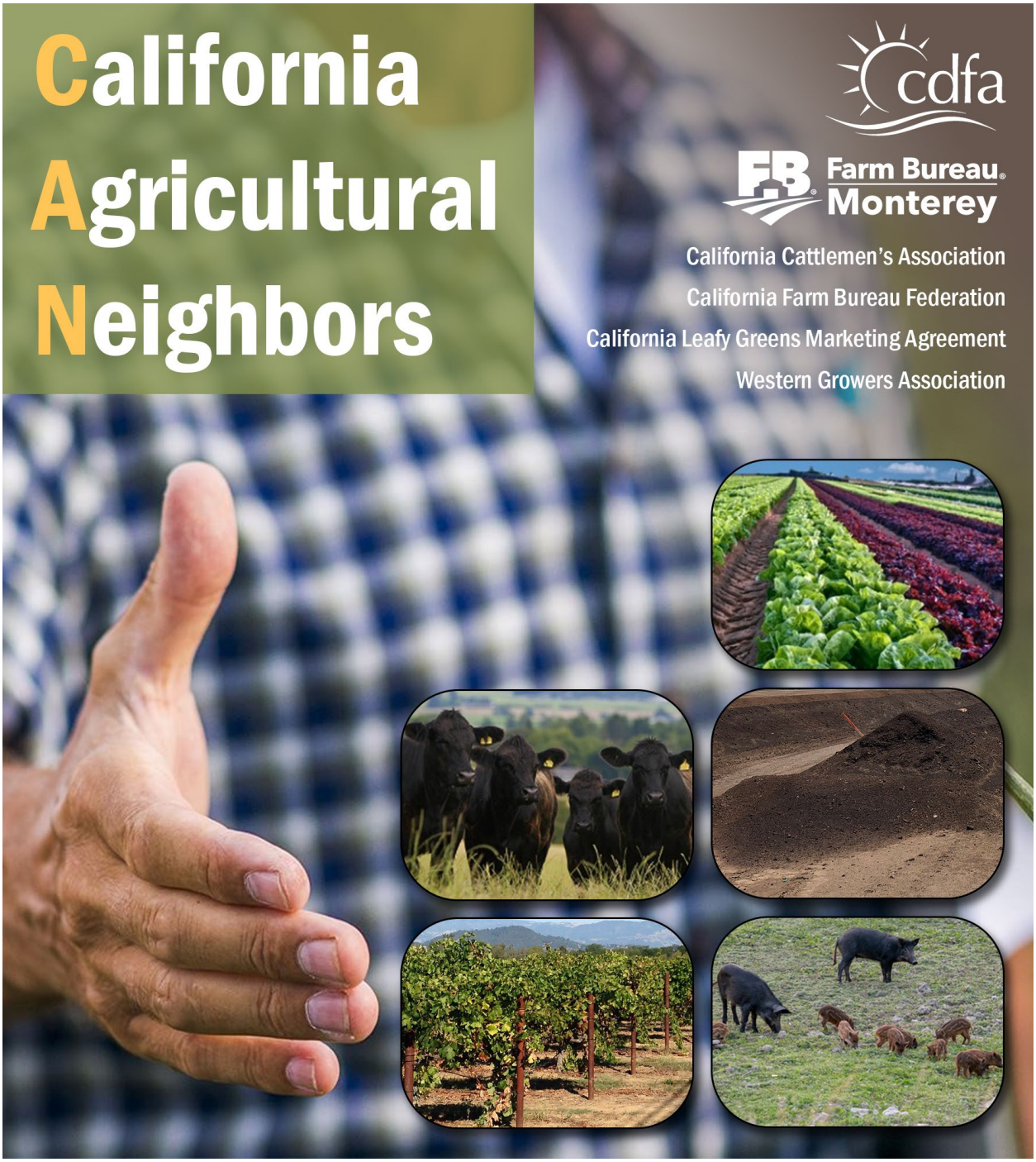

Building a proactive food safety culture

Fall 2024

BACKGROUND

WORK GROUP ACTIONS

NEXT STEPS

WORK GROUP CHARTERS & REPORTS

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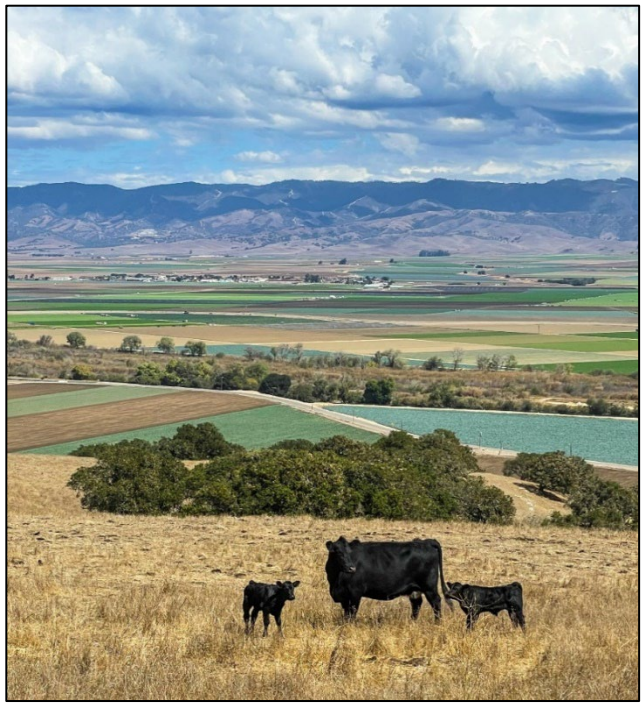
EXECUTIVE SUMMARY

Outbreaks of pathogenic *Escherichia coli* (*E. coli*) O157:H7 associated with leafy greens in the California Central Coast growing region in 2018-2020 necessitated a robust response to protect public health through efforts shared among local stakeholders.



The Salinas Valley. Photo Credit: David Anderson.

In January 2021, the Salinas Valley agricultural community came together in an effort known as California Agricultural Neighbors (CAN). Led by the California Department of Food and Agriculture (CDFA) and the Monterey County Farm Bureau (MCFB), the effort received support from agriculture associations and partners, including the California Cattlemen's Association (CCA), California Farm Bureau Federation (CFBF), California Leafy Greens Marketing Agreement (LGMA), and Western Growers Association (WGA). CAN provided a roundtable opportunity to foster collaboration and discuss enhanced neighborly food safety practices when various agriculture operations such as leafy green fields, cattle ranches, vineyards, and compost sites are adjacent to one another.

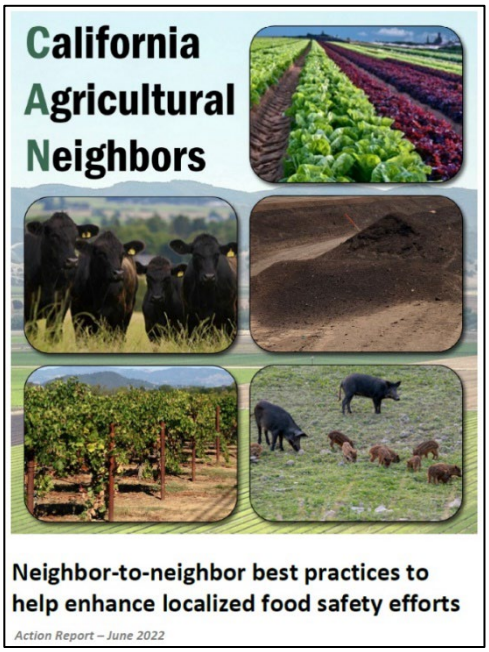
An increased number of leafy green product recalls followed by three investigative reports issued by the United States Food and Drug Administration (FDA) prompted a concerted effort focused on food safety research, risk analysis, and outreach and education throughout the Salinas Valley agriculture community. The federal reports associated with the outbreak incidents indicated that additional food safety measures needed to be considered, including those related to adjacent land use. This brought added focus and awareness to food safety in a region that leads domestic leafy green production and shares a diversified agriculture production environment. CAN emphasized the need and fostered an opportunity to explore new pathways to problem solving not previously pursued, considered, or researched from a collective and multidisciplinary vantage point of One Health.

Fostering a culture of food safety amplifies the shared values, beliefs, and behaviors within a community that prioritizes and promotes the importance of food safety. CAN has looked beyond simply implementing food safety protocols and procedures emphasizing the integration of a food safety mindset into the community and everyday practices of individuals involved in production agriculture. This also ensures that CAN partners remain focused and steadfast in building a proactive culture of food safety while keeping the best interests and safety of consumers central in our endeavors.

After the issuance of the June 2022 CAN Action Report and as part of moving into implementation of recommendations contained in the report, members of the Salinas Valley agriculture community, with participation from the other sponsoring organizations, academics, and representatives from state and federal agencies, formed four Work Groups. Each Work Group held meetings to communicate, collaborate, and develop the valuable information summarized in this report with detailed information, guides, and templates contained in the appendices.

Throughout 2025, CAN is planning several outreach and education events, workshops, and producer and supply chain engagement opportunities to pursue the food safety practices laid out in this report. CAN will also serve as an important communication and collaboration partner for the outcomes of the California Longitudinal Study (CALS) work expected in fall 2025.

The collective efforts of CAN demonstrate that the work of One Health and food safety is a lot more complex than initially thought. CAN recognizes that there is more to consider as we contemplate the next steps and future needs. However, it is important to acknowledge what have been notable sequential accomplishments that have allowed for progress at a local level. A more detailed step-by-step process of the multi-year endeavor can be found within the body of the report.



Click here to view the June 2022 CAN Action Report.

CAN timeline summary:

- **2021:** CAN established a locally led, locally convened Dialogue Group and Steering Committee that has served as an important function for communication, discussion, learning, guidance, and to focus attention towards building a proactive food safety culture.
- **2022:** Issuance of the CAN Report helped bring to light the more complex local needs, especially those that couldn't be solved by one entity alone but required a diverse group of invested stakeholders who were willing to look at the challenges and address them through a more wholistic approach.
- **2022 CAN Action Report:** Oriented toward future progress, and as such, the four key areas rooted in actionable next steps helped lend to future thinking and advancement.
    - **Action 1.** Foster Neighbor-to-Neighbor Interactions and Conversations
    - **Action 2.** Build a Research Roadmap for the Salinas Valley
    - **Action 3.** Create a Quantitative Microbial Risk Assessment (QMRA) Framework
    - **Action 4.** Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice
- **2023-2024:** Keeping with the spirit of CAN being a collaborative among stakeholders, the Action areas of CAN were further developed and moved toward implementation through the four Work Group efforts. The key areas to next steps and progress became more evident through the process of diverse stakeholder input, including the critical interplay between the efforts of each Action and ultimately the Work Group recommendations.

  The regular interaction of a Steering Committee and the Dialogue Group helped offer a proof-of-concept communication and collaboration model for California. Recognizing that the state has tremendous diversity in the commodities produced along with the production regions that support agriculture, CAN daylighted that this model lends value to the topic of food safety and One Health.

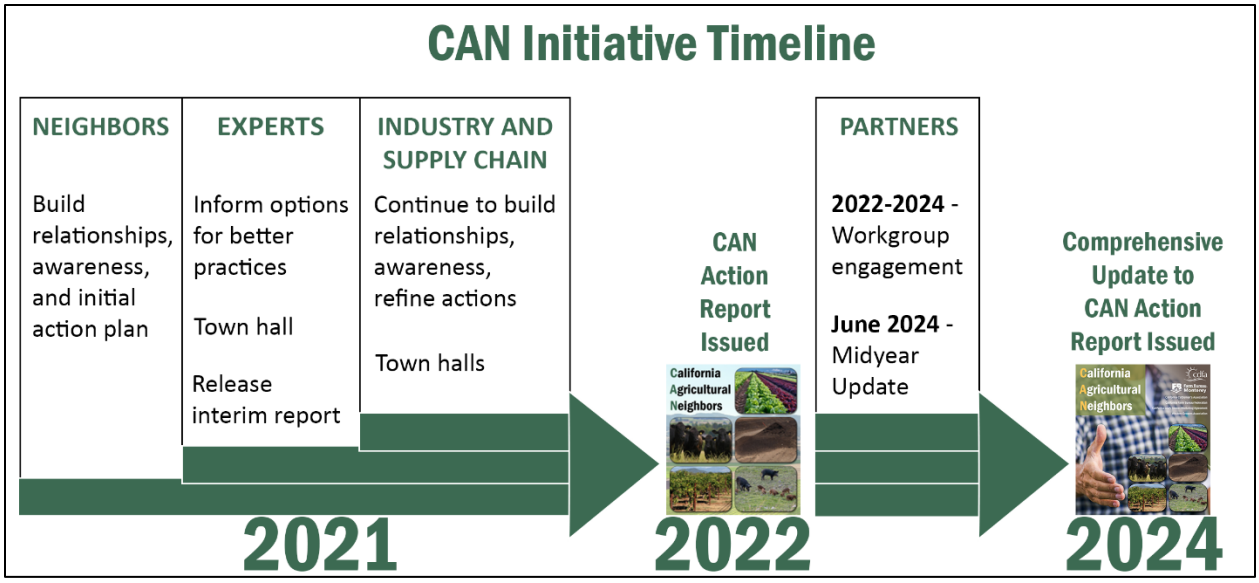


Figure 1. The CAN initiative timeline up to point of publication of this report in fall 2024.

The work that CAN accomplished in 2022-2024 filled gaps that previously were difficult to define, collaborate on, and identify progress for as the solutions cannot be solved by a single entity alone, instead requiring intense collaboration, vision, and an innovative One Health approach. Neighbor-to-Neighbor interactions are leading to critical solutions reducing pathogen risk while expanding the knowledge base of practices that will inform future decisions on safe food production.

In this way, CAN lends value to supporting and building upon the key next steps to foster a proactive food safety culture.

Key Next Steps laid out in the SUMMARY AND NEXT STEPS section of this 2024 CAN Report: Building a Proactive Food Safety Culture:

1. **Communication to broaden engagement that is supportive of a proactive food safety culture**

   1.1 CAN is focused on the most effective means of reaching out to a broader web of stakeholders to share insights, information, and plans for action. Impact will be achieved through engagement and participation of the *broader community of the Salinas Valley* and beyond.

