. Local government planners play an important role in supporting local food markets, such as farm stands and farmers markets, by providing permits for these operations. As demonstrated by the representative quotes below, participants linked these functions with other social and environmental functions of agriculture. Even in current descriptions of agriculture in their community, many planners referenced their local farmers markets. Some noted that this type of direct-to-consumer market is the main outlet for farmers in their community, while institutions such as schools may be a missed opportunity. Some planners made the connection that the benefits of local food and agriculture can increase the quality of life for the community, which may translate into higher tourism income. While job numbers are a typical economic development metric, these results suggest that promoting local food and agriculture markets for businesses and community well-being are also important factors to consider.

Next, participants were asked about how agriculture contributes to the natural environment of their community (Figure 5). Qualitative themes related to the environmental dimension were not as strong as those for social and economic dimensions. This suggests that relying solely on the number of acres in production may not be a comprehensive measure of local agriculture's environmental impact and that there is a need to incorporate other metrics. When describing current agriculture, open space was a major theme that emerged, especially in relation to community character and culture. This theme was not as prominent when asking about sustainability and resilience goals. Conversely, conservation of natural resources was not a prominent theme when asking about current descriptions and contributions, but rather, was a more prominent theme when asked about the next 10 years, which shows an area of future focus for planning practice and research. Comments about this topic focused heavily on farmer decisions about sustainable and regenerative agriculture practices in relation to water quality and stormwater management, with some planners commenting that they would like to work more closely with farmers on this topic. There were some comments about environmental degradation from industrial agriculture. Of note, participants did not directly discuss hazard mitigation but acknowledged that local farms do contribute to hazard mitigation in the closed-ended question. Other comments from participants included a desire to reduce food miles–the distance that food travels across the supply chain–to reduce the carbon footprint of food systems. These results suggest that preserving open space that is tied to community culture and increasing information about both ecosystem services and conservation strategies on agricultural lands may be areas for future work.

Last, participants were asked about the social dimensions of sustainability (Figure 6). Reflecting the quantitative data asking about current contributions, participants described cultural preservation and community well-being in their current descriptions of agriculture. These topics were also strong when asking about the next 10 years, with the inclusion of food security and access. Urban agriculture emerged as a strategy to work towards these goals with a variety of methods mentioned, including integrating agriculture into residential development, institutions hosting community gardens, edible streetscaping, and pocket farms and urban farms into city landscapes. These results suggest agriculture as an important contributor to cultural preservation and placemaking strategy.

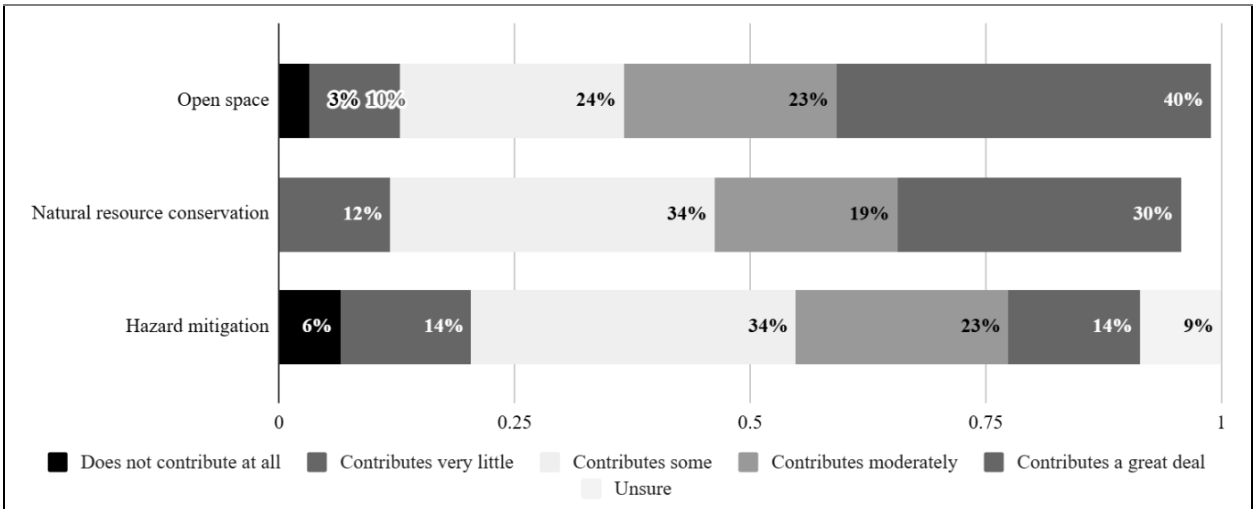
Challenges and Opportunities

To dig deeper into the responses from the previous block of questions, this block of questions focused on what is needed so that local government planners can better support local food and agriculture systems. Participants were asked to describe the

