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**Gleaning for Sustainability: Understanding Farmers' Social, Environmental,
and Economic Motivations for Charitable Food Donation**

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Abstract:

Gleaning, the collection and reallocation of extra produce from farms for donation to people in need, contributes to sustainability by simultaneously addressing food insecurity and food loss. This practice largely depends on gleaning organizations to gather and distribute excess produce, making their relationships with farmers critically important. Existing literature recognizes economic incentives for farmers' participation in gleaning (namely, the federal tax deduction), but social and environmental considerations have not been formally researched. Understanding how these three sustainability pillars motivate farmers to participate in gleaning can help organizations build stronger relationships. We interviewed 23 farmers in the United States who currently glean to learn how the three sustainability pillars motivate their participation. Farmers in our study most valued the social and environmental benefits that accompany gleaning, while economic considerations were not as influential in decision making. The most referenced benefit of gleaning was "feeding people," cited by 87% (20) of participants. Interestingly, only 26% (6) of participants cited emissions reduction, which many studies present as the most prominent environmental benefit of gleaning. We also found that 26% (6) of participants used the federal tax deduction for charitable food donations, while 39% (9) were qualified for the deduction but chose not to use it, and the remaining 35% (8) did not qualify. This suggests that the tax benefit is not as effective as previously reported. These findings convey that gleaning organizations can strategically use the three pillars of sustainability to attract new farmers to the practice of gleaning.

Introduction:

In 2023, 47.4 million Americans were food insecure, or unable to acquire enough food to meet their needs, according the United States Department of Agriculture (U.S. Department of Agriculture 2025). Meanwhile, an estimated 27% of all food in the United States (equivalent to about 63 million tons) goes un-used between production and consumption every year (ReFED 2025). Charitable food donation is at the nexus of this mismatch, creating an opportunity to avoid food loss by moving potentially wasted food into the hands of people who need it.

Food loss occurs upstream on food supply chain prior to consumer sales, while “food waste” refers to food that is thrown away downstream by retailers and consumers (Nat Food 2024). Thus, produce un-used at the farm level is considered to be “food loss,” serving as the focus of this paper.

Addressing food loss is a key component in building sustainable food systems. Sustainability is a longstanding term, defined by the World Commission on Environment and Development as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (1987). The sustainability framework is comprised of three complimentary pillars, all of which are necessary for adapting to a changing world: economic viability, environmental protection, and social equity (Hampl et al., 2004; Purvis et al., 2019; Thiele 2013). Food donation has already been proven a “sustainable practice” (Schneider 2013) by reducing food loss (environmental), alleviating hunger (social), and yielding cost savings (economic). The top two most important activities for reducing food waste are donation and upcycling, due to minimal environmental impacts and potential for economic circularity (Figure 1; Environmental Protection Agency 2024).



Wasted Food Scale

How to reduce the environmental impacts of wasted food

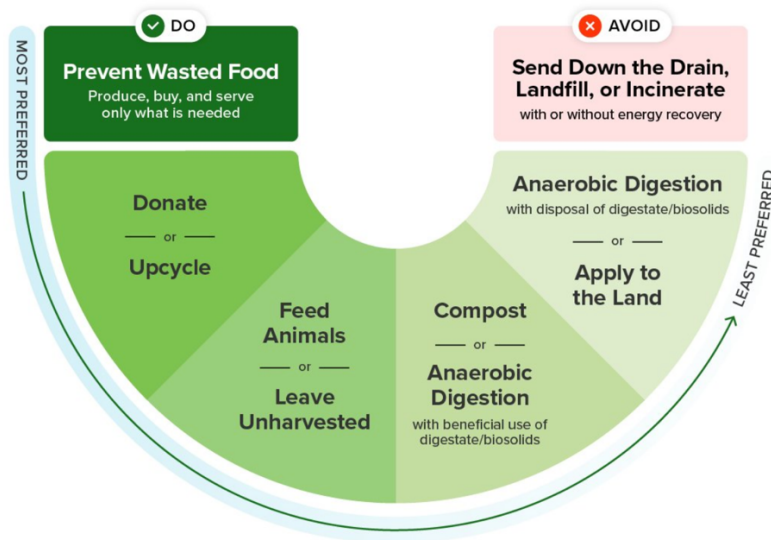


Fig. 1 The EPA Wasted Food Scale ranks the preferable outcomes for food across the whole system (Environmental Protection Agency 2024). On-farm food loss follows the same scale.

While gleaning is an ancient method of charitable food donation, first referenced in the Hebrew Bible (Leviticus 19:9-10; New Revised Standard Version), the practice has evolved in modern times. Today, gleaning is accepted as the collection and reallocation of extra produce, whether already harvested or not, for donation to the hungry (Baker 2006; King 1991).

Typically, gleaning organizations collect leftover fruits and vegetables from nearby farmers that would otherwise rot or be thrown away. Sometimes gleaning organizations collect produce that has already been harvested (Society of St. Andrew 2022), and other times, gleaning volunteers harvest produce themselves (Laura Gallagher et al. 2019). Next, gleaning organizations transport the collected food to distribution centers, such as food banks or churches, making fresh, nutrient-dense produce available to their communities. Establishing trust through

clear communication is essential for gleaning organizations to build lasting, reliable relationships with farmers (Lott et al. 2020).

Gleaning organizations pair two problems to make one solution, so maximizing their reach is important for improving large-scale food insecurity and food loss problems in the United States. If gleaners can better understand what factors motivate farmers when deciding whether to participate in food donation, organizations can inform their relationship building with new farmers to grow and sustain a lasting system that improves the satisfaction of both parties (Lott et al. 2020).

Gleaning organizations already recognize tax deductions as a primary incentive for farmers to participate in gleaning, yet we do not know if these incentives actually influence farmers' decision making. Although Harvey et al. (2022) found the tax deduction to be financially beneficial to 12 gleaning participants in Kansas City, Kansas, farmers' opinions related to the federal tax deduction have not been researched on a broader level. Furthermore, social and environmental motivators have not formally been considered at any scale. To more holistically learn about the value that food donors derive from gleaning participation, we talked to farmers about their motivations to glean through a lens of sustainability.