   1.2 CAN seeks to explore different avenues of education, communication, and knowledge transfer through outreach to *all segments of the supply chain*, not only in the Salinas Valley, but across California, as well as nationally. Collaboration with other food safety initiatives will aid in sharing critical information that all segments of agricultural production will need to consider for their daily operational practices, as well as to encourage efficiency and deployment of resources effectively.

   1.3 CAN will continue to *refine the message of "shared responsibility" for food integrity risk reductions* as CAN becomes an integral part of the food safety initiatives within federal, state, and regional agencies and organizations.

2. **Expanded research partnerships and leveraging data science to fill information gaps essential for more effective action**

   2.1 Research that incorporates a holistic understanding of the region's community, its partners, their production activities, and potential shared impacts, will facilitate the development of mitigation

strategies for reducing transmission of zoonotic pathogens that are pragmatic and effective for both leafy green growers and adjacent land operations. The research roadmap developed by Work Group #2 should be regularly updated with consideration routinely given to the local needs of producers.

2.2 Data science, including data-sharing initiatives and quantitative risk modeling, provide a promising path forward for assessing unique, complex agricultural ecosystems and hold merit towards advancing a culture of food safety.

2.3 Diversified research partnerships that include the Center for Produce Safety, USDA Agricultural Research Service, and Centers of Excellence hold future promise to addressing the needs of food safety in the multidiscipline area of One Health.

3. Engagement of additional partners and collaboratives, including the California Longitudinal Study, to accelerate translation of new information to action

3.1 The California Longitudinal Study (CALS) is expected to be complete by fall 2025 and together CAN and CALS forge a valuable partnership of science and collaboration in the next steps ahead of enhanced food safety.

3.2 The CALS effort aims to provide an extensive data set to evaluate trends or changes over time, including metagenomics that may yield important clues to the changes taking place in the microbial community in response to the changing environment of the California coastal region. This will help aid in proactive next steps towards enhanced food safety, including building upon the Quantitative Microbial Risk Assessment modeling efforts of Work Group #3.

3.3 Engage research organizations and/or policy partners to help ideate funding opportunities and potential solution-based outcomes that respect the diversity of agricultural production and public health with a vision towards proactive food safety outcomes.

4. Investing in the future expertise and capacity to enhance transfer of knowledge from research into applied practice

4.1 Right-size the required depth and breadth of dedicated experts to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley utilizing the roadmap laid out in the white paper written by Work Group #4. The roadmap highlights the need for key entities to help lead the work, as well as suggests an advisory framework to represent all of California agriculture's interests tied to produce safety.

4.2 Foster development of individuals who hold expertise in a transdisciplinary understanding of food safety and are diversified in their knowledge who will help fill research, extension, and outreach pipelines. Traditional compartmentalization models of scientific disciplines or expertise has limitations in its ability to serve the diverse challenges of food safety that exist within complex interactive ecological systems.

4.3 Organize a separate and distinct Coalition that can help identify the funding support needs of the local region and also advocate for these needs at a state and national level. Consideration for this type of food safety baseline funding and also long-term investments can help make incremental advancements towards the collective future vision and foster adoption of a proactive food safety culture.

The need for shaping and encouraging a culture of food safety has never been more profound. Implementation of the Food Safety Modernization Act (FSMA) has challenged growers on many levels. Sets of rules can be subjective and intentionally written to be flexible, but that requires an understanding of trade-offs or where more information may be needed for appropriate risk modeling and intervention strategies. Food safety work is a process of continual improvement based on knowledge gained, insights translated into implementable actions, and processes refined.

The California Agricultural Neighbors unique contribution towards enhanced food safety is the collaboration between and among neighbors, and thus the whole community, to take actions resulting in reduced risk of microbial contamination. Prioritized actions are expected to be science-based, clear, and compelling for addressing factors relevant for improving food safety.

CAN promotes a "proactive food safety culture" through a well-informed conversation with a foundation that food safety is a shared responsibility for all agricultural producers. Culture itself comes from implemented practices after verified scientific research provides a pathway to improving on-farm agronomics and field practices. Communicating neighbor-to-neighbor is a culture change itself within the agricultural community, promoting an understanding of roles and responsibilities. Whether through data, education, expanded knowledge capacity, or through value-added food products and their processing, CAN's proactive culture is defining improvements within food safety practices. By promoting a proactive attitude and collaboration, the change in food safety becomes a culture of improvement.

The dynamics of fresh food production, particularly quick-turning crops such as leafy greens, emphasize the need for collaborative solutions that are both supported by science and implementable in a short production window. Salinas Valley producers continue to explore new dynamics to reduce risk, now including their neighbors, but many data and research gaps need to be further explored to ensure that what is ultimately put into practice is based on sound science and viable outcomes.

California's farmers and ranchers play an outsized role in contributing to nutritionally dense produce and protein products that make their way into consumers hands each and every day. Food safety has grown in complexity as the science has evolved, and yet we recognize that food safety is a shared responsibility. A safe and abundant food supply affords food security, and food security is cornerstone to national security. With a finite amount of agriculture land, it is important to render decisions using science while also considering the needs of the population.

Recognizing that the average consumer continues to be further removed from agriculture production, it becomes important to communicate the alternatives being considered – one way CAN has begun to explore is using risk models. This approach helps to preserve the future opportunity to source the abundance of food choices we know today domestically under the highest food safety standards and avoids overly broad interpretations or visceral reactions that have irreparable consequences to our nation's food supply and the economic viability for farmers, ranchers, and communities that depend on this future success to feed our nation and yield positive population health outcomes.

OVERVIEW, UPDATE, PROGRESS OF CALIFORNIA AGRICULTURAL NEIGHBORS

In June 2022, the first CAN Action Report was published after a year-long commitment and engagement by the CAN Dialogue Group. CAN brought together vested stakeholders within the Salinas Valley agriculture community in discussions surrounding farm and rangeland management practices and potential food safety risks for exposure to field-grown crops adjacent to rangeland, compost operations, or vineyards.

Publication of the 2022 CAN Report was intended to be outcome driven and noted four key areas to promote next steps:

- **Action 1.** Foster Neighbor-to-Neighbor Interactions and Conversations
- **Action 2.** Build a Research Roadmap for the Salinas Valley
- **Action 3.** Create a Quantitative Microbial Risk Assessment (QMRA) Framework
- **Action 4.** Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

Figure 2. CAN helped create the foundation for a food safety framework by enhancing communication among stakeholders.

CAN helped create the foundation for a food safety framework in California by enhancing communication among the agricultural communities through scientific insights and enhanced food safety education and action. Soon after the initial report was issued, CAN formed Work Groups focused on further developing and advancing toward implementation of Actions 1-4. Each Work Group had a Charter that included, in part, the purpose, objectives, goals, and deliverables (see appendices). The Work Groups were led by a chairperson and co-chair and met regularly with the CAN Steering Committee members. The implementation of the Work Groups was staggered in order to maximize participation of subject matter experts who offered valuable input to more than one Work Group. This sequentially allowed for the progress and outcomes of each Action to build upon subsequent Work Group functions, goals, and deliverables.

More sophisticated information to action for improved food safety

The need for shaping and encouraging a culture of food safety has never been more profound. Implementation of the Food Safety Modernization Act (FSMA) has challenged growers in multiple ways. Sets of rules can be readily implemented, but fostering behavioral change is a longer endeavor. Food safety work is a process of continual improvement based on knowledge gained, insights translated into implementable actions, and processes refined. To bolster a learning continuum that is lasting to meet modern-day needs, California needed a process that engaged individual and collaborative communication, identified the evolving research needs, and used this information to offer risk interpretation related to the growing environment. Importantly, there will continue to be a need to develop the opportunity for scientists with multidisciplinary research expertise, funding sources to adequately fund necessary produce

safety research, and agricultural extension advisors who translate and communicate research findings into applied recommendations.

Each CAN Action and related Work Group are intentionally designed to be interdependent to one another. As such, this allows for the CAN model to support a continuous loop of food safety progress and 'leveling up' in those advancements. This concept is further illustrated in the diagram to the right.

Figure 3. Each CAN Action and related Work Group are intentionally designed to be interdependent.

For example, when neighborly relationships are forged under the partnership efforts of Action 1 (Neighbor-to-Neighbor), additional needs become visible, relevant, and focused. This allows for the scientific gaps associated with these needs to be prioritized under Action 2 (Research Roadmap) as part of the local research priorities and/or further understood by way of risk modeling using the framework developed as part of Action 3 (QMRA). Actions 2 and 3 are supported through engagement and expertise at the university, which are detailed in Action 4 (Transfer Knowledge). These capacity needs include resources both in human capital and monetary investment for scientific and economic studies, outreach and education of the learnings, and implementation or removal of practices directly and uniquely associated with the specific needs of an operation. When taken as a whole, this model described builds upon itself and benefits the advancement of operations individually and also collectively towards the enhancement of food safety.

A summary of each Action Work Group can be found within the body of this report. Additional materials and supporting documents are included within the appendices. As part of the next steps for the remainder of 2024 and 2025, CAN is focused on communication and outreach of the materials developed to date and presented in the June 2022, as well as this report. Opportunities to further communication about the CAN resources, insights and information will be through associations helping to connect membership, subject-specific webinars, in-person workshops, meeting engagement, and through requests for proposals such as those requested for research needs. CAN will continue to meet as a Steering Committee in order to ensure that the outreach and communication needs are met with the specific intent of advancing food safety culture. Additionally, members of the CAN Steering Committee will continue to engage locally and nationally in order to support the initiatives and efforts of One Health in this critical area.

CAN PROCESS – COMPREHENSIVE OVERVIEW OF DESIGN AND IMPLEMENTATION

As noted, the California Agricultural Neighbors initiative began in January 2021 prompted by a series of food safety incidences linked to the Salinas Valley and a common commitment to working together to reduce food safety risk. The potentially unique contribution of such an endeavor is the collaboration between and among neighbors, and thus the whole community, to take actions resulting in reduced risk of microbial contamination. Prioritized actions are determined by the group and are expected to be science-based, clear, and compelling for addressing factors relevant for improving food safety.

As of September 2024, the CAN effort has worked through two primary phases. The first phase involved developing recommendations for action, captured in the report released in June of 2022. The second phase contained in this report focuses on implementation of those recommendations. Additionally, the CAN process has endeavored to link to and not repeat other, related efforts. And, based on insights and lessons learned, make improvements and build paths for forward progress.

This continuous improvement attribute has been intentionally incorporated into this initiative, especially as part of Phase Two, and requires ongoing assessment, revision, and a rigorous fidelity to providing a unique platform for collaborative effort and, thereby, practicing what the group is preaching. CAN is modeling shared responsibility for food safety and holding the effort accountable for achieving on the ground results. As noted, the CAN effort, having developed substantial substantive insights and recommendations, is now embarking on a more robust communication program with the goal of advancing food safety culture across the Salinas Valley and beyond. In addition to engaging key stakeholders on the CAN developed content, effort also is being made to continue linking with other, related food safety initiatives.

Making these food safety culture goals and expectations a reality requires several process features in the first two phases. Following are outlined the process features for each of these two phases.

Phase One: Development of Recommendations

1. **Convening** – Clarity of mission and design for achieving success.

   a. Assessment – Those sponsoring and leading the initiative need to articulate the case for the proposed project, including why it is necessary, what the expectations are for its impact, and how it is viewed as contributing a unique role in addressing the larger issues – in this case, why the effort launched as

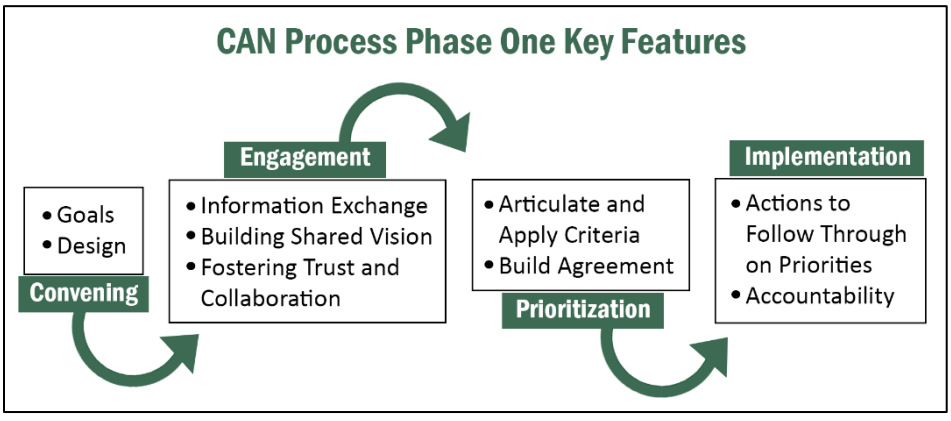


Figure 4. Key features of CAN's development of recommendations included continuous improvement, in which the linear process illustrated above becomes cyclical and manifests through design of deliberative process going forward, along with building capacity and incorporating new information as available.

CAN is filling a gap and can provide a unique role for improving food safety risk reduction in the Salinas Valley.

b. Design – Assessment must be coupled with process design that helps support the mission and achieve success. Design includes establishing the scope of the CAN focus, specifically the Salinas Valley, but with acknowledgement of broader implications regionally, nationally, and across the food supply chain. Design considerations include the anticipated timeframe of the effort (approximately one year from the time of the first meeting); identifying key groups to be engaged, along with how they will participate in the project, and how their deliberations will be governed. For CAN, groups were determined by the goals of the effort, namely those who could represent key neighbors, and the community at large, essential for communicating across fences to spur actions that could improve food safety. For CAN, critical neighbors included not only cattle ranchers and produce growers, but also vineyard operators, and composters, all of whom conduct relevant activities on their lands and across the Salina Valley that may have an impact on food safety and risk reduction. In addition, the substantive content of their conversations must be informed by science and made as practical and compelling as possible. Thus, scientific experts, as well as regulatory entities at the state and local levels, and those providing technical expertise, like extension agents, were also of interest as participants. How participants engaged was influenced by the project starting at the tail end of the COVID-19 pandemic so that deliberations were held virtually. Other design features were further shaped by virtual engagement, such as dedicating more time for relationship development with shorter, more numerous virtual sessions. Given the challenging nature of these discussions, and the desire of the sponsors to fully participate in the deliberations as interested parties and communicate progress with those interested in the results, it was determined early in the process to include the services of an outside, expert facilitator. Discussion governance also requires ground rules, including decision-making protocols, roles and responsibilities of participants, and other features important to a common and agreed to set of rules of the road. Another design feature includes identifying the types of outputs expected and how those outputs will be acted upon and by whom. For CAN, it was anticipated that recommendations would be determined for supporting neighbor-to-neighbor communications that could foster shared responsibility in reducing food safety risk. The leadership and co-sponsorship of CDFA and the Monterey County Farm Bureau, along with the early participation of leading produce grower and cattle rancher organizations, ensured an expectant and well-situated core audience for receiving and acting upon resulting recommendations. As the importance of other stakeholders became clear, additional participants were added, including within the Salinas Valley, Monterey County, and with reach across California, as well as along the food supply chain from inputs to retail.