challenges faced in leveraging food and agriculture when attempting to meet planning goals for their community. Sixty participants responded to this question. A prominent theme that emerged from the data was how development pressure and growth of communities were prominent challenges for the communities where they work.

Next, participants were asked if they collaborate with any other agencies to support food and agriculture systems in their community. Half of total participants (n = 47, 51%) reported not collaborating with other agencies to support food and agriculture systems in their community. If they answered that they did collaborate with other agencies (n = 33, 36%), they were asked to name those agencies. Twenty-eight participants provided agencies they collaborate with; North Carolina Cooperative Extension and state and local government agencies such as Soil and Water Conservation Districts, and the North Carolina Department of Agriculture were the most common answers. Other responses included nonprofits, food and agriculture businesses, and food policy councils. Participants were then asked whether increased collaboration would help them better support food and agriculture systems. A majority (n = 62, 67%) of parti-

Figure 5. Description of How Agriculture Currently and Can Contribute to Local Environments (N = 93)

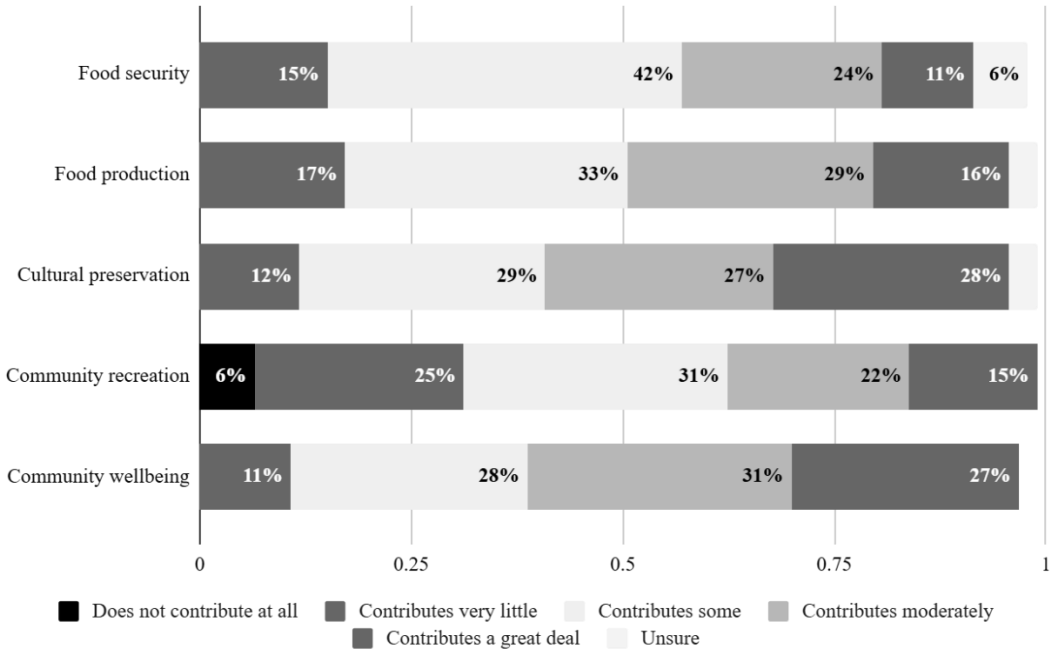


Topic	Current Description of Agriculture	How Food and Agriculture Can Address Sustainability and Resilience Over the Next 10 Years
Open Space	"There are many family farms in town that preserve green, pasture space and the rural feel of the town." "Mostly row crop farming. Also, nice aesthetics—view shed."	"I'd like to see our community be able to balance land development with maintenance of conservation areas, tree corridors, et cetera."
Natural Resource Conservation	"Conservation land used for recreation and farming purposes."	"I would like to see better farm management through drainage swales, proper pesticide and nutrient management, as well as effective crop rotation." "Local food and related products make our region more resilient and sustainable. Agricultural lands are an important part of our green infrastructure network, which is important for habitats, water quality, native species, healthy ecosystems."
Hazard Mitigation	None	"Increase agriculture in flood areas where past development has been destroyed by disasters."

cipants agreed that it would, while some participants (n = 30, 32%) were not sure whether increased collaboration would benefit them.