Focusing on on-farm food loss, we set out to answer the following question: *How do farmers understand the drawbacks and benefits of gleaning?* We conducted a literature review and interviewed 23 fruit and vegetable farmers who currently work with gleaning organizations on the East Coast of the United States to learn about why they partake in charitable food donation. By asking questions related to the social, environmental, and economic motivators behind gleaning participation, both on their farms and at a larger scale, we found that most

farmers value the social aspects of gleaning, while only few are motivated by economic incentives.

Literature Review:

Existing literature acknowledges the economic, social, and environmental benefits of gleaning, but we only found one article putting these three pillars of sustainability in conversation with one another. Furthermore, few current studies analyze farmers' perceptions related to gleaning. The intersection of farmers' perceptions and gleaning as a sustainable practice remains unexplored in current literature.

i. Economic Impacts

Many farmers cite human labor as the costliest input to their operations (Johnson et al. 2019; Swinnen et al. 2005). When farmers donate harvested produce, often in the absence of market opportunities, they cannot recover production and harvest costs (Dunning, Johnson, and Boys 2019; Johnson et al. 2019; Leasure-Earnhardt, Scrufari, and Valentine 2017). The federal tax deduction for gleaned produce is intended to reduce the economic burden of food donation for farmers. Passed in 2011, The Internal Revenue Code 170(e)(3) offers farm businesses a tax deduction to encourage produce donations to food insecure people (US Department of Agriculture 2021), quantified on a per-weight basis.

A study by Harvey et al. (2022) interviewed 12 farmers who participate in gleaning local to the Kansas City, Kansas area, finding federal tax breaks to be cited as a primary benefit of gleaning participation. Given the costly inputs that accompany any farming operation,

Harvey's conclusion related to tax breaks is not surprising, but another study found contradictory evidence. Soma et al. (2021) interviewed 18 farmers who reported the food donation tax incentive to be complicated and "not economically worth it."

Parallel to the findings of Soma et al., other researchers propose adjustments to the current federal tax deduction structure. For instance, a study by Leasure-Earnhardt et al. (2017) suggested shifting towards a state-by-state tax deduction model to meet the localized needs of farmers. Lee et al. (2017) also argued that a more generous state-level tax deduction would provide further incentive for farmers to participate in donation, with potential to increase the supply of produce to gleaning organizations. Some states already instituted more generous tax breaks for charitable food donation (Leasure-Earnhardt et al. 2017). More pushback on current tax deductions (both federal and state) comes from Ata et al. (2019), reasoning that gleaning production "value" cannot always be captured by the scale that is currently used to quantify tax deductions, for various produce items hold different weights relative to their nutritional density. In fact, a study by Vitiello et al. found that most produce donations are not even recorded by farmers due to small resulting tax deductions (Vitiello et al. 2014). These conclusions suggest that the current tax donation structure could be improved.

Current literature addresses economic concerns of gleaning as well. For instance, gleaning might draw down regular prices due to a decrease in market competition. However, a study by Kowalczyk et al. (2020) found that food donation operates within its own market, not influencing primary market prices.

Furthermore, a study by Hoisington et al. found some farmers to be wary of welcoming volunteers onto their property for field gleaning, fearing responsibility for an injury or

property damage (Hoisington et al. 2001). To reduce this concern, the Bill Emerson Good Samaritan Food Donation Act protects farmers in the event of an injury or illness that may result from gleaning participation, and major crop insurance providers encourage donations (Food, Law, and Policy Clinic at Harvard Law School n.d.). Due to a lack of legal precedent, the aforementioned liabilities remain a concern for many farmers (Leasure-Earnhardt, Scrufari, and Valentine 2017).

ii. *Social Impacts*

Existing literature recognizes many of the different social benefits that gleaning participation brings to a community, but no study considers the personal benefits that farmers receive from gleaning or their perceptions of gleaning's social impact. As recounted in Janet Poppendieck's book *Sweet Charity*, community member volunteers, both in need and not, gain great fulfillment from helping the hungry (Poppendieck 1999; Vitiello et al. 2014). Other studies interviewed non-farmer gleaning participants to learn about the values they derive from the practice (Chiarella et al. 2023; Hoisington et al. 2001). Researchers found that gleaning can help to improve the social confidence of resource constrained families, serve as a space to share knowledge related to gardening and food preparation, and work as a coping mechanism for people struggling with mental health.

Further support for the social importance of gleaning comes from the 2021 Annual Report of a nationally recognized gleaning organization, Society of St. Andrew (2022). This report is heavily focused on the community impacts of St. Andrew's efforts, making clear that their work is centered around a social cause. While research studies and gleaning organizations have achieved a consensus on the numerous social benefits of charitable food

donation, no published work establishes how farmers understand the impact of their work on other people. Learning about farmers' perceptions can tell us about their level of involvement in gleaning and motivations for participation.

iii. Environmental Impacts

Several journal articles analyze the environmental impacts of food donation as they relate to food loss and emissions reduction, but current literature has not yet explored farmers' perceptions related to these topics. The EPA's Wasted Food Scale prioritizes alternative food uses in order of least environmental impact, showing that donation has a smaller negative impact than leaving produce un-harvested (Environmental Protection Agency 2024). Therefore, more environmental harm results when produce is left un-harvested, rather than gleaned.

When produce is left to spoil in the field, methane emissions result from anaerobic breakdown (Karakurt, Aydin, and Aydiner 2012). Methane is a severely potent greenhouse gas that causes severe global warming, so production should be minimized (Mohajan 2011). Some other environmental impacts of farm-level food loss include reduced water quality and increased pesticide and fertilizer application (Conrad et al. 2018; Kummu et al. 2012; Muth et al. 2019).

On the flip side, research suggests that gleaning has the potential to result in a greater lifecycle emissions than if it were never harvested to begin with (Sulis et al. 2021; Sundin et al. 2022). Gleaning is estimated to reduce food loss and its environmental impacts by 3 million tons each year (ReFED n.d.), but this scale is limited by the finite shelf life of

produce. In the event of perishability or lack of demand, gleaned produce may end up in a landfill, resulting in an un-preferred outcome on the Wasted Food Scale (Figure 1).