2. **Engagement** – Establishing a respectful, productive environment for collaboration and cooperation is essential for achieving success. In addition to protocols or ground rules, and as groups begin their deliberations, interactions lay the groundwork for building relationships for working toward meeting their collective goal as laid out by the project's mission.

a. Information exchange – A first step for understanding each other and, ultimately, how best to inform neighbor-to-neighbor discussions, CAN participants shared information about their activities in conducting their operations on their land and across the community. This information was critical as it established a common base of knowledge from original sources. Given that some of the heat around food safety issues is generated around suppositions and assumptions, it is very important to listen to and share information with each other directly. Providing some parameters

around information exchange is important, but too narrowly defining those parameters may exclude important information, so some flexibility with the shared narratives is helpful. Being generous with boundaries can open up productive areas of conversation and reveal information not expected at the outset. An example with CAN was the seasonal traffic patterns and opportunities for coordination to reduce proximity of cattle and produce on the roads and during important harvesting activities.

Figure 5. Neighbor to Neighbor engagement is fostered through shared discussion topics.

b. Building a shared understanding – From the sharing of information, a collective process of focusing on what is most important to dig into further and develop recommendations for change begins to form. Without a shared understanding, choosing priorities and achieving agreement on recommendations becomes much more challenging. Even with a shared understanding, achieving conclusions and developing and embracing full support of final recommendations are no small tasks.

c. Fostering trust and collaboration – To make progress from sharing information to agreeing to recommendations, trust in each other and the group's common cause is critical. Each participant needs to be heard, feel heard, and listen to understand others for collaboration to have the chance of success. Achieving this state of give and take for a group of individuals dedicating their time and energy is not a given; it takes work, open minds, and respect.

3. **Prioritization** – Taking a lot of information and ideas and shaping them into recommendations for the greatest impact is the next step of progress toward achieving a project's mission. Without prioritizing, the project runs the risk of putting out a whole lot of shared information and ideas that are overwhelming to the point of dismissal by the intended audience. If the participants cannot clearly articulate top recommendations and why they are important to implement, target audiences and the community as a whole will be unable to understand what is being asked of them and could dismiss the report and any recommendations within it.

a. Articulation and application of criteria – Establishing agreed-to criteria will help facilitate selection of top priorities. Those criteria should be highlighted and determined in a report with the recommendations so that they are understood by the target audiences. As CAN participants considered various areas of focus for attention, they determined criteria for working through whether or not each potential area of action rose to a low, medium, or high level of importance. Criteria included whether or not the action was supported by science, how expensive or complicated it might be to implement it, the likelihood of it being implemented, and its potential for impact. These criteria were then applied to each identified possible action and given a score of high, medium, or low, accompanied by a brief explanation. This exercise was critical in formulating top priorities.

b. Building agreement and acknowledgement of continued disagreements – While criteria are necessary, they are not always sufficient for reaching agreement on all priorities or recommendations. Any ongoing disagreements should not be considered a failure, unless they number more than the

areas of agreements. If that is the case, then criteria should be revisited and, perhaps, revised. Those areas with continued disagreements, if important to the overall project (i.e., notable by their absence), should be explained and fairly described.

4. **Implementation** – how best to act upon those areas of greatest importance. The overall goal of CAN is to improve food safety through the collective efforts of the community, initiated by conversations between neighboring agricultural operations. Providing context and support for how best to act upon those top areas for the greatest impact to improve food safety provides a framework and road map for moving the priorities forward to implementation.

   a. Actions to follow through on priorities – Having the group determine priorities and explain the logic and decision-making process is important information to compel action – the why of the recommended action. Also important is providing guidance and expectations for how to implement those priorities. For CAN, recommendations for action included areas of additional research to help clarify and inform how best to reduce microbial contamination specific to the Salinas Valley, infrastructure needs for translating research into actionable guidance for new or changing behaviors, and a preliminary template for how to initiate or enhance neighbor-to-neighbor discussions that can result in risk reduction and improve food safety. Explanations for why these recommendations are important and how they will achieve better outcomes can help encourage uptake of the recommended actions.

   b. Accountability – Highlighting actions is important, and so is laying out and committing to ongoing efforts to mobilize action around the recommendations. This combination establishes accountability among the participants, as well as the opportunity to assess, finetune, or course correct top priorities. In a continuous improvement model, accountability is critical. As part of the accountability for CAN, participants supported not only a strong effort to have broader community input on preliminary recommendations, but also to continue the work in a second phase.

Phase Two – Report Recommendations Implementation, Assessment, and Ongoing Improvement

As noted above, the CAN group supported ongoing work to ensure their recommendations were acted upon and also to continue deepening and improving the impact of the recommendations. Process features needed to be adjusted in this new phase. Below are some of the more notable considerations.

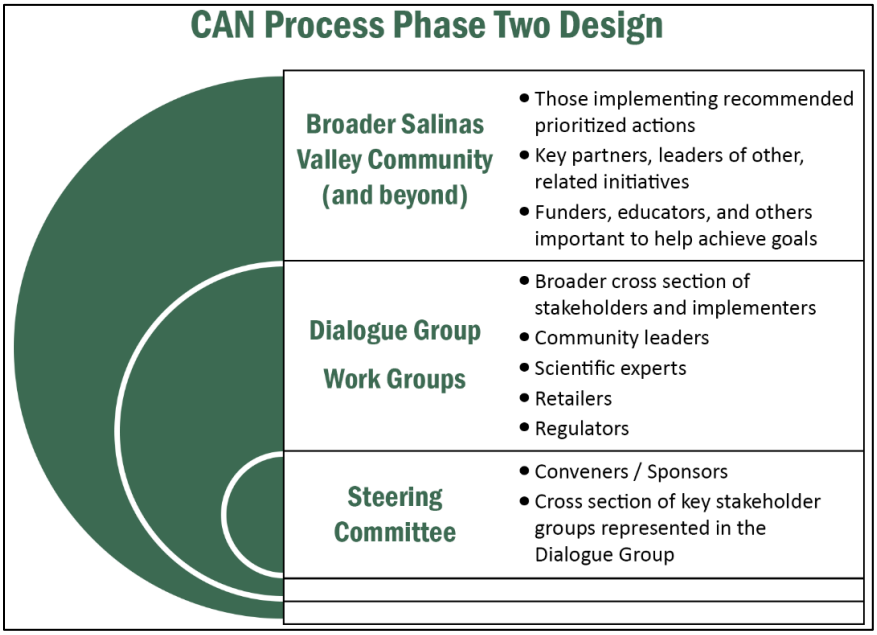


Figure 6. Phase Two process design.

1. **Stay anchored in the unique value of the project's initiative and its mission** – As the CAN project moved to the next phase of

implementing its first report recommendations, it would be all too easy to expand attention to a variety of important related issues. However, that tendency runs the risk of diluting the particular role CAN plays, with its emphasis on building shared responsibility within the Salinas Valley community and driven by neighbor-to-neighbor connection and collective action. Continuing to ground the next phase in that mission is critical and connecting how it will function and the outputs for this next phase need to be tethered to that mission.

2. **Re-shape the table** – In the first phase, CAN was powered by a dialogue group that had broad and duplicative representation of the constituencies most critical to building shared community responsibility beginning with neighboring agricultural operations. Understanding who should be included expanded over the course of the project, to include researchers, regulators, and others in the supply chain not necessarily located in the Salinas Valley, but definitely critical to the agricultural community. These considerations remained salient, but commitment of time and effort also became a factor. Additionally, participants thought a "divide and conquer" approach to this implementation and accountability phase of the CAN enterprise would be useful and appropriate. Consequently, CAN created a layered approach to participation, with a Steering Committee taking on the responsibility of overseeing and pressing forward with implementation; Work Groups to dive more deeply into the four areas of recommendations in the first report; retaining the larger dialogue group to engage as the Work Groups made progress and needed feedback; and continuing to involve the larger community in town hall style events when greater feedback and/or presenting additional results or recommendations were achieved and needed action at a broader level.

3. **Define the Phase Two work plan** – Just as the shape of the table was modified, so too was the work plan for these various groups to conduct their responsibilities and to keep these different nodes of activity apprised of progress and moving forward together.

4. **Continue to connect with other relevant food safety efforts** – CAN was not established and does not operate in a vacuum. Food safety work launched before, during, and after the CAN initiative continues and new information is generated constantly. For CAN to remain relevant and to have impact, making connections to, and defining its work as unique from, other efforts is critical. This takes constant communication among the group, as well as outreach to other initiatives. For example, research needs highlighted are only relevant if they are fed into consideration by those funding research. CAN's research priorities have been shared with those in positions to fund research, such as the Center for Produce Safety.

5. **Be intentional about accountability and continuous improvement** – early on in Phase Two, it was recognized how connected each of the Work Groups' efforts are and need to be. New research provides additional information to inform what neighbors discuss and act upon, as well as fill in the Quantitative Microbial Risk Assessment skeletal framework. The capacity building efforts to build the brain trust necessary to conduct research and translate it into on-the-ground actionable practices is critical to inform the neighbor-to-neighbor dialogue. As that

Figure 7. CAN success depends on continuous improvement.

dialogue becomes more sophisticated, food safety improves. Acknowledging this connection and reinforcing it through communication within the governance structure, as well as externally to other community and supply chain stakeholders also is important. CAN leadership, particularly through the Steering Committee, has incorporated this feature into its deliberations and is communicating this connectivity externally through this report and in its next wave of activities. This external effort also is part of holding the CAN project to account for its recommendations in the first report.

As noted, the California Agricultural Neighbors initiative began in January 2021 prompted by a series of food safety incidences linked to the Salinas Valley and a common commitment to working together to reduce food safety risk. The potentially unique contribution of such an endeavor is the collaboration between and among neighbors, and thus the whole community, to take actions resulting in reduced risk of microbial contamination. Prioritized actions are determined by the group and are expected to be science-based, clear, and compelling for addressing factors relevant for improving food safety.

CAN COLLABORATION WITH OTHER INITIATIVES

The work conducted by CAN has helped foster a One Health awareness and strategy among Salinas Valley agriculture neighbors. These efforts further support ongoing state and national efforts.

California Longitudinal Study (CALS)

The California Longitudinal Study (CALS) started in 2020 and is focused along California's coastal growing region including the Salinas Valley. It represents one California effort aimed to adaptively address the outbreaks of *E. coli* O157:H7 associated with leafy green crops. To accomplish CALS, California's leafy green industry is collaborating with partners from California's cattle, viticulture, and compost industries, UC Davis Western Center for Food Safety, and state and federal partners. The results of this study are anticipated in the fall of 2025. More information is available at https://www.fda.gov/food/environmental-studies/california-longitudinal-study-2020-present.

Healthy People 2030

The Healthy People initiative is designed to guide national health promotion and disease prevention efforts to improve the health of the nation. Released by the U.S. Department of Health and Human Services (HHS) every decade since 1980, Healthy People identifies science-based objectives with targets to monitor progress and motivate and focus action. Healthy People 2030 (HP2030) is the current iteration of the Healthy People initiative and is available at www.HealthyPeople.gov.

In January 2020, the Association of Food and Drug Officials held the Foodborne Illness Reduction through Healthy People 2030 Summit. At this meeting a group of 130+ Food Safety Leaders came together to discuss changes needed to reduce foodborne illness. Discussions were focused on Shiga toxin-producing *Escherichia coli* (STEC), Listeria, Salmonella, Campylobacter, Norovirus, and various commodities.

In 2023, HP2030 members indicated the desire to create a new Work Group focusing on One Health and its impact on food safety through the interaction of plants, animals, and humans. As such, the One Health Work Group and made its own independent Work Group in order to broaden its scope, while still focusing on areas of importance such as Produce and *E. coli* O157:H7.

At the Healthy People 2030 meeting held April 24-26, 2024, in Atlanta, GA, the One Health Work Group focused on building collaboration among produce and animal agriculture production. There were two initial outcomes that helped build upon these efforts:

1. **USDA and FDA Farm to Fork meeting**

   The first meeting was held in May 2024 near Washington, D.C., during which USDA and FDA brought together academic, industry, and agency individuals working on multiple food safety research projects, including potential food safety innovations for poultry, cattle, and leafy greens. CAN was included on the program as an exemplary effort of how adjacent land uses are collaborating on reducing food risks and identifying locally focused research projects to fill information gaps. While the conference focused on several studies already in progress, the outcome of the meeting was that much more research is needed to understand STEC transference and survivability in the environment.

2. **Sustainable Alliance for Food Ecosystems (SAFE) Think Tank**

   SAFE serves as a collaborative think tank focusing on One Health solutions for agriculture. In recent years, concerns have emerged surrounding the interaction within food ecosystems and the potential for environmental pathogen transport. The mission of SAFE is to develop helpful, sustainable solutions and resources for food producers who work across the spectrum of agricultural ecosystems. Thus, the objective for SAFE is to bring together subject-matter experts in government, industry, and academia for a collaborative think tank setting to help identify research gaps, develop project approaches, and ideate potential partnerships and funding opportunities that respect agricultural production and public health.

CAN ACTIONS 1 – 4 AND WORK GROUP OUTCOMES

Action #1: Foster Neighbor-to-Neighbor Interactions and Conversations

CAN Work Group #1 was provided a charter developed by the CAN Steering Committee at the end of September 2022; the team went to work with its first meeting on October 3, 2022 (Appendix 1A).