In addition to collaboration, participants were asked about what type of professional development and materials would help them support local food and agriculture systems. One open-ended question asked what type of professional development mate-

Figure 6. Description of How Agriculture Currently and Can Contribute to Social Dimensions of Local Communities (*N* = 93)



Topic	Current Description of Agriculture	How Food and Agriculture Can Address Sustainability and Resilience Over the Next 10 Years
Food Security	"Agriculture plays a vital role in balancing the food production needs and access to fresh foods for underserved populations. With the need for more robust transportation systems, access to fresh foods can be challenging in some communities."	"Food that doesn't have to be shipped from far away helps reduce greenhouse gases. The food is fresher and it is easier to trace if there are contaminants (e.g., E. coli, salmonella, etc.). Enhances social equity (reduces food deserts)." "I am not sure. … We generally focus our sustainability and resilience goals on infrastructure and development and less so on farmed land. I would rather focus my planning on community resilience, meaning eliminating food deserts which is a social problem rather than sustainable farming practices which seem to me to be more of a private company decision."
Food Production	"Rural areas outside of city center along with urban agriculture (backyard chickens, farmers markets, produce stands, community gardens, etc.) opportunities in the city limits." "The community is suburban with few greenfields sites left. There is no agriculturally zoned land in municipal limits. There is a municipality-sponsored community garden. …"	"Support for small farmers to convert to food production that can be sold locally. This reduces the transportation toll on the local network and the transportation impact included in the food."

continued

Table 6 continued

Cultural Preservation	"Agriculture is vitally important to our community as I am a planner in Eastern North Carolina. It is both of economic importance and social importance. Economically it generates revenue and provides importance. Socially, it is [a] foundation stone of community identity. …" "Preserving farmland helps preserve the open spaces and economic opportunities that gives my county a sense of place."	"Helping to decrease food deserts, but allowing farmers markets to utilize locally produce food, which supports local businesses/farmers, allows for healthier food choices and a placemaking opportunity for the community."
Community Recreation	"Conservation land [is] used for recreation and farming purposes."	"I would like to see more communal food growth and production opportunities through shared gardens and urban farms. Perhaps it could be used as a recreational and open space feature in our subdivision and development code."
Community Well-being	"Large agritourism presence. Offers healthy food options and sustainable local food."	"Providing greater resources for locally produced urban foods has the opportunity to provide healthy foods to the community, opportunities for employment, opportunities for social engagement as well as physical activity." "I think ag[riculture] needs to be a priority for all—people & governments. This means a higher importance on small farms and their well-being, promoting eating locally, and ways to help encourage continued use of ag land, but not in a way that it is detrimental to generational farmers (meaning not to enact zoning that causes their land value to be reduced)."

rials they personally need to better support local food and agriculture systems (n = 58). Overall, participants were not sure about what would be helpful. Resources that were named included model examples of how other communities are successfully engaging and preserving local food and agriculture systems while growing, specific data points about their community and how to interpret the data, and more webinars and presentations about agriculture and land-use planning.

The other question asked what type of educational and outreach materials they need to provide in their community to leverage food and agriculture to meet sustainability and resilience goals (n = 57). Again, the majority of participants was unsure about what would be helpful. Examples of materials that could be helpful included data that is digestible, such as infographics, local food directories for their area, talking points about the importance of buying local, and engagement of community members to help spread the word. Participants described wanting materials to engage both the public and elected officials.