Gleaning undoubtedly has environmental impacts. Understanding if environmentalism factors into farmers' decision making on gleaning will be important for organizations to recognize when building farmer relationships.

Our literature review suggests that food donation meets all three pillars of sustainability. In support, Hampl et al. argues, "gleaning is an important component of sustainable agriculture by conserving resources, enhancing environmental quality, and providing for basic human needs" (Hampl et al. 2004). Thus, increasing gleaning efforts can result in numerous benefits. Researchers have not yet uncovered how farmers perceive gleaning as having economic, social, and environmental benefits, but this understanding can help gleaning organizations to frame their relationship building approach to make gleaning efforts more effective.

Methods:

We collected pilot data to inform our understanding of gleaning operations. In October 2022, we conducted four participatory observations in Society of St. Andrew's Yam Jam gleaning campaign. During this time, we also held conversations with various gleaning organizational staff and researchers to identify a useful and unique topic of study. From October 2022 to December 2022, we conducted interviews with farmers to gather qualitative data. All methods, including our interview guide and accompanying documents, were approved by the Institutional Review Board at Duke University.⁴

⁴ Protocol Number 2023-0115

i. Participants

We engaged with gleaning and agricultural organizations via email explaining the goals of our study. Organizational staff members then asked farmers in their networks to participate in our study. If a farmer expressed interest in holding a phone conversation, we directly emailed them to schedule a call and conducted an interview over the phone. Participants were not compensated for their participation. The six connecting organizations that assisted in this study were Fields to Families (Charleston, South Carolina), Food Rescue U.S. (Stamford, Connecticut), South-Central Community Action Program (Gettysburg, Pennsylvania), Appalachian Sustainable Agriculture Project (Asheville, North Carolina), Carolina Stewardship Foundation (Pittsboro, North Carolina), and Society of St. Andrew (Durham, North Carolina).

In total, we conducted 22 interviews with 23 farmers, two of which were husband and wife wishing to be interviewed together. Participants were all involved in gleaning and farmed on the East Coast of the United States. Our study was limited to farmers with primary production crops of fruits and/or vegetables.

ii. Data Collection

We interviewed farmers about the benefits and drawbacks of gleaning participation as they relate to the economy, society, and environment in a 30 to 50-minute phone call. To maintain farmer anonymity, we assigned a unique ID number to each participant that we used for the duration of the study. All farmers consented to study participation and public sharing of their responses. We recorded all interviews using QuickTime Audio and

transcribed audio files with Otter.ai. Data was stored in a password-protected filing system approved by Duke University (Duke Box) that was only accessible to the research team

We used a semi-structured interview guide to explore the theme of sustainability. Topics were based upon the principal research question as it related to the economic, societal, and environmental benefits and drawbacks of gleaning. Farmers in our study were given the opportunity to cite an unlimited number of benefits and drawbacks related to each sustainability pillar.

We classified farmers based on their self-specified attributes, including farm size (total number of cultivated acres), operation type (business, nonprofit, or hobby), and location (rural, suburban, or urban areas). We labeled farms with less than 5 cultivated acres as “very small,” farms with five to fifty cultivated acres as “small,” and any farm with more than fifty cultivated acres as “large.”

iii. Thematic Analysis

The data analysis method we used for this study is well described by Gareth et al. (2017), with a brief explanation of modifications included below.

We uploaded interview transcriptions into a qualitative data analysis software, NVivo 12. We then developed a codebook with parent coding themes based upon recurring discussion topics. All parent themes included more detailed child and grandchild themes. All themes are defined in Appendix A.

We independently coded participants’ responses based on content and substance. For instance, a participant’s response of “*I think the waste reduction aspects are very positive for the environment*” was coded as “weak,” while a participant who explained or validated their

response was coded as “strong.” Strong responses were coded on content rather than length. An example of a strong response reads, “*This connection with people is a way to also share [our] values. And that is what we want to do, not just keep a business, but keep a vision about the work we do.*” While each theme had at least one response in it, no participant was coded to every theme. We coded some participants multiple times to the same theme.

We then looked through all the responses in each theme to identify patterns. Themes coded in more than half of interviews were given special attention. We used queries in NVivo 12 to look across different themes for trends as well. Exemplary quotes were pulled for each theme. We then classified evident trends into one or more of the three sustainability pillars. The number of coding references and strength of responses associated with each pattern were then used to identify the eight main themes presented in our results.

Results:

This study provides an understanding of the factors motivating farmers to participate in gleaning, which can provide gleaning organizations with useful insights related to relationship building. When conducting interviews, we posed questions to participants through a sustainability framework, so the following results are organized in a similar manner. We took the strength, measured by elaboration, and frequency of responses into consideration when classifying data and identifying patterns. Nineteen of the most relevant themes are included in Figure 2, eight of which we chose to discuss in more detail because they are supported by consistent participant responses and exemplary quotes.

i. Participant Demographics

All participants selected for our study participated in gleaning. Self-reported participant demographics from the farmers in our study are included below in Table 1 ($n=23$). Detailed demographics by participant can be found in Appendix B. While farm sizes and organization types differed, all participants were from four East Coast states (Table 1). Most farmers in our study participated in post-harvest gleaning, meaning they harvested donations without help of volunteers (Table 1).

Table 1 Farmer Participant Demographics.

Farmer Characteristics	Farmer Participants (<i>n</i>)	% of Participants
Organization type		
Business	19	83%
Nonprofit	3	13%
Hobby	1	4%
Size of farm		
Very small	10	43%
Small	7	30%
Large	6	26%
Crops grown		
Vegetables	11	48%
Fruits and vegetables	10	43%
Fruits	2	9%
Surrounding area		
Rural area	12	52%
Suburban area	9	39%
Urban area	2	9%
Farm location		
North Carolina	12	52%
Connecticut	6	26%
Pennsylvania	3	13%
South Carolina	2	9%
Type of gleaning		
Post-harvest gleaning	13	57%
Field gleaning	5	22%
Field gleaning and post-harvest gleaning	5	22%

ii. *Sustainability Pillars*

We classified the gleaning impacts cited by participants as economic, environmental, or social (Figure 2). From analysis in NVivo 12, we found that several themes were coded into more than one sustainability pillar, as indicated in the overlapping portions of each circle (Figure 2). Food loss is at the center of all three circles because it was cited as impacting each aspect of sustainability (Figure 2).