Work Group #1 consisted of members from academia, agricultural industry associations, local agencies, corporate buying groups, and members of the ranching community from the Salinas Valley. The committee was initially chaired by Afreen Malik of Western Growers Association and co-chaired by Scott Violini, a beef producer in Monterey County. In 2023, the committee chair was changed to Greg Komar of CA Leafy Greens Marketing Agreement (LGMA). Work Group team members represented a diversity of interests and expertise from local and state associations, county agricultural commissioners, university extension, CDFA, and buying representatives for retail.

Action 1: Foster Neighbor-to-Neighbor Interactions and Conversations

1.1 Sharing California Agricultural Neighbors (CAN) glossary of terms to foster a common understanding.

1.2 Collaborating with partnerships in CAN Outcomes Table that engender goodwill among vested agricultural stakeholders.

1.3 Creating a Discussion Template to support neighbor-to-neighbor dialogue.

The team met once a week focusing on the deliverables outlined in the charter to develop a discussion and communication plan template that was successfully delivered at the November 29, 2022, CAN Steering Committee meeting. Also developed was a neighbor-to-neighbor introduction letter (Appendix 1B), an Ag neighbor dialog practices guideline (dos and don'ts) (Appendix 1C) and several flowcharts that complemented the templates to simplify the discussion (Appendix 1D).

Upon completion of the deliverables, a smaller group began working within the parameters of what was presented to initiate a pilot program to included farmers and ranchers to obtain their perspective on the documents that are available and how these documents can be better utilized to enhance the knowledge around food safety practices.

The meetings were held once a week via Zoom, generally lasting 60 minutes. Resources utilized to fulfill the charter objectives followed that of the CAN Action Report document (https://www.cdfa.ca.gov/is/docs/CAN_Action_Report_2022.pdf), LGMA requirements, experience in developing similar bodies of work by academia, and the everyday *living is doing* by the agricultural representatives. Work Group #1 was successful in the endeavor because of the mutual respect that was shown by such a diverse group and the work ethic of everyone involved.

The Work Group's first objective was to develop a CAN value proposition or statement of value. This consisted of a one-page document with six bullet points that identified why food safety awareness is important and how all stakeholders can reduce food safety risk through a collaborative approach with already existing knowledge, recognizing not only communication of farmers and ranchers but the entire Salinas Valley community to strengthen consumer health. It also quantified the need for a proactive approach even amid increased regulatory pressures to achieve a win-win for all participants (Appendix 1E).

To initiate the topics of discussion, several templates were drafted and refined. The Work Group was fortunate to have industry representatives from both sides of the fence to compare the timing of all agricultural activities involved in producing a vegetable crop and how it coincided with livestock activities during an annual production cycle.

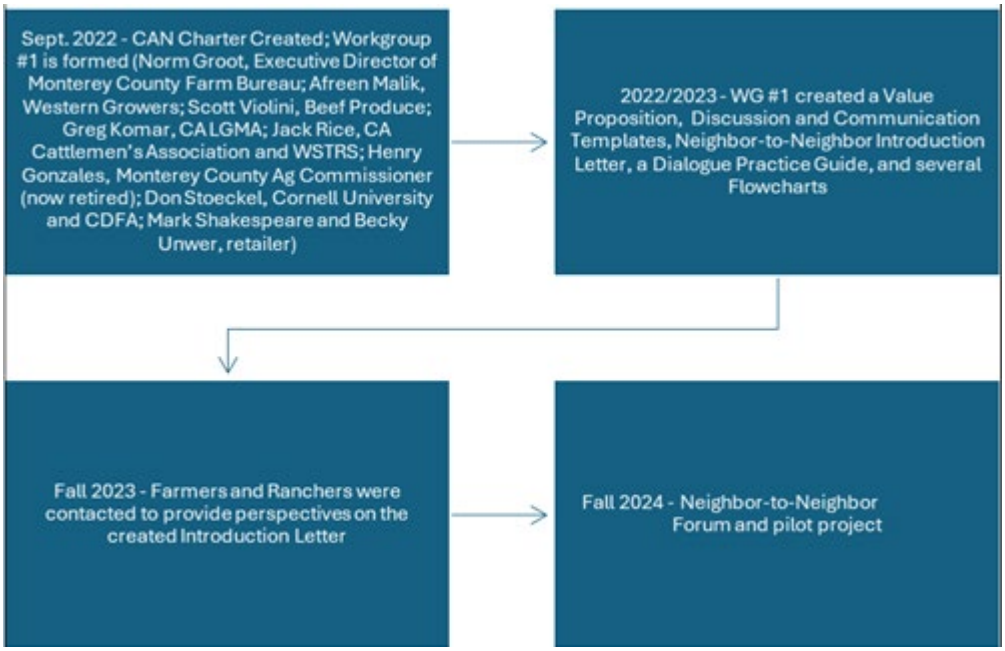


Figure 8. Work Group #1 timeline.

The initial templates were simple comparisons of farming and ranching activities; this allowed for questions and what-if scenarios by all participants in the Work Group. Proactive input by all participants immediately spawned a detailed matrix that could be utilized by all agricultural operations. This Farm and Ranch Matrix became the basis for the nine topics of discussion template the group referred to as the conceptual question document. LGMA led the effort by providing a grower perspective for each topic; cattlemen, vineyard, and compost operators were then asked to give their perspective in reference to LGMA. The outcome was successful because discussions entertained thinking outside the box of normal everyday farming activities with questions and scenarios presented by representatives of academia and the consumer buying group (Appendix 1F).

Overall, Work Group #1 performed its assignment of Action 1: Foster Neighbor-to-Neighbor Interactions and Conversations by developing a template available in Appendix 1A-1F of this report. The template facilitates and aids in neighbor-to-neighbor dialogue about food safety practices and potential risk areas. The comparison charts and the conceptual question document was then available to be utilized by the other Work Groups and industry representatives in the efforts to enhance food safety and understand the dynamics of farming and ranching in the same environment.

In the Fall 2024, the CAN Work Group #1 conducted a forum (similar to a focus group) of farmers, ranchers, composters, and food safety personnel. The topic was Neighborly Conversations; how to get all aspects of agricultural production to communicate better about operational practices and timing. The conversation included a brief explanation of CAN and its objectives, how the Work Group completed its tasks, and review of the templates developed to assist with conversation initiation. The forum touched on several issues related to additional research and science needed to justify practices that minimize risk. For example, there are food safety risks that are tagged with public misperceptions; grazing of rangeland buffers when fields are in fallow supports wildfire fuel load reductions and wildlife management. A good number of insights were gained as individuals shared their individual concerns, many motivated by liability and market influences. The Work Group will reengage with the same participants to further explore a long list of items brought out in this discussion.

Action #2: Build a Research Roadmap for the Salinas Valley

The task of the Action #2 Work Group of the California Agricultural Neighbors (CAN) was to build a research roadmap for the Salinas Valley growing region.

As described in CAN's *Neighbor-to-neighbor best practices to help enhance localized food safety efforts,* Action Report, published in June 2022, the purpose of a research roadmap is to help further knowledge and enhance or streamline food safety practices and maximize their effectiveness and to provide relevant data for a Quantitative Microbial Risk Assessment (QMRA).

Action 2: Build a Research Roadmap for the Salinas Valley based on:

2.1 Introduction of pathogenic *E. coli* to host populations, and re-introduction into the environment in a cycle that leads to continuing exposure and outbreaks.

2.2 Amplification of pathogenic *E. coli* within host populations, following introduction, and through conditions that may allow for regrowth in produce-growing lands and adjacent lands.

2.3 Survival and persistence of pathogenic *E. coli* under various conditions that do not allow for amplification, but which do allow more time for transport opportunities and intersection with leafy green crops.

2.4 Mechanisms of movement and transport of pathogenic *E. coli* across the landscape, including by air, water, animals, and machinery.

From February through May 2023, the Work Group met approximately twice a month to work on the research roadmap. Work Group members included representatives from universities, CA Leafy Greens Marketing Agreement and research board, FDA, associations, farming entities, and industry consultants. Per their charge, Work Group members based their discussions on the following research areas pertaining to pathogenic *E. coli*:

- Introduction into animal host populations and re-introduction into the environment
- Amplification within host populations and through conditions that may allow for regrowth in growing land and land surrounding production areas
- Survival and persistence under various conditions that do not allow for amplification
- Mechanisms of movement and transport across the landscape by air, water, animals, and machinery

Using these four areas as a framework, the Work Group further focused its discussions on evaluating the corresponding priority research questions as outlined in CAN's Action Report. In describing what research is needed to conduct a QMRA, the Work Group approached gaps in information and research from the perspective and experience of what is needed without consideration of available funding, thus creating a wish list of sorts. The group also noted limitations and restrictions in achieving answers to research questions based on the feasibility of conducting a study and/or implementing study findings. The priority of each research question is ranked as one of the following:

- **High** (research highly likely to provide solutions or enabling/actionable knowledge)
- **Moderate** (research likely to result in filling a knowledge gap or a long-term solution)
- **Low** (researchable question unlikely to be defined, meaningful, or implemented)

To round out the roadmap as depicted in the objectives (Appendix 2A), the group listed relevant ongoing and in-process research (e.g., Specialty Crop Research Initiative, CA Leafy Greens Research Board, Center

for Produce Safety, FDA, USDA, etc.) of which members were aware, as well as published studies that were pertinent to the research question (Appendix 2B). To keep the Research Roadmap evergreen, future stakeholder collaboration will be important and necessary as new study results are shared or information comes to light.

Action #3: Create a Quantitative Microbial Risk Assessment (QMRA) Framework

The California Agricultural Neighbors (CAN) Work Group #3 objective was to identify the biotic and abiotic variables to be studied and characterized if a complete and comprehensive Quantitative Microbial Risk Assessment (QMRA) for *E. coli* O157:H7 on leafy greens in the Salinas Valley was to be completed.

The group set out to construct a skeleton framework aimed to integrate, align, and apply information generated from all CAN working groups (#1, #2, #4) with information from current and on-going research projects (SCRI, CALS, CPS), past research data, and industry and expert knowledge.

Action 3: Create a Quantitative Microbial Risk Assessment (QMRA) Framework

3.1 Assess the current state of knowledge and sponsored research underway and supported by various entities.

3.2 Apply a QMRA framework to organize data, both existing and upcoming through the research pipeline, as a means to prioritize data needs and research gaps for a completely populated QMRA foundational data set.

The final product developed into a structured document that identifies and communicates the factors needed for a QMRA, and the information, known or unknown, that would be necessary to consider as a contributing element in the QMRA. Importantly, the skeleton framework also informs where individual factors (e.g., weather, wind pattern, particulate size, etc.) could be studied and documented separately from a complete QMRA. These more limited studies would generate data that could be used for future incorporation into a comprehensive QMRA for *E. coli* O157:H7 in the Salinas Valley.

Process Update

Over six months, a cross-functional team representing growers, researchers, scientists, and industry experts met to assemble the factors that contribute to the final risk of *E. coli* O157:H7 on Salinas Valley leafy greens. The working group process incorporated existing information from previously completed research, integrated expert opinion/hypothesis, and identified data gaps and areas for expanded research.

Work Group #3 created five modules with the skeleton framework that aimed at identifying all involved factors, conditions, and modifiers that would influence them. The five modules are the animal operations module, wildlife module, waterways module, environmental transfer module, and growing module.

Work Group #3 Modules

Animal Operation Module - commercial and domestic animal operations
Wildlife Module - all wildlife in the Salinas Valley
Waterways Module - irrigation water, watershed, precipitation, recycled water
Environmental Transfer Module - potential movement and interaction of pathogens in environment
Growing Module - agronomic systems and practices

Each module was approached independently by the group to build out a comprehensive list of factors independent of other modules, factors, or conditions. The stepwise process generated a list of factors and conditions under each module that would require further characterization and study. The lists were then assembled into one document to clearly communicate the number of variables and infer the need to assess their potential relationship to each other. Each of the noted module factors requires individual characterization under numerous conditions and also requires evaluation collectively to identify real-life correlations and relationships.

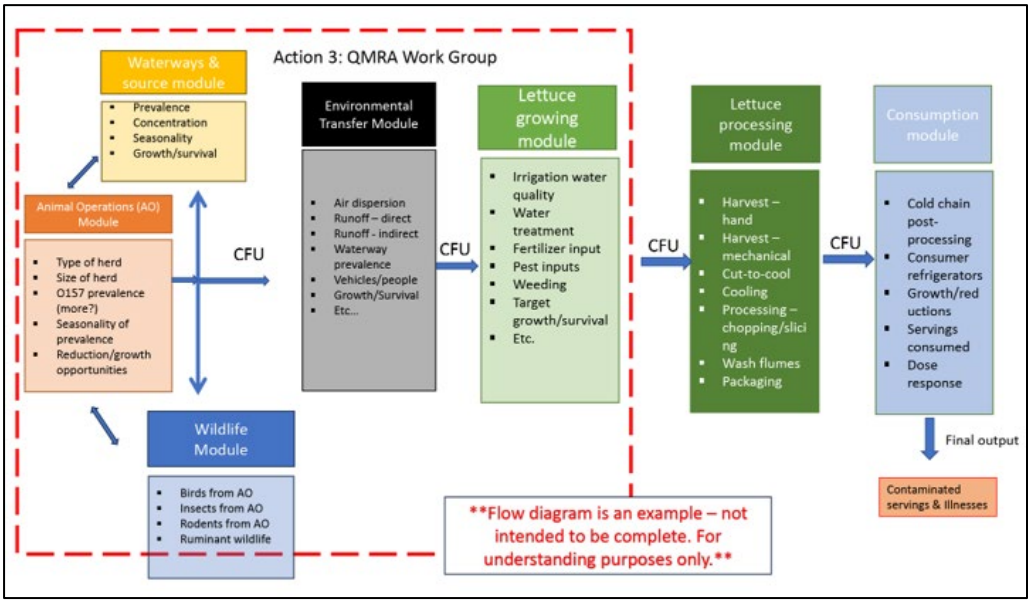


Figure 9. Work Group #3 flow diagram, viewable in bigger format in Appendix 3B.