Discussion

This study explores the connections between food, agriculture, and community planning, with a focus on building sustainable and resilient communities. While participants acknowledge the potential for food and agriculture to support community resilience over the next decade, a contrast appeared showing that planners do not frequently interact with local food and agriculture systems. However, when they do, it appears to be in a long-range or comprehensive context, but they do believe these systems provide a net benefit to their communities. The recognition of these systems remains ahead of daily operational reality, which focuses on regulated built and natural-environment frameworks over nonmandate agri-food initiatives.

Despite the growing recognition of the interconnectedness of food systems with environmental, social, and economic well-being, planning for food and agriculture has not been as strongly emphasized in community planning the way that other essential systems, such as housing and water,

have been. There are opportunities for communities to include agriculture and food systems as they envision while planning for their long-term sustainability and resilience. In this study, participants prioritized sustainable transportation, natural hazard preparedness, and physical activity opportunities (Figure 1). While these rankings focus on the built and natural environments, many participants described agriculture in relation to markets or economic development and to open space and the preservation of community character. However, participants reported that they believe agriculture and local food systems can support their sustainability and resilience goals, with a slightly higher perception of local food systems contributing to such goals. These mixed results highlight a disconnect and an opportunity to specify environmental land-use benefits of agriculture. By prioritizing essential community systems, integrating food and agriculture into planning more explicitly can help support these goals while making communities more sustainable and resilient.

A key finding from the questionnaire highlights a specific area for future education. Throughout the questionnaire, participants cited local food and agricultural systems as reducing "food miles," or the miles that food travels from farm to fork, specifically noting that localized food systems have lower food miles and therefore result in lower greenhouse gas emissions. However, current research does not support the idea that local food systems are necessarily more environmentally sustainable than larger systems because of reduced transportation, but rather that the situation is nuanced (Brinkmeyer et al., 2023; Enthoven & Van den Broeck, 2021). This specific area could be addressed in outreach and training materials.

The mixed perceptions surrounding the current contribution of planning practice to long-term community resilience, combined with the strong agreement on the potential of food and agriculture to support resilience, makes it difficult to understand where food and agriculture can fit into planning practice. While participants acknowledge the value of food and agriculture, the disconnect between this recognition and their regular engagement with these systems suggests a need for greater awareness and practical tools to effectively integrate food and agriculture into their daily work. Results show how local government planners recognize the benefits of food and agriculture but do not regularly engage with these systems. This leads to further research questions asking whether this comes from a lack of understanding of how to effectively engage with such systems, a perceived lack of jurisdiction or mandate from elected officials, or the absence of established frameworks and partnerships, such as with Cooperative Extension. Bridging this gap is important to translate the acknowledged potential into tangible planning outcomes.

Participants demonstrated an understanding of the multidimensional nature of agriculture, recognizing social, economic, and environmental functions beyond zoning policies and acres in production. This awareness provides a foundation for moving beyond simplistic metrics and incorporating a more holistic view of agriculture's contributions into planning policies and practices. Recognizing agriculture's role in cultural preservation, community well-being, and open space preservation opens avenues for innovative planning strategies that leverage these benefits. For example, as one participant noted, subdivision development codes can incorporate agriculture by name into open space and recreational guidelines.

The specific areas identified by planners as strong current contributions of agriculture— food and product sales, open space preservation, cultural preservation, and community well-being—offer starting points for integration and alignment with other community systems. These areas align well with broader sustainability goals and can be readily incorporated into various planning elements, from comprehensive plans to zoning regulations and economic development strategies. Building an understanding of how agriculture can contribute to environmental sustainability, including natural hazard mitigation, stood out as a potential area for future outreach and research efforts.

The demand for urban expansion will continue to challenge communities to address the tension between conventional development patterns and the preservation of agricultural land and its associated benefits. This finding reinforces the urgency of integrating food and agriculture considerations

into land-use planning decisions. Without proactive planning, the continued expansion of low-density development will lead to the permanent loss of valuable farmland, undermine local food systems and domestic food supply, and exacerbate the challenges of building sustainable and resilient communities. There is an urgent need for policies that promote sustainable development, protect agricultural land through zoning and easements, and strategically integrate agriculture into the urban fabric through initiatives like urban farming and community gardens.