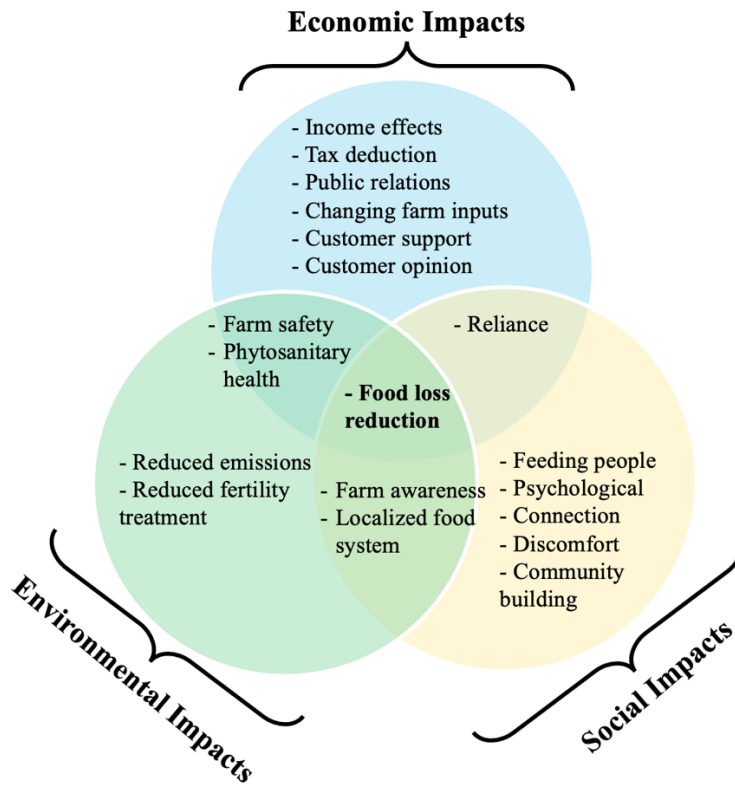


Fig. 2 Overlap of Gleaning Impacts Cited by Participants (made in PowerPoint)

Although there were at least four major benefits cited by participants under each sustainability pillar (Tables 2, 3, 4), not every farmer in the study was coded to an economic benefit. All participants (100%, 23) reported at least one social and

environmental benefit of gleaning, while only three-quarters of participants (74%, 17) cited an economic benefit of gleaning. This result shows that farmers in our study least recognized the economic benefits of gleaning. Participants were most likely to cite economic and social drawbacks (70%, 16) while only 57% (13) of participants cited environmental drawbacks. This difference indicates that study participants recognized environmental drawbacks related to gleaning the least. The response rate to gleaning benefits cited by participants under each pillar was higher than the cited drawbacks under each pillar; thus, we found more overall benefits than drawbacks to gleaning in our study.

a. Economic Motivators

Participants’ response rates for discussion topics related to the financial impacts of gleaning participation on their farm operations are listed in Table 2 ($n=23$). Of the entries displayed in Table 2, priority findings related to economic impact responses are discussed in the four economic themes below. Responses related to profitability and tax deductions were mutually exclusive (Table 2).

Table 2 Economic Impacts of Gleaning Cited by Participants

Economic Impact	Farmer Participants (n)	% of Participants
Effect on profitability		
No effect	13	57%
Loss	5	22%
Profit	5	22%
Tax deduction use		
Qualify but don't use tax deduction by choice	9	39%
Would like to use tax deduction but don't qualify	8	35%
Use tax deduction	6	26%
Other cited economic benefits		

Improved public relations	12	52%
Decreased inputs	7	30%
Increased customer support	5	22%
Tax benefit	4	17%
Improved farm safety	1	4%
<hr/>		
Other cited economic drawbacks		
Increased inputs	17	74%
Negative customer opinion	4	17%

Theme 1: Gleaning Impacts on Farm Profitability. A majority of farmers in our study (57%, 13) reported that gleaning participation had no effect on their profits (Table 2), due to a lack of alternative market options. For example, one farmer noted, “*Most of what's being gleaned is excess anyway. We really don't have any market for it. So, to this point, gleaning has no negative impact on our profitability*” (ID 6).

The remainder of participants stated that their gleaning activities were equally likely to result in a profit (22%, 5) or a loss (22%, 5). One participant attributed their losses to costly inputs, “*It costs a good bit to glean. Planting the seeds is a minor part of the farming. The major part right now is diesel and any fertilizers and stuff that you use*” (ID 20). Another participant said that gleaning is normally a revenue-neutral activity for their farm, but external funding, when available, turns it into a profitable activity, noting:

“In the past two years, pandemic grant funding allowed us to get paid for it [donations] at wholesale price. That funding is out, and we looked for more funding. It [gleaning] was too ingrained in my soul to stop bringing them lots of food, so we just kept on doing it” (ID 21).

This participant shares their appreciation for grant support, but it is not the only reason for their involvement. Aside from grant funding, the other economic benefits listed in Table 2 were often cited by participants in support of an overall profit.

Theme 2: Motivation for Tax Deduction Use. One quarter of participants (26%, 6) reported using the federal tax deduction, and 39% (9) of participants reported not using the tax deduction by choice (Table 2). The remaining 35% (8) of participants claimed that they did not qualify for the deduction (Table 2). Furthermore, only 17% (4) of participants referenced the federal tax deduction as an economic benefit for their farm (Table 2).

One of the most noted reasons for participants to opt out of the federal tax deduction was a lack of intention to earn money. In response to a question about deduction, one farmer expressed their personal satisfaction by saying, *“We provide free food because we love to do it. Not because we want to have some tax benefits. And we haven't used [the benefit] for the last two years now”* (ID 13).