The final product of Work Group #3, a skeleton framework, combined these modules' factors and modifiers into a document structure aimed at highlighting the complexity related to this challenge, and to assist in identifying where future research could be completed. The skeleton framework was developed to be inclusive of all factors, but the group recognizes that there likely still are missing factors and conditions. Despite best efforts, the skeleton framework is a comprehensive list and tool to aid in understanding the complexity of the leafy green challenge in Salinas Valley. The skeleton framework highlights there are over 65 million combinations of factors if only one factor was picked from each of the framework's modules, and that numerous QMRA models and scenarios could be completed using this as a guide.

The complexity of agricultural ecosystems makes identification of pathogen introduction, transfer, and proliferation difficult. As more information is obtained on the factors and relationships within the ecosystem and agricultural environment, a more comprehensive and realistic QMRA can be completed. This QMRA would be inclusive of scenario analysis that may provide further insight into the events and conditions necessary for a food safety event. Work Group #2's work identified research studies and trials that are needed to provide insight into the *E. coli* O157:H7 challenge for leafy greens in Salinas Valley. Work Group #3 has further identified within the skeleton framework individual factors that also have data gaps and require additional research. Efforts to collect information on these individual factors could aid in better root cause investigations and identification of conditions that may be involved in food safety events. The collection of information on these factors can be concurrent with the research studies identified by Work Group #2 but could also be approached separately from a broader research study. Efforts to collect data on these factors over time and location within the Salinas Valley would help address data gaps, provide datasets to analyze relative to industry and research findings, and offer the opportunity to develop prevention-based food safety systems.

View Appendix 3A for more information.

Action #4: Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

Work Group #4 was tasked with developing the fourth action item of California Agricultural Neighbors (CAN) titled "Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice" as highlighted in the 2022 CAN Action Report.

The goal was to establish a collaborative produce safety network and applied research capacity as well as outreach and education efforts essential for continuous learning and focused local action. Work Group #4 sought to gather responses from a set of participants via targeted interview questions. Participants were selected with a goal of representing subject matter experts from the various sectors and organizations active in produce safety throughout California. Facilitators developed a series of interview questions to evaluate the mechanisms potentially needed to restructure the training and education approaches in agriculture and produce safety, define the roles of each sector or entity, and identify funding allocation and distribution necessary and appropriate for short- and long-term objectives.

Work Group #4 met in a kick-off meeting in December 2023. Work Group goals (Appendix 4A) and expectations for future interviews were discussed. During the winter of 2023-24, 21 participants were individually interviewed online through video conferencing technologies. The interview process began with an introduction to the Work Group #4 objective and a display of the 10 interview questions. The facilitator captured responses by taking notes while participants addressed the questions. Upon completion of each interview, responses were reviewed and organized into four main categories: Gaps, Goals, Roles, and Funding. These categories identified common responses as well as novel ideas.

Action 4: Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

4.1 Research Capacity. Right-size the needed depth and breadth of experts to fully support farmers, ranchers, and agriculture neighbors in the Salinas Valley. Experts will need to have a multidisciplinary approach to collectively foster food safety, food security, and environmental sustainability with a One Health goal of achieving target health outcomes.

4.2 Research Funding Sources. Typical and non-typical funding sources and partnerships need to be pursued to support produce-specific research efforts. Researchers from allied fields of study / specializations should be actively engaged, particularly specialists in climate and weather patterns that might impact produce safety in the Salinas Valley and researchers who are able to study wildlife populations, migration patterns, and STEC carriage rates.

4.3 Capacity to Transfer Knowledge. Agricultural extension partners at land-grant universities, particularly including historically Black State colleges and universities and Tribal colleges, are valuable partners in providing research capacity and translating research findings into applied, science-based recommendations to industry. Non-traditional partners such as industry trade organizations should continue to be encour-

The Work Group #4 participant list was determined by the CAN Dialogue and Steering committees. Once selected, those individuals were invited to participate. Additional interviewees were suggested and selected based on approval from the Work Group #4 chair. Participants ranged from state and federal

regulators, technical assistance staff from UC Davis Division of Agriculture and Natural Resources (UCANR) and UC Cooperative Extension (UCCE), and industry representatives.

CAN was established in 2021 in response to a series of *Escherichia coli (E. coli)* O157:H7 outbreaks associated with leafy greens grown in the California coastal region (CDFA, 2022). CDFA and the Monterey County Farm Bureau led efforts to foster collaboration and discussion to protect public health through efforts shared among the production, processing, retail industry, agricultural industry, and regulatory entities to address the action items previously presented in this report.

Work Groups #1-3 established the background, the roadmap, and the data to model the implementation of a successful food safety culture in California. Work Group #4 was tasked with transferring the efforts and outcomes of Work Groups #1-3 into applied practices to help shape behavioral change in the agricultural industry.

CAN Work Group #4 sought to help right-size the required breadth of experts in order to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley, while also considering the need for a multidisciplinary approach to foster produce safety, nutritional food security, and environmental sustainability with a One Health approach of achieving target health outcomes. It became clear that there is no one office, person, or entity championing food safety, which has resulted in a scattershot approach and a capacity deficiency. CAN Work Group #4 has attempted to build the roadmap for food safety across California and attempted to fill in the gaps over a long-term timeline.

The outcomes from interviews included identifying CDFA or university as a primary facilitator, including a need for dedicated UCCE staffing in this area. A separate and distinct coalition, resulting from the needs assessment of Work Group #4, will continue this work by advocating for consistent baseline funding for long-term benefits. Efforts from Work Group #4 must be reviewed on a regular basis to ensure efficacy and efficiency, and the efforts must continuously align with the goals of what it means to be a part of California Agricultural Neighbors now and into the future.

View Appendix 4B for more information.

SUMMARY AND NEXT STEPS

The work that CAN accomplished in 2022-2024 filled gaps that previously were difficult to define, collaborate on, and identify progress for as the solutions cannot be solved by a single entity alone, instead requiring intense collaboration, vision, and an innovative One Health approach. Neighbor-to-Neighbor interactions are leading to critical solutions reducing pathogen risk while expanding the knowledge base of practices that will inform future decisions on safe food production.

Since inception in 2021 and the progress to date, the collective efforts of CAN recognize that the work of One Health and food safety is a lot more complex than initially thought. CAN recognizes that there is more to consider as we contemplate the next steps and future needs. Throughout the duration of CAN, there have been some notable sequential accomplishments that have allowed for progress at a local level shaping the future focus, vision, and next steps. The timeline of events includes:

- **2021**: CAN established a locally led, locally convened Dialogue Group and Steering Committee that has served as an important function for communication, discussion, learning, guidance, and to focus attention towards building a culture of proactive food safety.
- **2022:** Issuance of the CAN Report helped bring to light the more complex local needs, especially those that couldn't be solved by one entity alone but required a diverse group of invested stakeholders who were willing to look at the challenges and address them through a more wholistic approach.
- **2022:** The June 2022 CAN Action Report was oriented toward future progress, and as such, the four key areas rooted in actionable next steps helped lend to future thinking and advancement.
- **2023-2024:** Keeping with the spirit of CAN being a collaborative among stakeholders, the Action areas of CAN were further developed and moved toward implementation through Work Group efforts. The key areas to next steps and progress became more evident through the process of diverse stakeholder input, including the critical interplay between the efforts of each Action and ultimately the Work Group recommendations.

  The regular interaction of a Steering Committee and the Dialogue Group helped offer a proof-of-concept communication and collaboration model for California. Recognizing that the state has tremendous diversity in the commodities produced along with the production regions that support agriculture, CAN daylighted that this model of a Steering Committee lends value to the topic of food safety and One Health.

Fostering a culture of food safety amplifies the shared values, beliefs, and behaviors within a community that prioritizes and promotes the importance of food safety. CAN has looked beyond simply implementing food safety protocols and procedures emphasizing the integration of a food safety mindset into the community and everyday practices of individuals involved in production agriculture. In this way, CAN lends value to supporting and building upon the key next steps to foster a proactive culture of food safety and ensures that we remain focused and steadfast to keep the best interest and safety of consumers core in our endeavors.

While a summary of each Action Work Group is found within the body of this report, there are additional materials and supporting documents that are included within the appendices. As part of the next steps for the remainder of 2024 and 2025, CAN is focused on communication and outreach of the materials developed to date and presented in the June 2022, as well as this report. Opportunities to further communicate about the CAN resources, insights, and information will be through associations helping to connect membership, subject-specific webinars, in-person workshops, meeting engagement, and through

requests for proposals such as those requested for research needs. CAN will continue to meet as a Steering Committee in order to ensure that the outreach and communication needs are met with the specific intent of advancing food safety culture. Additionally, members of the CAN Steering Committee will continue to engage locally and nationally in order to support the initiatives and efforts of One Health in this critical area.

Throughout the coming year you can look to the partners helping to lead CAN (CDFA, MCFB, CCA, CFBF, LGMA, and WGA) for future planned outreach and education events, workshops, and producer and supply chain engagement opportunities to pursue the food safety engagement and practices laid out in this report. CAN will serve as an important communication and collaboration partner for the outcomes of the California Longitudinal Study (CALS) work also expected in the Fall 2025. The following areas highlight important next steps in order to help implement and support the efforts of CAN and building a proactive culture of food safety.

Next Step 1: Communication to broaden engagement that is supportive of a proactive food safety culture

Since its beginning in 2021, CAN has relied on a diverse group of designated stakeholders to develop a community-led effort and articulate with enough clarity and detail what needs to be done differently to improve food safety. CAN has reached the phase where impact will be achieved through engagement and participation of the broader community of the Salinas Valley and beyond. Accordingly, CAN is focused on continuing its localized Neighbor-to-Neighbor work, while also utilizing the most effective means of reaching out to a broader web of stakeholders to share insights, information, and plans for action.

Next Step 1: CAN Communication Goals

1.1 CAN is focused on the most effective means of reaching out to a broader web of stakeholders to share insights, information, and plans for action. Impact will be achieved through engagement and participation of the *broader community of the Salinas Valley* and beyond.

1.2 CAN seeks to explore different avenues of education, communication, and knowledge transfer through outreach to *all segments of the supply chain*, not only in the Salinas Valley, but across California, as well as nationally. Collaboration with other food safety initiatives will aid in sharing critical information that all segments of agricultural production will need to consider for their daily operational practices, as well as to encourage efficiency and deployment of resources effectively.

1.3 CAN will continue to *refine the message of "shared responsibility" for food integrity risk reductions* as CAN becomes an integral part of the food safety initiatives within federal, state, and regional agencies and organizations.

In a continuous improvement model, as new and on-going research leads to improved practices and areas where adulteration risk can be reduced or minimized, a large effort will be needed for ongoing communication of the outcomes and practice modifications needed to improve food integrity. Collaboration with other food safety initiatives will aid in sharing critical information that all segments of agricultural production will need to consider for their daily operational practices, as well as to encourage efficiency and deployment of resources effectively. Additionally, CAN seeks to explore different avenues of

education, communication, and knowledge transfer through outreach to all segments of the supply chain, not only in the Salinas Valley, but across California, as well as nationally.

In addition to specific actions recommended be taken, CAN will continue to refine the message of "shared responsibility" for food integrity risk reductions in the coming year, becoming an integral part of the food safety initiatives within federal, state, and regional agencies and organizations. It remains critical that a pathway to improvement can only be successful when knowledge transfers can be made, and acted upon, throughout the agricultural production sectors.

Next Step 2: Expanded research partnerships and leveraging data science to fill information gaps essential for more effective action

While zoonotic pathogens have been linked to leafy green outbreaks, it remains unclear which of the potential environmental transmission pathways, including water, dust, wildlife, and other potential vectors, are the most important in leading to contamination and under what conditions are these vectors importance. Simply put, understanding the risk associated with zoonotic pathogens, and circumstances that lead to changes in risk that fresh produce may be contaminated, need much more research. Relying solely on current grower hazard-based mitigation strategies such as set-back distances and other field-based practices do not allow for responsiveness to circumstances that may increase risk. In mixed agricultural systems, these circumstances may not be in control of the grower and may be a necessary part of the region's agricultural community (i.e., cattle movement). Accounting for how these circumstances impact the risk of environmental transmission of zoonotic pathogens and how to mitigate this risk requires collaborative and cooperative research with the region's agricultural partners.

Next Step 2: CAN Research Goals

2.1 Research that incorporates a holistic understanding of the region's community, its partners, their production activities, and potential shared impacts, will facilitate the development of mitigation strategies for reducing transmission of zoonotic pathogens that are pragmatic and effective for both leafy green growers and adjacent land operations. The research roadmap developed by Work Group #2 should be regularly updated with consideration routinely given to the local needs of producers.

2.2 Data science, including data-sharing initiatives and quantitative risk modeling, provide a promising path forward for assessing unique, complex agricultural ecosystems and hold merit towards advancing a culture of food safety.

2.3 Diversified research partnerships that include the Center for Produce Safety, USDA Agricultural Research Service, and CDC Integrated Food Safety Centers of Excellence hold future promise to addressing the needs of food safety in the multidiscipline area of One Health.

Such research, which incorporates a holistic understanding of the region's community, its partners, their production activities, and potential shared impacts, will facilitate the development of mitigation strategies for reducing transmission of zoonotic pathogens that are pragmatic and effective for both leafy green growers and (potentially) adjacent land operations. Data science, including data-sharing initiatives and quantitative risk modeling, also provides a promising path forward for assessing unique, complex agricultural ecosystems.

Specifically, research partnerships that include the Center for Produce Safety, USDA Agricultural Research Service, and Centers of Excellence hold future promise to addressing the needs of food safety in this area of One Health.

Next Step 3: Engagement of additional partners and collaboratives, including the California Longitudinal Study to accelerate translation of new information to action

The California Longitudinal Study (CALS) started in 2020 and is focused along California's coastal growing region. CALS is expected to be complete by fall 2025 and together CAN and CALS forge a valuable partnership of science and collaboration in the next steps ahead of enhanced food safety.

To start, CAN brings together vested stakeholders within the Salinas Valley agriculture community in discussions surrounding farm and rangeland management practices and potential food safety risks for exposure to field-grown crops adjacent to rangeland, compost operations, or vineyards. The work that CAN has accomplished recently has filled gaps that previously were difficult to define, collaborate on, and identify progress forward as the solutions cannot be solved by a single entity alone, rather require intense collaboration, vision, and a new One Health approach. CAN also serves in an important role to engage with additional subject matter experts and resources, such as those nationally at USDA ARS, regionally at a Center of Excellence, or locally.