Results finding that participants collaborate with agriculture organizations when needed suggests an existing foundation for partnership. These collaborations can provide planners with expertise, facilitate the development of mutually beneficial policies, and foster a shared vision for a resilient food and agriculture system in the community. While largely unsure, participants named some types of resources and professional development that could benefit their practice. The need identified for digestible data about food systems and agriculture for both planners and the public is a critical barrier to overcome. The complexity of food systems and agricultural practices can be daunting for those outside the sector. Providing clear, accessible, and locally relevant data on the economic, social, and environmental impacts of agriculture can empower planners to make informed decisions, allowing them to effectively communicate the importance of food and agriculture to the broader community. This data could include information on local food production capacity, economic contributions of the agricultural sector, environmental benefits of specific farming practices, and the social-equity implications of food access. Additionally, model ordinances and other policies can be used as outreach and training tools. North Carolina Cooperative Extension, a named trusted partner, can be of further assistance in this area. For example, it provides county, regional, and state-level Food and Farm Profiles.[1]

This study was exploratory and highlighted areas for future research, while having some limitations. While this study aims to shed light on the integration of food and agriculture systems in community development, several potential limitations should be considered. First, this research is geographically constrained to North Carolina, which can limit the generalizability of the findings to other regions with distinct community contexts and agricultural landscapes. This study relies on self-reported perceptions and priorities of local government planners, introducing the possibility of response bias or social desirability bias. The questionnaire, although designed to capture nuanced perspectives, may not fully encompass the complexity of decision-making processes related to land-use planning and may oversimplify the multidimensional nature of the issues at hand. Future research may focus on specific types of agriculture or elements of local food systems. Overall, the findings from this study contribute to our understanding of the relationship between food, agriculture, and planning. Takeaways for planning practice include viewing agriculture as an essential community system, acknowledging the multidimensional contributions of food and agriculture and using metrics that reflect those functions, and incorporating the multidimensional functions of food and agriculture into rezoning decisions and comprehensive plans. Areas of future research can include policy evaluation that can be explored to understand how the multiple dimensions of agriculture are currently integrated (or not) into official documents and actions. This would provide a baseline for measuring progress and identifying areas for improvement. Similarly, a review of rezoning processes to understand how agriculture is measured against development pressures is crucial for ensuring that the long-term benefits of agricultural land are adequately considered in land-use decisions. Data visualization, mapping of overlapping community systems, and pragmatic tools can be developed in partnership with planners and agricultural actors to create more tools for planners to leverage in their practice. In-depth interviews or focus groups could be used to explore what determines how often planners engage with food and agriculture systems and explore food and agriculture as private activities for the public good.

[1] See https://go.ncsu.edu/agcensus

The findings of this study highlight a crucial opportunity to deepen the integration of food and agriculture into community planning for sustainability and resilience. By recognizing the multidimensional contributions of agriculture, fostering collaboration, developing appropriate tools and data, and prioritizing these considerations in policy and practice, planners can play a vital role in cultivating communities that are not only environmentally sound and economically vibrant, but also food-secure and resilient in the face of future challenges. The time is ripe to move beyond a simplistic view of agriculture and embrace its role in supporting sustainable and resilient communities for the future.



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Appendix A. Planner Questionnaire Tool

Title of Study: Agriculture and Urban Development: An Investigation into Local Government Planning for Agriculture in North Carolina
IRB Protocol: 27548

You are being asked to complete a survey for research purposes. The survey is about community planning and agriculture. You can expect that the survey will take roughly twelve minutes to complete.

You must be 18 years of age or older, reside in the United States, and be a local government planner to participate in this study.

For this study, you will be asked questions about your perceptions of agriculture, associations between agriculture and community sustainability, challenges and opportunities for supporting agriculture in your practice, and demographics. Completing this survey is voluntary and you can stop at any time by exiting the window on your browser.

There are minimal risks associated with your participation in this survey. Only confidential data will be gathered. We suggest that you take this survey using a private device, in a private location, using a web browser set to private/incognito mode. The data collected about you from this survey will be stored in accordance with NC State University data protection standards.

You will not receive direct payment for completing this survey. You may select to enter your email for a raffle drawing for a gift at the end of the survey. You will enter your name and contact information into a Google Form that is separate from the survey in order to protect your confidential survey response.