A minority (26%, 6) of participants also discussed the logistical difficulty that accompanies claiming a tax deduction,

“Honestly, we don't do that good a job of that [tax deductions]. We don't keep up. We could and we should. It's just not happening. We probably should do a better job of it, but we don't donate our surplus for that reason. We do it because it's the right thing to do” (ID 18).

While participants referenced increased organizational efforts as a reason to not use the deduction, most participants emphasized donating out of goodwill rather than monetary benefits.

Theme 3: Gleaning Impacts on Public Relations. Over half (52%, 12) of participants benefit from improved public relations due to gleaning participation (Table 2). While many participants spoke humbly about gleaning participation and did not actively advertise their involvement to the community, the majority of farmers in our study still recognized that their donations increase community support of their farms. For example, one farmer said, *“I think [gleaning] could help benefit the farm. Kind of upcycling some of our waste, being able to use that for you know, marketing. Also, if it's good for the community, it's usually good for the business”* (ID 2). Aside from public relations, 22% (5) of farmers in our study cited an increase in customer support for their farm due to gleaning participation (Table 2).

Theme 4: Full Use of Production. In total, 35% (8) of participants reported increasing farm inputs to meet their full market demand, knowing that any extras will not contribute to food loss. One participant expressed this feeling of security, *“We have peace in the sense that everything has a home now. So rather than narrowing it down to what will only be harvested to be sold, we are confident in bringing additional items, or overstocking our markets, so that we have those items for gleaning”* (ID 3). Many participants recognize food loss reduction benefits for the environment as well. In support of reduced environmental impacts, one participant noted, *“I think it's good environmentally because people will not feel burdened by over-planting... we can plant slightly more than enough and know that it's not going to just go to waste or decompose, that it can be utilized”* (ID 16). This result suggests participants

have dual intentions when overplanting: meeting full market demand while reducing food loss.

b. Social Motivators

Table 3 includes participant response rates for discussion topics related to the social impacts of gleaning participation. Priority participant responses related to personal (self) and societal gleaning impacts were used to create our next theme.

Table 3 Social Impacts of Gleaning Cited by Participants

Social Impact	Farmer Participants (n)	% of Participants
Personal benefits		
Feeding people	13	57%
Food loss reduction	12	52%
Psychological	10	43%
Connection	6	26%
Personal drawbacks		
Discomfort	6	26%
Societal benefits		
Feeding people	19	83%
Increased farm awareness	8	35%
Community building	6	26%
Societal drawbacks		
Reliance	2	9%

Theme 5: Gleaning to Feed People. Whether participants gained personal satisfaction from gleaning participation or knew other community members would benefit from their donations, “feeding people” was the most frequently coded benefit of gleaning overall. Almost all (87%, 20) participants cited feeding people as a social benefit of gleaning, either

as a societal or personal benefit. One participant expressed the personal satisfaction they feel when sharing healthy food with others:

"[Gleaning] benefits me as an individual person ... I got into farming because I love to feed people and make sure that people have healthy food to eat. So being able to get that food to underserved communities, as close to home as possible, is just very fulfilling to me and makes me sleep easier at night" (ID 21).

When asked about the community benefits of gleaning, another participant shared their belief that gleaning has the potential to benefit surrounding communities:

"[Gleaning benefits] people who need high quality nutrition but can't afford it. They have a better outcome in life, health wise and mentally, when they're eating healthier food ... specifically food that's gleaned, that's vegetables, grains, things that combat heart disease, or combat obesity or diabetes" (ID 5).

c. Environmental Motivators

Table 4 includes participant response rates for discussion topics related to the environmental impacts of gleaning participation, as they relate to participants' farms and the global environment at large. Findings related to environmental impact responses were used to form the following three themes.

Table 4 Environmental Impacts of Gleaning Cited by Participants

Environmental Impact	Farmer Participants (n)	% of Participants
Farm benefits		

Food loss reduction	8	35%
Improved phytosanitary health	8	35%
Reduced emissions	4	17%
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Farm drawbacks		
Reduced fertility treatment	11	48%
<hr/>		
Global benefits		
Food loss reduction	7	30%
Reduced emissions	6	26%
Localized food system	5	22%
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Global drawbacks		
Reduced fertility treatment	2	9%

Theme 6: Emissions Reduction from Gleaning. Only a quarter of participants (26%, 6) linked food loss to greenhouse gas emissions. One of only two (9%) participants demonstrating a strong understanding of climate change drivers explained,

"Most food goes into landfills. And when food and carbon-based things decompose in landfills, [they] produce methane instead of like CO2 because there's no oxygen, and methane is so much worse [of a] greenhouse gas ... I think on the whole, most gleaning is net 1,000% for the environment" (ID 9).

Less than a quarter (17%, 4) of participants mentioned emissions resulting from transportation between their farms and gleaning organizations as potentially having an environmental impact, although responses were generally vague and uncertain of the extent. For example, one farmer said, *"I realize that there'll be some automobiles or pickup trucks close to the field, but that's no different than the tractor when we harvest. I know they [gleaning organizations] have to burn fossil fuels to get here, but I think all that's about the same if this was harvested" (ID 7).*

Overall, these findings suggest that farmers in our study might not recognize a strong link between food loss reduction and greenhouse gas emissions.

Theme 7: Food Loss Reduction from Gleaning. Farmers in our study personally despise food loss. If produce cannot be sold, participants would rather donate their surplus than compost or throw it away. Most participants (70%, 16) cited food loss reduction as adding some benefit to their gleaning participation, whether economic, social, or environmental. One farmer emphasized this distaste for food loss, *“I hate wasting or pitching anything. It drives me crazy”* (ID 11). The personal benefits of food loss reduction were especially prevalent, to which one participant said, *“It is a very simple way to give back to my community and to reduce food waste. If you put effort into growing something, you might as well at least have somebody eat it, even if [you’re] not able to sell it”* (ID 5).