Next Step 3: CAN Collaboration Goals

3.1 The California Longitudinal Study (CALS) is expected to be complete by the fall 2025 and together CAN and CALS forge a valuable partnership of science and collaboration in the next steps ahead of enhanced food safety.

3.2 The CALS effort aims to provide an extensive data set to evaluate trends or changes over time, including metagenomics that may yield important clues to the changes taking place in the microbial community in response to the changing environment of the California coastal region. This will help aid in proactive next steps towards enhanced food safety, including building upon the Quantitative Microbial Risk Assessment modeling efforts of Work Group #3.

3.3 Engage research organizations and/or policy partners to help ideate funding opportunities and potential solution-based outcomes that respect the diversity of agricultural production and public health with a vision towards proactive food safety outcomes.

The CALS approach serves as a model to: offer an adaptive research strategy; perform research on a large geographic area to better understand underlying causes of contamination in the production environment; provide a scientific basis for recommendations; offer information that guides the development of practical preventive controls; and, assist in solution-oriented outcomes. The CALS effort should allow growers and affiliates in the agriculture industry to understand prevalence of human pathogens in and around leafy green crop growing environments. These data can bring awareness to leafy green growers and their farming systems and allow the industry to respond to that awareness with practices and measures that ultimately help prevent foodborne illness. The study enables sampling to be conducted in priority regions, with attention to seasonal/temporal changes. It also aims to provide an extensive data set to evaluate trends or changes over time, including metagenomics that may yield important clues to

the changes taking place in the microbial community in response to the changing environment of the California coastal region.

The California coastal region is a richly diversified agricultural environment that leads the country's production of leafy greens and several other fresh produce commodities. The research efforts taking place in California are based on the globally supported One Health approach. One Health is a collaborative, multidisciplinary, systems-thinking approach that recognizes the health of people is interconnected to the health of animals, plants, and our shared environments. The One Health approach is also a fundamental component of the national Healthy People initiative, which guides health promotion and disease prevention efforts to improve the health of the nation. Healthy People 2030 (HP2030) is the latest release with objectives (of the Healthy People initiative) aimed in reducing Shiga toxin-producing *E. coli* risk in produce and leafy greens. Food safety is a shared responsibility, and CAN remains committed to enhanced produce safety efforts for Californians and beyond through active collaboration and engagement with partners.

Next Step 4: Investing in the future expertise and capacity to enhance transfer of knowledge from research into applied practice

We have learned through the CAN process that the traditional compartmentalization model of scientific disciplines or expertise has limitations in its ability to serve the diverse challenges of food safety. While subject matter expertise in one subject area certainly is still needed, there is a growing necessity to help fill pipelines with individuals who are diversified in their knowledge and can help work within complex interactive ecological systems. The efforts of Work Group #4 really highlight the importance of having individuals that hold expertise in a transdisciplinary understanding of food safety grounded in the principles of One Health.

Right-sizing the required breadth of experts to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley entails ongoing efforts for an entity to help lead this work. It became clear through the outcomes of Work Group #4 that there is no one office, person, or entity championing food safety, which has resulted

Next Step 4: CAN Knowledge Transfer Goals

4.1 Right-size the required depth and breadth of dedicated experts to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley utilizing the roadmap laid out in the white paper written by Work Group #4. The roadmap highlights the need for a key entities to help lead the work, as well as suggests an advisory framework to represent all of California agriculture's interests tied to produce safety.

4.2 Foster development of individuals who hold expertise in a transdisciplinary understanding of food safety and are diversified in their knowledge who will help fill research, extension, and outreach pipelines. This can help work within complex interactive ecological systems and grounded in One Health. Traditional compartmentalization models of scientific disciplines or expertise has limitations in its ability to serve the diverse challenges of food safety.

4.3 Organize a separate and distinct Coalition that can help identify the funding support needs of the local region and also advocate for these needs at a state and national level. Consideration for this type of food safety baseline funding and also long-term investments can help make incremental advancements towards the collective future vision and foster adoption of a proactive food safety culture.

in a scattershot approach and a capacity deficiency. The outcomes from interviews conducted as part of Work Group #4 included identifying CDFA or university (or both) as a primary facilitator, including a need for dedicated and expanded Cooperative Extension staffing in this area. CAN Work Group #4 has attempted to build the roadmap for food safety across California and made an effort to fill in the gaps over a long-term timeline.

A separate and distinct coalition, resulting from the needs assessment of Work Group #4 is recommended as an important next step. As such, the coalition can hone in on the support needs of the local region and also help advocate for these local needs at a state and national level. Consideration for this type of food safety baseline funding and also long-term investment can help make incremental advancements towards the future vision. It's recognized that the efforts from Work Group #4 must be reviewed on a regular basis to ensure efficacy and efficiency, and the efforts must continuously align with the goals of what it means to be a part of California Agricultural Neighbors now and into the future.

Final Thoughts

The need for shaping and encouraging a culture of food safety has never been more profound. Implementation of the Food Safety Modernization Act (FSMA) has challenged growers on many levels. Sets of rules can be subjective and intentionally written to be flexible, but that requires an understanding of trade-offs or where more information may be needed for appropriate risk modeling and intervention strategies. Food safety work is a process of continual improvement based on knowledge gained, insights translated into implementable actions, and processes refined.

The California Agricultural Neighbors' unique contribution towards enhanced food safety is the collaboration between and among neighbors, and thus the whole community, to take actions resulting in reduced risk of microbial contamination. Prioritized actions are expected to be science-based, clear, and compelling for addressing factors relevant for improving food safety.

The dynamics of fresh food production, particularly quick-turning crops such as leafy greens, emphasize the need for collaborative solutions that are both supported by science and implementable in a short production window. Salinas Valley producers continue to explore new dynamics to reduce risk, now including their neighbors, but many data and research gaps need to be further explored to ensure that what is ultimately put into practice is based on sound science and viable outcomes.

California's farmers and ranchers play an outsized role in contributing to nutritionally dense produce and protein products that make their way into consumers' hands each and every day. Food safety has grown in complexity as the science has evolved, and yet we recognize that food safety is a shared responsibility. A safe and abundant food supply affords food security, and food security is cornerstone to national security. With a finite amount of agriculture land, it is important to render decisions using science while also considering the needs of the population. Recognizing that the average consumer continues to be further removed from agriculture production, it becomes important to communicate the alternatives being considered – one way CAN has begun to explore is using risk models. This approach helps to preserve the future opportunity to source the abundance of food choices we know today domestically under the highest food safety standards and avoids overly broad interpretations or visceral reactions that have irreparable consequences to our nation's food supply and the economic viability for farmers, ranchers, and communities that depend on this future success to feed our nation and yield positive population health outcomes.

APPENDICES

Appendix 1A

CALIFORNIA AGRICULTURAL NEIGHBORS

Action #1 Work Group: Neighbor-to-Neighbor Interactions and Conversations

CHARTER

Purpose

This charter establishes the California Agricultural Neighbors (CAN) Work Group that will develop a template to facilitate and aid in neighbor-to-neighbor dialogue about food safety practices and potential risk areas.

Work Group Objectives

This Work Group will develop talking points that will aid in 'getting the dialogue started' from the different viewpoints of growers, ranchers, vineyard managers, and compost providers. This will also involve a sharing of terms that are commonly used in agricultural, husbandry, and vineyard production.

Work Group Background

This Work Group will support the first strategy of CAN as highlighted in the Action Report issued in June 2022: Foster Neighbor-to-Neighbor Interactions and Dialogues. This will be accomplished by building a collaborative network necessary for collective input and impact, including the research capacity essential for continuous learning and focused local action.

As part of the process leading to these actions, CAN established a common understanding of key terms; a move to fill knowledge gaps through building a vision for future efforts with recommendations, considerations, and opportunities; and, perhaps most importantly, recognizing that productive action toward common goals is dependent on the goodwill engendered by continued dialogue among those who are vested agricultural stakeholders in the Salinas Valley. More specifically these actions include:

1.1. Sharing the CAN glossary of terms in order to help foster a common understanding of terms used in specific agricultural production practices.

1.2. Collaborating with partnerships noted in the CAN Outcomes Table that foster a culture of awareness in specific categorical areas. Prioritization into near-term, mid-term, and long-term was done largely on a practicality basis using work group quantitative input related to probability of successful implementation and impact of implementation.

1.3. Creating a Discussion Template as an immediate and valuable next step to the ongoing work of CAN. This will help support neighbor-to-neighbor dialogue about individual production practices and annual or other patterns of those events. This report presents action steps for good neighbor-to-neighbor communications on seasonal activities,
outlines other action steps toward food safety integrity, and defines knowledge gaps that require further research and collaboration.

Several areas identified in the CAN Outcomes Table note that specific research would be needed in order to delineate the appropriate recommendations. A work group was formed composed of academia, industry, and government to explore a systemized approach (e.g., a roadmap) to filling these research knowledge gaps. The work group identified that progress towards near-term outcomes requires an end-to-end framework for near-term effort, adapted into future processes, and accounted for in resource needs (both personnel and funding) and future requests for these needs.

The Working Group charges are focused on developing key talking points for the discussion template and noting where anecdotal conversations or examples have proven valuable to progressing the conversation among neighbors, providing guidance for documenting the dialogues utilizing the template format, and provide common language that is understood by both sides of the fence.

Work Group Goals

- The first goal of this project is to develop a dialogue template that reflects key points of food safety concerns and risks when varied agricultural operations are sharing a fence or are in proximity of each other.
- The second goal of this work group is to identify the pathways for outreach of the dialogue template developed.
- Finally, the Work Group will also develop a statement of value for the participants (neighbor-to-neighbor) that fosters initiation of the food safety discussions.

Work Group Team

The Work Group will consist of Strategic Partners from federal, state and local agencies, associations, private industry, academia, nonprofit, advocacy groups, as well as farmers (growers), ranchers, vineyard managers, and compost suppliers.

Chair: Afreen Malik, WGA
Co-chair: TBD

Work Group Operations

The Work Group chair and co-chair will define the approval mechanism for project objectives.

This Work Group will meet regularly to formulate concepts, ideas, and template recommendations into a working draft document.

The charge to the Work Group will be to propose a draft discussion template and communication plan to the CAN Steering Committee. This will include providing monthly updates to the Steering Committee during the development process.

Assumptions:

- Neighbor-to-neighbor dialogues are difficult to initiate, and possibly uncomfortable.
- Many growers do not know what to ask of their rancher neighbors, and vice-versa.
- Documentation of neighbor-to-neighbor dialogues on food safety risk management may become part of this template process.
- Challenges with land lease turnover will necessitate multiple dialogues, at least at the beginning of the growing season
- Farmers are reluctant to share proprietary growing agronomics.
- Compost use is not widely understood.

Strategies if the Assumptions Above Are Determined to be True:

- Initiate outreach to 'boots on the ground' to determine which talking points will ease the start of a dialogue.
- Find work-arounds for proprietary agronomic situations that allow for food safety dialogues to yield valuable outcomes.
- Determine best ways to document and retain dialogues between neighbors.
- Pilot the template developed with a small subset of agricultural operations (growers, ranchers, vineyards, etc.) in order to determine applicability and usefulness.

Work Group Deliverables

- Discussion Template draft will be presented to CAN Steering Committee at November 29, 2022 meeting for final approval.
- Communication plan for template will be presented for review to CAN Steering Committee at November 29, 2022 meeting.

Appendix 1B

Neighbor Introduction Letter

Date:

Dear Neighbor:

I am your neighbor at the following locations and a vegetable farmer {or any other stakeholder}. [enter farm location(s) here]

Since we are neighbors, I want to introduce myself and see if you'd be interested in meeting and learning more about each other's operations. We both conduct business in the Salinas Valley and I think there are things we can learn from each other about food safety. To that end, I would appreciate an in-person meeting at a local café or any other location of your choice.

Thank you for considering my request and I look forward to hearing from you soon. I can be reached at {phone number} or via email at {email address}.

Sincerely,

{Farmer name}

{Preferred contact information}

Appendix 1C

California Agriculture Neighbors

Ag Neighbor Dialogue Practices

The following general guidance points are designed to help maintain a productive and ongoing dialog between neighbors regarding food safety related matters.

Do's

1) Do thank the neighbor(s) for their willingness to engage, participate, and collaborate in the process.
2) Do practice good listening skills, i.e., do ensure that it is a two-sided conversation.
3) Do have a basic plan of conversation points for scheduled meetings and be respectful of your neighbor's time.
4) Do practice consensus building and have an empathetic mindset.
5) Do leave the door open for continued ad hoc and routine communication (potentially on all neighbor topics not just food safety).
6) Do take a measured and adaptive approach. Assess your interaction before re-engaging with neighbor.

Don'ts

1) Do not use inflammatory or accusatory language and do not attempt to lay blame.
2) Do not attempt to audit/judge the neighbor's operations and issue non-conformances.
3) Do not hypothesize about the cause of an issue, e.g., an outbreak, without the evidence to support the hypothesis.
4) Do not try and cover every issue in one meeting (not a one and done situation).