If you have any questions about the survey, how it is implemented, or the research study, please contact the researchers, Hannah Dankbar at hcdankba@ncsu.edu or (919) 515-1195. Please reference study number 27548 when contacting anybody about this project.

If you have questions about your rights as a participant or are concerned with your treatment throughout the research process, please contact the NC State University IRB Director at IRB-Director@ncsu.edu, 919-515-8754, or fill out a confidential form online at https://research.ncsu.edu/administration/compliance/research-compliance/irb/irb-forms-and-templates/participant-concern-and-complaint-form/

If you consent to complete this survey, please click the "Yes, I agree to consent" button to see the survey.

1. Yes, I agree to consent (proceed to survey)
2. No, I do not agree to consent (proceed to exit screen)

Block One: Local Food and Agriculture
This block of questions contains open and closed-ended questions for you to share your understanding about agriculture in relation to the community you serve.

1. In what ways would you like to see your community become more sustainable or resilient over the next 10 years? Rank the following options.
    a. Increase renewable energy availability and building efficiency

   b. Reduce waste
   c. Enhance sustainable transportation
   d. Increase green infrastructure
   e. Promote local businesses
   f. Increase opportunities for physical activity
   g. Prepare for natural disasters
   h. Support social equity
   i. Support a diverse economy
2. To what degree do you believe your current planning practice supports your long-term vision for your community?
   a. 5-point Likert scale
3. How often do you engage with agriculture in your planning practice?
   a. Never
   b. Rarely
   c. Sometimes
   d. Often
4. Can agriculture be used to support any of the sustainability or resiliency goals you prioritized above?
   a. Yes
   b. No
   c. Unsure
5. Describe agriculture in your community, including what role it plays in your community.
   a. Open-ended
6. Do you believe agriculture has an overall benefit or harm to your community?
   a. Benefit
   b. Harm
   c. Unsure
7. Why did you select either benefit or harm in the question above?
   a. Open-ended
8. How do you define local food?
   a. food that is grown or raised within a 50 mile radius of where it is sold regardless of state or county boundaries
   b. food that is grown or raised within a 100 mile radius of where it is sold regardless of state or county boundaries
   c. food that is grown or raised within a 400 mile radius of where it is sold regardless of state or county boundaries
   d. food that is produced in the county you live in and surrounding counties
   e. food that is produced anywhere in North Carolina
   f. food that is produced in the U.S.
   g. food that is sold outside of major grocery chains
   h. Other:
9. How do you define local food systems?
   a. Open-ended
10. How often do you engage with food systems in your planning practice?
   a. Never
   b. Rarely
   c. Sometimes
   d. Often

11. Can local food and local food systems be used to support the sustainability or resiliency goals you prioritized above?
    a. Yes
    b. No
    c. Unsure
12. Describe how you would like to see food and agriculture be used to meet sustainability and resilience goals for your community over the next 10 years.
    a. Open-ended

Block Two: Agriculture and Sustainability

This block contains a series of Likert scale questions asking you to what degree agriculture in your community contributes to different dimensions of community sustainability. For each question responses range from 1 = does not contribute, up to 5 = contributes a great deal, with an option to select unsure.

For each dimension of sustainability, rank to what degree you believe farms in and near your community contribute to each element of sustainability.

13. Economic Development

Farms in and around my community contribute to local…

Statement	1 = does not contribute at all	2 = contributes very little	3 = contributes some	4 = contributes moderately	5 = contributes a great deal	Unsure
Jobs						
Tourism Income						
Food and Product Sales						

14. Social Impact

Farms in and around my community contribute to local…

Statement	1 = does not contribute at all	2 = contributes very little	3 = contributes some	4 = contributes moderately	5 = contributes a great deal	Unsure
Food Security						
Food Production						
Cultural Preservation						
Community Recreation						
Community Wellbeing						

15. Environmental Impact

Farms in and around my community contribute to local…

Statement	1 = does not contribute at all	2 = contributes very little	3 = contributes some	4 = contributes moderately	5 = contributes a great deal	Unsure
Open Space						
Natural Resource Conservation						
Hazard Mitigation						

16. Community Sustainability

For this section, rate to what degree you agree with the following statements. Consider the definition of local food systems you provided earlier in the survey.