Over half (56%, 13) of participants did not recognize food loss reduction as having an environmental impact on either farm or global scales. One farmer who did mention food loss reduction as an environmental benefit provided an explanation that was mostly personal in nature,

“I had the benefit from when I donated food of a connection on other levels to my community. A satisfaction that stuff wasn't going to waste and goodwill that I generated with people who are wanting to get that food to people. Those are the ways that I got a benefit from it. I would have done it even if nobody wanted me to do it, though, because I don't want the food waste” (ID 14).

Whether recognizing the environmental impacts of food loss or not, farmers in our study made clear their aversion unused produce.

Theme 8: Fertility Reduction from Gleaning. The most cited environmental drawback was a lost opportunity for soil fertility, or an ability for un-used produce to add nutrients back the soil. While over half (52%, 12) of total participants cited reduced fertility as an environmental drawback, only 26% (6) of participants felt strongly about it.

Most participants did not consider soil fertility in their decision to glean because due to alternate methods for improving soil nutrition. For example, 43% (10) of participants reported actively using a compost pile to add nutrients back into farm soil. Another farmer explained that their soil nutrients do not suffer from gleaning,

“You could let the vegetables rot there in place. And that's good organic matter and stuff.... We add so much leaf mulch to our fields every year [that] the harvest of the vegetables doesn't remove any. I mean, we've more than replaced the micronutrients each year from the vegetables we harvest with additional leaf mulch” (ID 7).

Discussion:

In efforts to learn which pillars of the sustainability triad (economy, society, and environment) most motivate farmers to participate in charitable food donation, we conducted interviews with 23 farmers who currently participate in gleaning. Understanding which sustainability pillars gleaning farmers place value upon can be used to inform relationship building between gleaning organizations and prospective farmers.

Here, we discuss four of the eight themes (numbers five, six, seven, and two) presented in our results section. We selected themes based upon prevalence, strength, and connections to literature. We also chose to focus this discussion on themes related to the positive aspects of gleaning because the overall benefits of gleaning outnumber drawbacks in our study.

i. Major Findings

Although prior studies discuss farmers' economic motivations for gleaning, no previous research has taken farmers' social or environmental motivations into consideration when discussing gleaning participation. From our study, we found that participants most commonly recognize gleaning as benefitting the society and themselves. All participants cited at least one social benefit of gleaning, providing strong rationale to support their ideas. Therefore, when appealing to potential farmers for gleaning participation, organizations should consider emphasizing the potential for their work to help others.

Theme 5: Gleaning to Feed People. Although we could not find any previous work on how farmers understand the social benefits of gleaning, our results suggest that farmers derive similar personal benefits from gleaning as others involved with the charitable food sector. Like the soup kitchen cooks and delivery driver volunteers interviewed in Janet Poppendieck's *Sweet Charity*, most farmers in our study reported a feeling of personal fulfillment from helping to feed other people (1999). This similarity suggests that farmers are not too different from any volunteer that wishes to donate their available time or resources toward a worthy cause.

Most of the farmers in our study view gleaning as an opportunity to share the healthy foods they grow with people in need, ultimately helping to nourish their local communities. Our findings imply that farmers benefit by feeling good about their contributions, likely

serving as a strong motivation for their gleaning participation. Knowing this, gleaning organizations might consider placing emphasis on the community impact and hunger-reduction aspects of their work when recruiting prospective produce donors. For example, gleaning organizations might encourage participating farmers to visit the soup kitchens or food banks where their produce is distributed to realize community appreciation for their gifts.

Themes 6 and 7: Emissions and Food Loss Reductions from Gleaning. In contrast with the academic literature, results suggest that farmers in our study may not prioritize the primary environmental benefits of food loss reduction and, by corollary, gleaning. While some participants agree with existing research findings that food loss is bad for the environment (Conrad et al. 2018; Kummu et al. 2012; Muth et al. 2019), the farmers in our study often did not explain why food loss was bad. Varying levels of connection between gleaning, food loss reduction, and greenhouse gas emissions could be due to different political views (O'Connor et al. 2002) or varying levels of education amongst farmers. With this insight, gleaning organizations can emphasize the relationship between food loss and changing environmental conditions when working with prospective farmers.

Food loss is a personal issue for many farmers who put a lot of time and effort into growing something, not to have it eaten by anyone. While no current research exists on the personal values that farmers derive from gleaning, our research suggests that farmers, like anyone, want to feel their work is valuable and important, not something that can be readily wasted (Gillman et al. 2019). To demonstrate this understanding, gleaning organizations might frame their work as preventing farmers' hard work from going to waste in periods of low demand.

Theme 2: Motivation for Tax Deduction Use. Whether or not a participant actively uses the federal tax deduction offered for food donation, the overwhelming response from farmers in our study indicated their fundamental motivation for gleaning participation was not financial in nature. This finding directly contradicts a previous study by Harvey et al. (2022), finding federal tax incentives to be a primary benefit of gleaning participation for a localized subset of urban farmers in Kansas. A lack of interest for federal tax benefits found amongst participants currently gleaning also suggests that state-level tax deductions, as proposed by other studies (Leasure-Earnhardt et al. 2017; Lee et al. 2017), might not be the most effective way to inspire new farmer interest in gleaning participation. Although opportunity exists to introduce a state tax deduction in most represented states (only South Carolina presently has one), results suggest that this effort may not be influential for gleaning participation (Harvard Law School Clinic 2019; McIntyre 2014; Pinho n.d.; South Carolina Income Tax Act 2021). Of course, lack of reported economic interests in our study could be biased toward maintaining a generous reputation for public relations. Otherwise, the difference between our findings and reported literature could be due to locality or consideration of environmental and social factors. In other words, economic considerations might be negligible to farmers when put in comparison with other motives.

However, the federal tax deduction still carries influence in some contexts, as many participants utilize its benefits.

Our study also uncovered an administrative burden with tax deductions, finding the documentation required for tax records to be a deterrent. This finding agrees with the tax deduction complications cited by Soma et al. (2021). While many gleaning organizations

already have a system in place to help farmers track their donations, organizational staff might consider advertising this record-keeping assistance more publicly to encourage its use.