Appendix 1D

California Agricultural Neighbors
Steps to Success

Step 1: Identify Your Neighbor:
- Same landowner
- Lessee
- Separate land uses and ownership

Resources to Identify Neighbors
- LGMA
- Farm Bureau
- Cattlemen's Association
- County Ag Commissioner
- Online paid subscriptions (ParcelQuest/Onyx)

Step 2: Engage
- Send a letter and meet in person
- Work with an independent mediator
- Reach out at functions like Ag office meetings

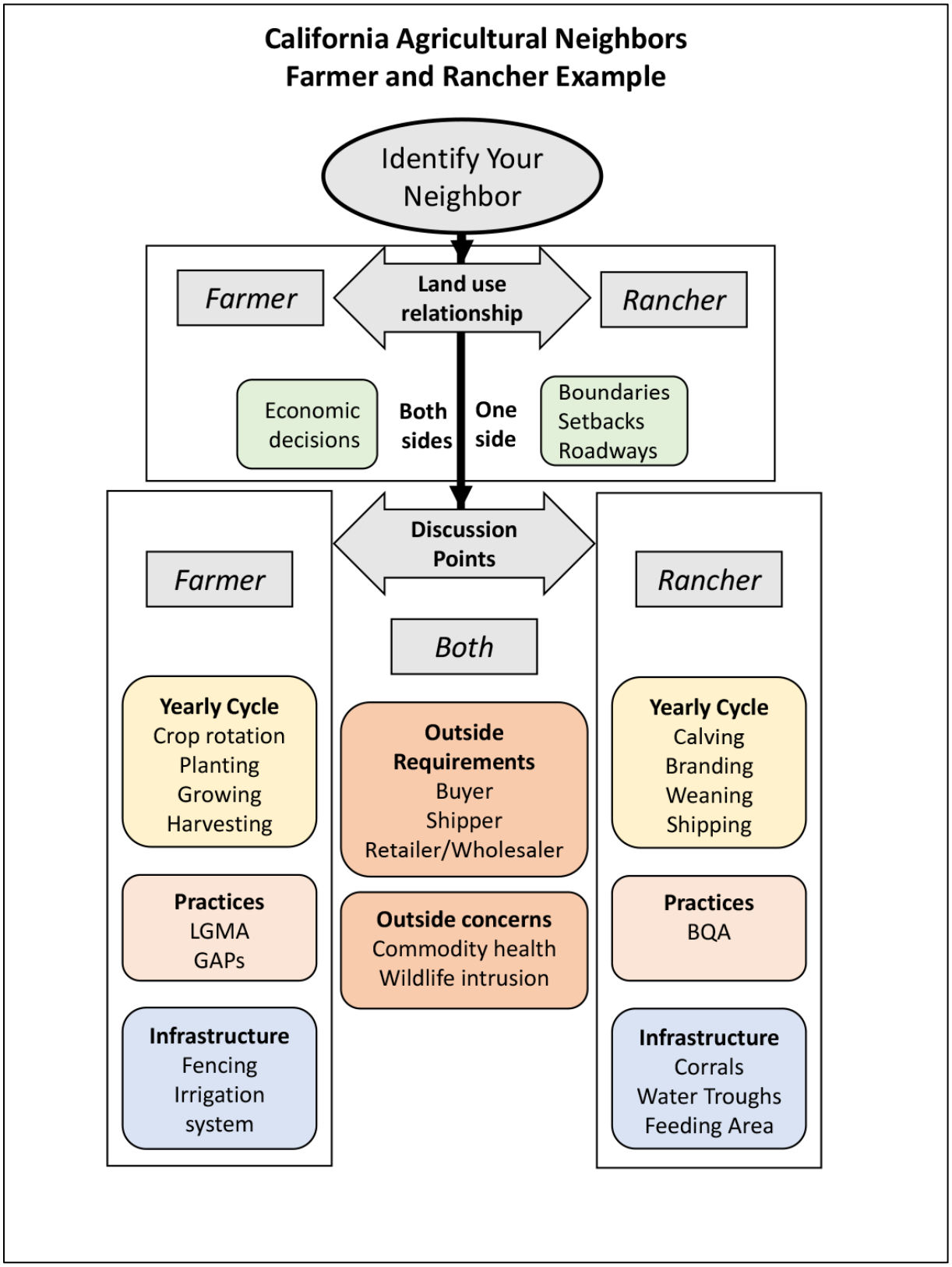
Resources to Engage
- CAN template introduction letter
- Mediators include LGMA, Farm Bureau, Cattlemen's Assoc., County Ag Commissioner, other neighbors.

Step 3: Discuss Common Issues
- Review CAN value proposition
- Think about how to keep the discussion positive and productive
- Find topics that may be useful in template discussion points

Resources for Discussion
- CAN value proposition
- CAN *Do and Don't* guidance
- CAN template discussion points

Step 4: See What Success Looks Like
- Improved relationships in food safety awareness
- Collaborative decision making

Continued – **Appendix 1D**



Appendix 1E

CAN Value Proposition

1. The long-term economic viability of the Salinas Valley involves a diverse set of stakeholders including leafy greens grower/shippers, cattle ranchers, vineyard managers, compost processors and others. Collaboration amongst these stakeholders is important for a multitude of reasons including continued civic development in the area, attraction of more businesses, availability of skilled workers, ongoing community services such as educational and medical facilities, and an overall continuation of quality of life. By standing together and communicating effectively, the entire community of the Salinas Valley is strengthened.
2. By working together, stakeholders can strive to improve food safety. Being a good neighbor in the interest of protecting consumer health is the right thing to do. We consume the products we cultivate and raise; it seems logical to ensure the safety of foods we feed to our families and families across the nation/globe.
3. A collaborative approach which leans on multi-generational local experience and knowledge, as well as the best available science, toward neighbor-to-neighbor conversations regarding best management practices that will benefit all neighboring operations "on both sides of the industry fence" will result in practical, effective, and efficient food safety solutions.
4. Neighbor to neighbor conversations will lead to refinement and innovation of best practices via direct stakeholder input, especially in collaboration with academic institutions such as UC Davis or other credible institutions.
    a. The industry needs a better understanding of how to reduce risk of illness to the consumer, while minimizing threats to the financial stability of all operators in the Salinas Valley esp. in the face of many uncertainties due to evolving regulatory and audit requirements.
5. This approach is proactive versus reactive, meaning that the risk of increased regulatory pressures and customer-specific supply chain management programs can be mitigated.
6. Specific outcomes from these conversations will be win-wins for all/multiple stakeholders as mutually beneficial solutions are discovered.
    a. This will ultimately lead to a reduction in food safety incidents, which will in turn:
        i. Reduces regulatory oversight for all parties.
        ii. Reduce negative media coverage for the area and local businesses.
        iii. Potentially reduce the need to implement higher-cost solutions that may not be scientifically validated or practical.
        iv. Potentially help in other projects outside of food safety like sustainability, environmental management and biodiversity.

Appendix 1F

1	**Discussion Point: Methods to notify neighbors and establish meeting schedule**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	If the land is leased for growing, the grower might not know who operates what sort of activity on the other side of the fence. ***Topic*** *(to land owner): Are you able to tell me more about activities on neighboring land? It would help us get in contact and sometimes meet to talk about cross-fence considerations.*	**Cattlemen**	If the cattle rancher owns the land and leases the other side of the fence for other ag activities (leafy greens), they know the lessor and are able to be in contact. If the landowner is leasing the land for both cattle and leafy greens, the lessee should provide contact information. If land is individually owned, cattle are on one side and leafy greens on the other, mutual respect with regards to food safety should be addressed. ***Topic****: I want to be a good neighbor. Can we set up a regular conversation to talk about our borderland and how we can work together?* - *What activities would be useful for you (neighbor) to know about?* - *Who do I contact to inform about those activities?* - *How far in advance would be useful to know?*
		Vineyard	Might be similar to cattle with minor adjustments
		Composter	Might be similar to cattle with minor adjustments
		Other	
2	**Discussion Point: Mutual awareness of events schedules**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Some activities on neighboring land might allow pathogenic bacteria to grow, or to get carried into leafy greens growing areas. ***Topic:*** *I have a challenge and I need your help finding a solution. Can we talk about ways we can work together to better understand and address these challenges that I am facing?*	**Cattlemen**	Pathogenic bacteria are everywhere and can also be a risk to the beef cattle industry. If a defined safety zone has been established, and the possibility of pathogens exist then we need to discuss what your management practices are and timing of your crops compared to my livestock activities. ***Topic:*** *Let's talk about livestock management and BQA training already do to reduce stress in cattle and how that may reduce pathogens that our cattle could potentially carry* - *Explain the basic rhythm of the operation.*
			- *What types of activities may have the potential, however remote, to move bacteria off my property. Are these things that can be controlled?* - *What types of activities may have the potential, however remote, to change how much bacteria might be on my property.* - *What things might cause bacteria to move around that cannot be changed?* *What types of activities are particularly sensitive to bacteria, regardless of where it may come from.*
		Vineyard	We understand that the sugars and other residues of our crop and processing practices can allow pathogenic bacteria to grow, and can attract pests and other wildlife that cross boundaries. ***Topic:*** *What time of year is especially sensitive to the greens growers?*
		Composter	Poop is our business. We take this waste product and we convert it into a resource to build soil health, improve plant health, in a low-risk way. ***Topic:*** *I'd like to share our practices to kill off pathogens, and to keep the untreated material on our property until it is fully treated*
		Other	**Wildlife management:** ***Topic:*** *How can neighbors collaborate to manage the populations of pests and other wildlife* **Climatologist:** ***Topic:*** *What do we know about weather patterns and how they affect runoff, wind, and wildlife movement?*
	Discussion Point: Communication of off-season activities		
	LGMA Grower Perspective:	**Other Perspectives:**	
	For Salinas, the actual off-season generally is limited to one month (December) but the low-risk	**Cattlemen**	Wildlife and cattle coexist on the landscape manage by the cattle producer 12 months a year. Livestock activities were defined into 4

	period, when relevant outbreaks historically are less common, extends from December through about August. LGMA requires growers to know certain things about adjacent land that can be challenging. For example, when not concentrated and visible it is difficult for a grower to know how many animal units are on adjacent land. Similarly, prior land use or adjacent land use (including disking in crop residues) can attract birds or other pests which are poop-generators and may carry hazards. The grower is motivated to keep these animals away from growing crop. The grower might focus on things such as: What are some off-season activities on neighboring lands that could potentially affect my upcoming plantings? What are some off-season potential weather events? How is off season defined for my neighbor's operation? ***Topic**: This is what off season means to me. Do you have an off season? If so, what activities occur in your off season? If you have a year-round operation, what activities are occurring in your operation during my off season?*		periods of time, each with its own unique circumstances and challenges. Review of the CAN document and webinars that were presented hold value in explaining the seasonality of the livestock operations. Off-season is July-August and Feb-March for livestock (animals are less concentrated in these seasons rather than gathered together actively)
		Vineyard	
		Composter	
		Other	
4	**Discussion Point: Implementation of various BMPs**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	LGMA growers operate with 'requirements' (audited) and 'best practices' (not audited). Best practices include knowing wassup on neighboring land and the recommendation to assess risks all the time. The only explicit BMP related to neighboring land relates to regulatory CAFOs. LGMA Appendix I risk assessment includes distance-based and landscape considerations related to animal activity on neighboring land. These are not requirements. The Appendix I assessments help determine whether conditions are 'risky' and warrant pre-harvest testing which is an expense. Appendix I, not the LGMA Metrics, contains the 800 foot (hobby farm) and 1200 foot (grazing land) setback criteria. This can happen most effectively once there is a good understanding between operations and alignment on which BMPs might minimize risk to leafy green crops. ***Topic:** None yet identified*	**Cattlemen**	Cattlemen do their best to minimize stress in livestock as outlined in the BQA program. Science has shown that reduced stress reduces shedding of STEC. - What things are done to reduce stress? - Are there feasible things that can be done to separate stress events from neighbors? Rangeland operations have seasonal fluctuations in density measured as animal units/acre. Density goes down during 'grazing' periods, and increases during 'gathered' stages of rangeland production. BQA helps focus on how to reduce stress during concentration/gathering times. ***Topic:** None yet identified*
		Vineyard	
		Composter	
		Other	
5	**Discussion Point: Practices related to contractors and visitors**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Contractors and visitors include: • Irrigation contractors • Pesticide applicators • Weeding crews • Portable toilet service • Harvest FLCs LGMA growers are more worried about practices on adjacent lands during harvest season, when contractors and visitors also peak.	**Cattlemen**	Security and Bio security is a top priority. Locked gates, good fences and no trespass signage. No need for outside contractors. Outside personnel are allowed on property during times of branding and weaning . Limited in number and at times of low risk for food safety. Well aware of visitors/contractors from a hygienic perspective for biosecurity reasons (e.g., FMD)
		Vineyard	
		Composter	

	Growers are required to develop and communicate robust supplier/service provider approval and monitoring programs. Similar requirements exist for visitors. Both visitors and contractors are required to follow BMPs when on farms. ***Topic**: Do my contractors/visitors pose any risks to your operation? Do you often have contractors and visitors and how do you manage this?*	**Other**	Contractor: We have a rotating crew of workers, but we always train them before sending them out to perform the service. ***Topic**: What do you need us to add into our training materials to meet your needs?*
6	**Discussion Point: Use of public/private roadways**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Growers realize that other users of shared roadways may present a hazard to their crops because of what can be carried on tires to the property. They also understand that more research is needed to understand risk factors and risk management practices. Some of those practices may be: 1) Awareness - communicate with your neighbor when this heavy use may occur so mitigation steps may be employed (dust abatement, minimizing farm activity to reduce the potential for farm equipment cross-contamination, etc.); 2) Reduce vehicle speed to minimize dislodging of potentially contamination materials; 3) Adjust timing of activity (if possible) to align with these mitigation steps and/or on-farm activities	Cattlemen	There are operational and economical limitations to how much cattlemen can abstain from using the roads. Much like the produce operations, cattle operations use large semi type trucks and trailers to move our commodity generally only once a year in the spring. Stocker operations may also receive cattle in the fall and remove them in the spring. It is important to keep in mind that public roadways are public. If private roadways are involved then times of use should be addressed by both sides. This may be an 'easy win' for cooperation – it doesn't cost the cattleman anything to cooperate with grower schedules. Coordination of activities is one reason to reach out and having a conversation with the grower(s) that are part of the conversation. Flexibility can go both ways; the livestock operation may also ask for flexibility in timing from the grower or packer/shipper or assistance defining acceptable alternate routes. ***Topic**: How can we manage our traffic patterns or equipment to minimize the poop on the road at sensitive times for greens growers?*
	4) Cover loads with tarps, and be aware of spatter-potential from wet roads in early morning dew/fog or rain events; … ***Topic:** Can we talk about the roadways that we both use (public and private lanes) and how we might work together to minimize the potential for hazards on those roadways?*		- *When does the road need to be used for produce and when for cattle?* - *How much time is best in between uses?*
		Vineyard	
		Composter	I have a year-round business and I have to get raw materials and shared equipment from point A to point B to get raw materials and deliver products. ***Topic**: Is there anything about our traffic patterns or equipment use that might be of concern related to roadways, especially at sensitive times?*
		Other	Contractor: We're paid to perform a service and it's not in our budget to clean and sanitize equipment. ***Topic**: How can you help us reduce risk and stay 'in the black' financially? Are you willing to pay extra fees to have us clean and sanitize at your farm gate?*
7	**Discussion Point: Wildlife management**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Not all farms require wildlife management. Farms adjacent to riparian zones or natural vegetated areas may experience higher wildlife pressure. We recognize that wildlife is part of the natural environment and have mitigation policies in place when intrusion occurs. Depending on the level of pressure and type of pest, or the potential for cross contamination from adjacent land, actions may vary from creating a buffer around affected area to acquiring depredation permits for animals such as wild hogs. How do my actions impact my neighbors? How do my wildlife management	Cattlemen	Wildlife exists on the same landscape that the rangeland livestock operators manage and provides for the economic benefit of the community. Wildlife are present year-round and utilize exisiting natural resources to survive in this landscape. The cattle operator should not be held responsible for the elimination of wildlife. Who pays to Utilize the services of contract personnel to trap and dispose of pests and wildlife. - Do unmanaged buffer zones make the wildlife and pest issues worse? - Are there ways to use managed grazing to actually reduce the likelihood that the buffer zones become wildlife/pest reservoirs?