Statement	1 = strongly disagree	2 = disagree	3= neither agree or disagree	4 = agree	5 = strongly agree
Local food systems are an important part of community sustainability.					
Local food systems are an important part of community resilience.					
I prioritize supporting local food systems in my planning practice.					
Local farms are an important part of community sustainability.					
Local agricultural landscapes are an important part of community resilience.					
I prioritize preserving and supporting agricultural landscapes as part of my planning practice.					
Planning for food and agriculture as urban areas expand is important.					

Block Three: Challenges and Opportunities
This block contains a series of questions for you to share challenges and opportunities for leveraging agriculture to address sustainability goals in your planning practice.

1. Describe how you engage with agriculture and local food systems in your current planning practice.
    a. Open ended
2. Describe the challenges you face in leveraging food and agriculture to meet planning goals for your community.
    a. Open-ended
3. Do you collaborate with other agencies at the state and local levels to support food and agriculture systems in your community?
    a. Yes
        i. If Yes, the ask to list which agencies
    b. No
4. Would increased collaboration with state and local agencies help you better support food and agriculture systems?
    a. Yes
    b. No
    c. Unsure
5. What professional development materials do you personally need in order to better leverage food and agriculture to meet sustainability and resilience goals for your community?
    a. Open-ended
6. What outreach and education materials do you need to provide in your community in order to leverage food and agriculture to meet sustainability and resilience goals for your community?
    a. Open-ended

Block Four: Demographics
This block contains questions about your planning practice and experience.

7. Which county are you employed in?
    a. Select from list of NC Counties
8. What type of planning do you primarily practice? Select all that apply.
    a. Land Use
    b. Environmental
    c. Economic
    d. Housing
    e. Transportation
    f. Other: _____
9. In which type of government entity do you work as a planner?
    a. County
    b. Municipality
    c. Region
10. How long have you been a practicing planner?
    a. 0-4 years
    b. 5-10 years
    c. 11-16 years
    d. 17-22 years
    e. 23-28 years
    f. 29+ years

Thank you for completing this survey!

Appendix B. Qualitative Codebook for Open-Answer Questionnaire Responses

Qualitative Codebook

Codebook validated through a peer review process including dissertation committee members and an NC-APA member.

1. **Social Sustainability**
   - Abbreviation: SC
   - Definition: This topic highlights social elements of sustainability which focus on the well-being of people and communities.
   - When to use: Use this code when participants discuss social and cultural elements of food and agriculture.
   - Child Codes
     - Food Security & Access (FS): Use when participants discuss food security and points of food access in their community. An example being the description of points of food access, whether they are local food related or not.
     - Health (H): Use when participants discuss health outcomes.
     - Culture (C): Use when participants discuss the relationship between food, agriculture, and community culture, including sense of place and deep place connection.
     - Wellbeing (WB): Use when participants describe the relationship between food, agriculture, and overall community wellness, wellbeing, or health (physical or mental). An example being the description of the availability of fresh produce or the mental health benefits of open green space.

2. **Economic Sustainability**
   - Abbreviation: ECON
   - Definition: This topic highlights economic elements of sustainability which focus on financial aspects of food and agriculture businesses that are conducted in such a way as to preserve and promote long-term economic well-being of these systems.
   - When to use: Use this code when participants discuss economic elements of food and agriculture.
   - Child Codes
     - Jobs (J): Use when participants discuss jobs and employment in agriculture and food sectors.
     - Tourism (AT): Use when participants discuss tourism events on farms.
     - Markets & Sales (MS): Use when participants describe local food markets or other types of agricultural markets for their economic value.
     - Economic Development (ED): Use when participants speak generally about the connection between local economies and agriculture.

3. **Environmental Sustainability**
   - Abbreviation: ENV
   - Definition: This topic highlights environmental elements of sustainability which focus on the ability to preserve and protect the natural environment over time.

- When to use: Use this code when participants discuss the natural environment, including aesthetics.
- Child Codes
  - Open Space (OS): Use when participants discuss open space or aesthetics.
  - Natural Resource Conservation (NRC): Use when participants discuss the relationship between food, agriculture, and protecting and preserving natural resources, such as water and soil. This includes descriptions of sustainable and regenerative agriculture practices.
  - Environmental Degradation (ED): Use when participants discuss harmful agricultural practices or negative impacts of agriculture.