Overall, the findings presented under Theme 2 suggest that few farmers in our study recognize the benefits of the federal tax deduction, which could partly be attributed to logistical difficulty. Our findings suggest that farmers may be most strongly motivated to participate in gleaning by non-economic factors. Therefore, a restructuring of the federal tax deduction or efforts to implement state-level incentives might not increase widespread farmer gleaning participation. Gleaning organizations may consider de-emphasizing tax deductions in favor of other benefits, such as feeding people.

Overall, our findings indicate that every farmer understands problems related to food loss differently, whether socially, environmentally, or economically, so gleaning organizations should approach food loss from several different angles to effectively engage with prospective farmers.

ii. Strengths and Weaknesses

While our research provides a wide breadth of the benefits received and the challenges faced by farmers who participate in gleaning, some limitations exist due to varying geographies and characteristics of the 23 farmers in our study. Future research might concentrate on one specific demographic for a more thorough and nuanced understanding of views toward gleaning.

Furthermore, we only interviewed cooperative farmers gleaning experiences, without considering farmers who do not partake in gleaning. This bias in selection could have

influenced our findings. To gain a more holistic understanding of farmer motivations, future studies should interview both farmers who do and do not glean.

In this study, we reached participants through several different gleaning organizations that all run their operations differently, so benefits and drawbacks may vary based on organizational structure and workflow.

iii. Future Directions

One noteworthy and unexpected topic came up when we were conducting farmer interviews. While not found in most responses, 26% (6) of participants discussed personally benefitting from connections and social exposure while gleaning. We found one study stating that gleaning can be an opportunity for socialization amongst subsistence gleaners (Grantham et al. 2020), but in the context of farmers, socialization might be related to mental wellbeing. Farmers have higher than average suicide and mental illness rates (Younker & Radunovich 2022), so the sense of connection some participants referenced may be useful for reducing the mental stressors caused by farmer isolation. This underdeveloped finding could be further explored in future studies.

Another area of potential growth related to our work could be to gather data on farmer educational statuses and political affiliations to see if they correlate to environmental motives. Furthermore, research could explore if our above recommendations are effective for gleaning organizations at increasing farmer involvement. Overall, understanding farmers' motivations for gleaning participation is an unexplored topic.

Conclusion:

We interviewed 23 produce farmers who participate in a form of charitable food donation known as gleaning – the harvest and donation of leftover produce. Our findings suggest that farmers recognize the social, environmental, and economic benefits of gleaning participation. Farmers in our study were most motivated to participate in gleaning due to social benefits, specifically hunger reduction. Participants generally did not prioritize the connection between gleaning and environmental benefits, such as emissions reductions. Economic benefits did not incentivize participants to the extent expected, based upon findings from previous studies. Gleaning organizations can utilize all three of these sustainability pillars to attract new farmers for food donations. Our findings suggest that gleaning organizations should place special emphasis on the hunger-reduction aspects of gleaning, while also recognizing and appreciating farmers’ hard work. There is also opportunity for gleaning organizations to inform prospective farmers of gleanings’ wide-ranging benefits, especially related to the environment. Future work might interview farmers who do not partake in gleaning as well as explore the mental health implications of gleaning involvement.

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Appendix:

Themes without coded interviews were used for organizational purposes. Child and Grandchild themes are not aggregated in Parent themes. The two farmers we talked with together are treated as separate interviews. The environmental benefit of improved phytosanitary health encompasses themes 4.1a, 4.1ai, 4.1d, and 4.1e.

Appendix A Theme Definitions and Prevalence.

Theme Level	Theme Name	Theme Description	Number of Interviews Coded/Responses Coded	Number of Strong/Weak Responses
Parent	1: Gleaning Benefits	All the benefits of gleaning cited by participants	---	---
Child	1.1: Economic Benefits	Farm operation benefits of gleaning cited by participants	---	---
Grandchild	1.1a: Improved Public Relations	Positive reputation perceived by community in knowing that a farm participates in gleaning	12/18	10/2
Grandchild	1.1b: Increased Customer Support	An increase in sales transactions because of gleaning participation	5/5	4/1
Grandchild	1.1c: Decreased Inputs	Gleaning participation saves the farm operation money spent on inputs such as time, labor, or supplies	7/9	5/2
Grandchild	1.1d: Tax Benefit	Tax deductions cited as a benefit by participants who use them	4/4	0/4
Grandchild	1.1e: Improved Farm Safety	Gleaning as a method to improve safety of participants' farms	1/1	1/0
Child	1.2: Personal Benefits	Personal benefits of gleaning for participants	---	---
Grandchild	1.2a: Food Loss Reduction Personal Benefit	Participants cite minimization of food loss as a personal benefit	12/14	8/4
Grandchild	1.2b: Feeding People Personal Benefit	Participants cite providing food to people in need as a personal benefit	13/16	12/1

Grandchild	1.2c: Psychological	Participants cite gleaning as providing peace of mind	10/15	5/5
Grandchild	1.2d: Connection	Participants cite building connections with other people as a personal benefit of gleaning	6/10	5/1
Child	1.3: Societal Benefits	Gleaning benefits for other people and/or the community cited by participants	---	---
Grandchild	1.3a: Feeding People Societal Benefit	Other people benefitting from access to free food that they would not otherwise have	19/34	16/3
Grandchild	1.3b: Increased Farm Awareness	Other people acknowledging that there is a farm in their community because of volunteering to glean	8/13	8/0
Grandchild	1.3c: Community Building	Providing community members with an opportunity to connect with each other	6/9	5/1
Parent	2: Gleaning Drawbacks	All the drawbacks of gleaning cited by participants	---	---
Child	2.1: Economic Drawbacks	Farm operation drawbacks of gleaning cited by participants	---	---
Grandchild	2.1a: Negative Customer Opinion	Customers feel as though the product they purchase is of low quality if it is being donated	4/6	3/1
Grandchild	2.1b: Increased Inputs	Gleaning participation requires the farm operation to spend more money on farm inputs such as time, labor, or supplies	17/32	13/4
Child	2.2: Personal Drawbacks	Personal drawbacks of gleaning for participants	---	---
Grandchild	2.2a: Discomfort	Unease with strangers being involved with their farm operations or being on their property	6/10	5/1
Child	2.3: Societal Drawbacks	Gleaning drawbacks for other people and/or the community cited by participants	---	---
Grandchild	2.3a: Reliance	Other people becoming dependent on free food when they receive donations	2/2	2/0
Parent	3: Gleaning Environmental Impacts	All the environmental impacts of gleaning cited by participants	---	---

Child	3.1: Farm Impacts	How participants recognize gleaning as impacting the environment on their farms	---	---
Grandchild	3.1a: Improved Sanitation	Improved cleanliness on the farm	4/5	3/1
Great Grandchild	3.1ai: Improved Disease Control	Reduced plant disease risk because of gleaning	2/4	2/0
Grandchild	3.1b: Food Loss Reduction on Farm	Gleaning as a method to reduce food loss on participants' farms	8/12	1/7
Grandchild	3.1d: Improved Pest Control	Gleaning as a method to deter on-farm pests	1/2	1/0
Grandchild	3.1e: Improved Plant Health	Gleaning as a method to improve plant wellbeing and productivity	3/4	3/0
Grandchild	3.1f: Compost	Food waste reduction as it relates to a farm's compost system	10/16	4/6
Grandchild	3.1g: Reduced Emissions on Farm	The release of greenhouse gases into the atmosphere on a farm-scale	4/4	1/3
Grandchild	3.1h: Reduced Fertility Treatment on Farm	Gleaning reduction to overall soil fertility on participants' farms	11/18	6/5
Child	3.2: Global Impacts	How participants recognize gleaning as impacting the world's environment	---	---
Grandchild	3.2a: Reduced Global Emissions	The release of greenhouse gases into the atmosphere on a large scale	---	---
Great Grandchild	3.2ai: Transportation Emission	Greenhouse gases resulting from vehicle use	5/5	3/2
Great Grandchild	3.2aai: Breakdown Emissions	Greenhouse gases resulting from food breakdown	3/3	2/1
Grandchild	3.2b: Global Food Loss Reduction	Gleaning as a method to reduce food loss on a large scale	7/9	5/2
Grandchild	3.2c: Localized Food System	Gleaning impacts on reducing size of world's food system	5/8	4/1
Grandchild	3.2d: Reduced Global Fertility Treatment	How does gleaning impact soil fertility on a large scale	2/2	0/2

Parent	4: Gleaning Economic Impacts	All the economic impacts of gleaning cited by participants	---	---
Child	4.1: Effect on Profitability	The effect of gleaning participation on farm income as cited by participants	---	---
Grandchild	4.1a: Profit	Financial gain because of gleaning participation	5/8	4/1
Grandchild	4.1b: Loss	Financial loss because of gleaning participation	5/8	4/1
Grandchild	4.1c: No Effect on Farming Inputs	Overall profitability is not affected by gleaning participation	13/15	10/3
Child	4.2: Changing Inputs	Whether a participant changes their annual farm inputs to account for gleaning	---	---
Grandchild	4.2a: Increased Inputs	Participant increases their annual inputs for gleaning	11/21	9/2
Grandchild	4.2b: No Effect on Inputs	Participant does not consider gleaning when making decisions about farming inputs	12/15	8/4
Child	4.3: Tax Deduction	Whether a participant uses the tax write off for food donation	---	---
Grandchild	5.4a: Use Tax Deduction	Participant takes advantage of tax break or has at some point in the past	6/11	4/2
Grandchild	5.4b: Does Not Use Tax Deduction	Participant has never taken advantage of the tax break	---	---
Great grandchild	5.4bi: Qualify but don't Use Tax Deduction by Choice	Participant qualifies for the tax deduction, but they have no desire to use it	9/11	8/1
Great grandchild	5.4bii: Would like to Use Tax Deduction but don't Qualify	Participant would like to use tax deduction, but they do not qualify	8/10	8/0

Appendix B Individual Farmer Participant Demographic Breakdown

Participant ID	Organization Type	Size of Farm	Cultivated Crops	Surrounding Area	Farm Location	Type of Gleaning
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1	Nonprofit	Very small	Vegetables	Suburban	Connecticut	Field and Post-Harvest
2	Business	Large	Fruits and Vegetables	Suburban	Connecticut	Post-Harvest
3	Business	Large	Vegetables	Rural	Connecticut	Post-Harvest
4	Business	Very Small	Fruits and Vegetables	Suburban	Connecticut	Field and Post-Harvest
5	Business	Very Small	Vegetables	Rural	North Carolina	Post-Harvest
6	Nonprofit	Very Small	Fruits and Vegetables	Urban	Connecticut	Post-Harvest
7	Business	Small	Vegetables	Rural	North Carolina	Field and Post-Harvest
8	Business	Small	Vegetables	Rural	North Carolina	Field and Post-Harvest
9	Business	Small	Fruits and Vegetables	Rural	Connecticut	Post-Harvest
10	Business	Very Small	Vegetables	Suburban	North Carolina	Post-Harvest
11	Business	Large	Fruits and Vegetables	Rural	Pennsylvania	Post-Harvest
12	Business	Large	Vegetables	Suburban	South Carolina	Field
13	Business	Very Small	Fruits and Vegetables	Suburban	North Carolina	Post-Harvest
14	Nonprofit	Small	Vegetables	Suburban	North Carolina	Field
15	Business	Small	Fruits	Rural	North Carolina	Field
16	Business	Large	Fruits and Vegetables	Rural	Pennsylvania	Field and Post-Harvest
17	Business	Small	Fruits	Suburban	North Carolina	Post-Harvest
18	Business	Very Small	Vegetables	Urban	North Carolina	Post-Harvest
19	Business	Small	Fruits and Vegetables	Suburban	North Carolina	Post-Harvest

20	Hobby	Very Small	Vegetables	Rural	South Carolina	Field
21	Business	Very Small	Vegetables	Rural	North Carolina	Post-Harvest
22	Business	Large	Fruits and Vegetables	Rural	Pennsylvania	Field
23	Business	Very Small	Fruits and Vegetables	Rural	North Carolina	Post-Harvest

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