4. Land Use and Urban Development

- Abbreviation: LUD
- Definition: This topic refers to land use planning and development across engagement, policy, and physical development, including policy goals such as preserving space.
- When to use: Use this code when participants discuss land use planning and development and its relationship to food and agriculture.
- Child Codes
  - Growth (G): Use when participants discuss the expansion of the built environment in relation to agricultural land.
  - Land Use Policies (LUP): Use when participants discuss specific planning documents and policies.
    - Zoning (Z): Use when participants discuss specific zoning codes or land use control policies.
  - Transportation (T): Use when participants discuss local transportation systems.
  - Housing (H): Use when participants discuss housing development.
  - Smart Growth (SG): Use when participants discuss compact or dense development.
  - Sprawl (SW): Use when participants discuss low-density urban sprawl.
  - Regional (R): Use when participants discuss the spatial distribution of agriculture and the built environment in a regional context. For example, rural agriculture outside of a city.
  - Planner Agency & Capacity (PAC): Use when participants discuss department priorities, staffing, and agency in decision making.

5. Resilience

- Abbreviation: RS
- Definition: This topic highlights community and landscape resilience, including the ability of these systems to resist or absorb changes, recover from disturbances, and adapt to new conditions (Masterson et al., 2014).
- When to use: Use this code when participants discuss resilience or characteristics of resilient systems.
- Child Codes
  - Self-Reliance (SR): Use when participants discuss creating systems to increase self-reliance in the face of disturbance of larger systems as a way to increase community security and adaptability.
  - Essential System (ES): Use when participants discuss the necessity of community systems and how they interact.

- Adaptation to Disturbance (AD): Use when participants name or describe a disturbance they have encountered or plan to encounter in their work. Examples could include natural hazards and climate change or the Covid-19 pandemic.
- Recover (R): Use when participants discuss the recovery process from a disturbance.

6. Agricultural Production

- Abbreviation: AG
- Definition: This topic highlights specific types of agricultural production.
- When to use: Use this code when participants discuss specific types of products that are grown and production techniques.
- Child Codes
  - Scale (SL): Use when participants discuss specific scales of agriculture, such as small or large.
  - Products (PR): Use when participants name specific agricultural products or production techniques.
  - Urban Agriculture (UAG): Use when participants discuss urban agriculture, including gardens.
  - Farmer Decision Making (FD): Use when participants discuss the decisions made by farmers or farmers as land managers generally.

7. Collaborating Organizations

- Abbreviation: CO
- Definition: This topic highlights the types of organizations who collaborate with local governments on agricultural planning.
- When to use: Use this code when participants name specific types of organizations they collaborate with.
- Child Codes
  - Extension (EX): Use when participants mention North Carolina Cooperative Extension.
  - Government (GT): Use when participants name a local, state, or federal organization.
  - Non-Profit (NP): Use when participants name a non-profit organization.
  - Farmers (F): Use when participants describe local producers.

8. Professional Development

- Abbreviation: PD
- Definition: This topic highlights the types of professional development that local government planners say will help them better be able to plan for agriculture.
- When to use: Use this code when participants discuss types of professional development needed.
- Child Codes
  - Data (D): Use this code when participants mention types of data that would help them.
  - Technical Assistance (TA): Use this code when participants mention types of direct technical assistance they would like to receive or support they already receive.
  - Model Examples (ME): Use this code when participants mention specific types of models they would like, such as example codes or other policies.
  - Relationships (R): Use this code when participants mention relationships that would help them better plan for agriculture.

- Outreach Materials (OM): Use when participants name materials to use for public engagement or outreach.
- Unsure (U): Use this code when participants aren't sure what type of professional development they think would be helpful.

9. Minimal Impact or Uncertainty

- Abbreviation: MI
- When to use: Use this code when participants express uncertainty or share there is minimal impact or relationship between agriculture and planning.

10. Miscellaneous

- Abbreviation: M
- When to use: Use this code when participants express an idea that does not fall under other codes.

11. Great Quotes

- Abbreviation: GC
- When to use: Use this code when participants have memorable quotes that can be used as examples in research reports.