	programs impact my neighbor? Could we potentially work synergistically? ***Topic:*** *This is what I am doing in my program. How do you address these challenges on your side of the fence? can we learn from each other and help each other?*		- What wildlife is of the greatest concern when they get into produce fields?
		Vineyard	
		Composter	
		Other	Topic- at what times of the year is there an increase in wildlife activity that may posses a heightened threat to Food Safety.
8	**Discussion Point: Handling and storage of raw materials**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Raw materials = compost? Compost is stored on farm for a short time prior to application. We can work with our contractors to further minimize this storage period. Each compost delivery is accompanied by a certificate of analysis for pathogens of concern. The compost is treated using scientifically validated methods and tested by the supplier. Compost applications occur under appropriate weather conditions (i.e., not applied during high winds) and applicators are educated to help reduce the risk of cross contamination. ***Topic:*** *Is there something I can be doing better to help you?*	Cattlemen	We do not utilize or produce any raw materials that may be in question to Food Safety.
		Vineyard	
		Composter	
		Other	
9	**Discussion Point: Soil inputs and formulations**		
	LGMA Grower Perspective:	**Other Perspectives:**	
	Soil inputs: compost/lime/gypsum/guano. Similar to above	Cattlemen	We do not utilize any services that would contribute to this section/.
		Vineyard	
		Composter	
		Other	

Appendix 2A

CALIFORNIA AGRICULTURAL NEIGHBORS

Action #2 Work Group: Build a Research Roadmap for the Salinas Valley

CHARTER

Purpose

This charter establishes the California Agricultural Neighbors (CAN) Work Group that will develop a research roadmap for the Salinas Valley in order to help further knowledge and enhance or streamline food safety practices in order to maximize their effectiveness.

Work Group Objectives

This Work Group will build upon the research areas identified in the California Agricultural Neighbors Action Report with a focus on addressing the outstanding priority research questions around pathogen introduction, amplification, survival, and movement for the Salinas growing region and to inform additional actions necessary to enhance food safety. The roadmap created by this Work Group should also consider other research projects underway (SCRI, CALS, CPS) and how those projects can be utilized in this framework towards next steps. The research roadmap created by this Work Group will help inform a QMRA model (Work Group #3) and building research and education capacity (Work Group #4); therefore, one should not be considered without the other.

Work Group Background

This Work Group will support the second strategy of CAN as highlighted in the Action Report issued inJune 2022: Build a Research Roadmap for the Salinas Valley. This will be accomplished bybuilding a collaborative network necessary for collective input and impact, including the research capacity essential for continuous learning and focused local action.

The Food Safety Modernization Act (FSMA) has reshaped our thinking and approach to food safety with a crucial shift of focus from response to prevention when it comes to foodborne illness. FSMA requires individual produce growers to make risk-based assessments and determine what preventive measures are appropriate for their unique operations. One reoccurring theme in the CAN Dialogue Group was the desire to begin by identifying the science-based facts and knowledge needed by growers and ranchers to have informed good Ag neighbor conversations to enhance produce safety in this localized region.

A research roadmap can serve as a tool to break intractable problems into subcategories to help with research planning and to specify milestones and pathways to those milestones. In one way, the process of CAN, using the CAN Outcomes Table, has helped to initiate the first step of this process by compiling a range of scenarios and noting where additional analysis or information is required before a decision can be made.

The CAN process established a foundation of information that is available, and recognition of information that is needed, in key areas. The overall goal is to understand landscape processes sufficiently to guide decision making at present and into the future. Processes represented in the research roadmap for which actions need to occur, include the following:

2.1. Introduction of pathogenic *E. coli* to host populations, and re-introduction into the environment in a cycle that leads to continuing exposure and outbreaks.

2.2. Amplification of pathogenic *E. coli* within host populations, following introduction, and through conditions that may allow for regrowth in growing lands and adjacent lands. Amplification may lead to increased exposure of leafy green crops to pathogens.

2.3. Survival and persistence of pathogenic *E. coli* under various conditions that do not allow for amplification, but which do allow more time for transport opportunities and intersection with leafy green crops.

2.4. Mechanisms of movement and transport of pathogenic *E. coli* across the landscape, including by air, water, animals, and machinery.

Work Group Goals

- The first goal of this project is to develop a research roadmap that focuses on addressing the outstanding research questions around pathogen introduction, amplification, survival, and movement for the Salinas Valley growing region.
- The second goal of this work group is to identify how the roadmap will leverage the work of other research projects currently underway.
- Finally, the Work Group will identify how the key areas of research will aid in supporting a QMRA model and inform capacity building priorities for research, outreach, and education.

Work Group Team

The Work Group will consist of Strategic Partners from federal, state and local agencies, associations, private industry, academia, nonprofit, advocacy groups, as well as farmers (growers), ranchers, vineyard managers, and compost suppliers.

Chair: Sonia Salas, WGA
Co-chair: TBD

Work Group Operations

The Work Group chair and co-chair will define the approval mechanism for project objectives.

This Work Group will meet regularly to formulate concepts, ideas, and recommendations into a working draft document.

The charge to the Work Group will be to propose a draft research roadmap to the CAN Steering Committee. This will include providing monthly updates to the SteeringCommittee during the development process.

Assumptions:

- Current research may be present but lacking the specificity to address current needs.
- Non-traditional, unique expertise may need to be consulted.
- Research for some of California's needs may already be occurring.
- Specific research needs for adjacent lands in the Salinas Valley may be desired to manage data gaps that exist in local land use conditions.
- Efforts of Work Group #2 are closely tied to Work Group #3 and #4.

Strategies if the Assumptions Above Are Determined to be True:

- Initiate outreach to 'boots on the ground' to determine the most pressing research questions to be answered.
- Determine best ways to document and retain what is missing for specificity in the current research.
- Engage with non-traditional expertise including, University and industry expertise (growers, ranchers, climate experts, equipment manufacturers, etc.).
- Manage research projects to avoid duplicative use of resources and available funding.
- Notate opportunities for collaboration with Work Group #3 and #4.

Work Group Deliverables

- Research roadmap draft will be presented to CAN Steering Committee at April 25,2023 meeting for final approval with interim updates leading up to the final discussion.
- Communication plan for broader dissemination of roadmap to stakeholders.

Appendix 2B

RESEARCH ROADMAP

FOR SALINAS VALLEY, CA

California Agricultural Neighbors (CAN) was established in 2021 in response to continued outbreaks of pathogenic *Escherichia coli (E. coli)* O157:H7 associated with leafy greens in the Salinas Valley. The California Department of Food and Agriculture (CDFA) and Monterey County Farm Bureau (MCFB) have led efforts to foster collaboration and discussion to protect public health through efforts shared among the production, processing, retail industry, agricultural industry, and regulatory entities to address the following action items:

Action 1: Foster Neighbor-to-Neighbor Interactions and Conversations
Action 2: Build a Research Roadmap for the Salinas Valley
Action 3: Create a Quantitative Microbial Risk Assessment (QMRA) Framework
Action 4: Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

CAN efforts are supported through the California Farm Bureau Federation, California Cattlemen's Association, Western Growers Association, and the California Leafy Green Marketing Agreement to help with facilitation services provided by RESOLVE.

CAN was formed with three key goals in mind:

1. Identify practices for agriculture neighbors that can potentially help enhance food safety and improve public health and trust.
2. Document the broader challenges of the California regulatory landscape that impacts produce growers, cattle ranchers, vineyard managers, compost processors, and wildlife management differently, and that may result in regulatory silos with competing or conflicting demands with produce food safety practices.
3. Develop accurate messaging to enhance education and adoption of continuously improving food safety practices founded in science, while acknowledging that simple neighborly courtesy measures of communication can have beneficial, lasting impacts.

Work product of Action 2 is presented in this document as a Research Roadmap for the Salinas Valley agricultural production area of the Central Coast of California.

Each Research inquiry is presented as a statement or question, along with a priority ranking (high, moderate, or low); notes on feasibility and other implementation considerations; data and information gaps identified (wish list of needed research); on-going and/or in-process research leads; and, published/completed documents relevant to the research inquiry (with a focus on seminal studies and review articles).

Research Priority Rankings: Informed Opinion to Guide Research Prioritization	HIGH: research likely to provide solutions or enable actionable knowledge. MODERATE: research likely to result in knowledge gap-filling or long-term solution. LOW: researchable question unlikely to be defined, meaningful, or implemented.

I. Introduction/Re-introduction

RESEARCH INQUIRY:
Non-cattle source introduction: Would an *E. coli* O157:H7 vaccine administered to cattle help control transference between populations of other species? Would animal reservoirs other than cattle (e.g., deer, feral hogs, and domestic hogs) ultimately hinder the ability of vaccine interventions to decrease overall re-introduction of *E. coli* O157:H7 into the environment over long timeframes?

PRIORITY RANKING: Low, a question needing an answer, but this is almost impossible to research.

Notes: Extremely challenging to do, given the vastness of the area, the different infrastructure involved. We still don't know which is the source and which is the vector (e.g., rodents, deer); very unlikely to be feasible as field research.
Data/Info Gaps: none identified.
Ongoing Research: none identified.
Published Documents: Wildlife species have been studied, but certainly nothing in terms of the effect of the vaccine on shedding in other species and the ecology of pasture/feedlot and surrounding environments.

RESEARCH INQUIRY:
Non-cattle source introduction: Does re-introduction to the environment explain year-over-year outbreaks and other detection events involving the same strain? Are those particular strains able to amplify in an environmental niche? Are we missing this possibility because of the intensive focus on manure and other feces?

PRIORITY RANKING: Moderate/High, more exploratory research is needed; not known if research can produce needed answers.

Notes: Would include both lab and field studies in a stepwise process involving feedback loops. Should include: persistent environmental reservoir or re-introduction; genomic and bioinformatic analysis and intensive effort to collect environmental isolates in the region (access to private land may be limited and prevalence rate of STEC in environment may lead to low success rate for detection and isolate recovery).
Data/Info Gaps: Is there an environmental niche outside a host that allows STEC to propagate? If focused on the recurring STEC strains (REPEXH02 specifically) then evidence for environmental amplification is currently very sparse; genomic studies to date have shown very limited to no diversification, which can have multiple explanations: 1) no growth, hence no mutations or 2) a highly stable genomic base due to environmental selection for no core mutations.
Ongoing Research: Landscape surveys ongoing; e.g. tree nuts – there may be environmental niches that are not related directly to the presence of animals; agricultural practices, soil amendments, compost; will the right conditions result in STEC regrowth? FDA studies – how soil amendments enhance growth of accidental introductions from wildlife. Current evidence argues against soil as a reservoir and very limited growth in non-host associations. Also, no outbreaks or isolation of the REPEXH02 strains from product or environment since 2020 … so is this still a priority focus as compared to a broader STEC issue of concern? Research on-going at CDC.
Published Documents : Liao et al. 2021. Adjacent terrestrial landscapes impact the biogeographical pattern of soil *Escherichia coli* strains in produce fields by modifying the importance of environmental selection and dispersal. *Appl Environ Microbiol.* 87(6):e02516-20.
Studies available on heat treated poultry pellets that enhance *E. coli* and other pathogens. Litt et al. 2021. Temporal and agricultural factors influence *Escherichia coli* survival in soil and transfer to

cucumbers. *Appl Environ Microbiol.* 87(7):e02418-20. Limoges et al. 2022. Differential survival of *Escherichia coli* and *Listeria* spp. In Northeastern U.S. soils amended with dairy manure compost, poultry litter compost, and heat-treated poultry pellets and fate in raw edible radish crops. *J Food Prot.* 85(12):1708-1715.

RESEARCH INQUIRY:
Non-cattle source introduction: Do facilities that aggregate and hold feces (including composting operations) contribute to re-introduction of STEC to the environment or introduction of STEC into wildlife populations?

PRIORITY RANKING: High, but for producer education and outreach.

Notes: Education and outreach are important to first ensure current composting process is understood and used appropriately. Industry practices and BMP implementation are clearly issues for data-informed standards refinement.
Data/Info Gaps: How do you compost correctly to make compost a solution to pathogen introduction; what are the process controls necessary to ensure safe compost? There is already a process standard included in the FDA's PSR that could be used to label compost, but there is no requirement for products produced using the FDA PSR standard to be labeled, and many products make no reference to processing conditions used.
Ongoing Research: FDA usually follows fecal matter including composting facilities and use of surface water to find strains and identify potential for pathogen sources.
Published Documents: EPA & FDA developed PFRP – Process to further reduce pathogens – Appendix B of Part 503.

RESEARCH INQUIRY:
E. coli O157:H7 vaccine to reduce carriage rates in cattle: Safety of *E. coli* O157:H7 vaccine in pregnant cows in a cow-calf operation.

PRIORITY RANKING: N/A

Notes: Adoption and cost must be considered.
Data/Info Gaps: Ongoing research on safety (efficacy and adoption are different issues) – Spring 2024.
Ongoing Research: Gabriele Maier, UC Davis School of Veterinary Medicine, Michele Jay-Russell, UC Davis WCFS.
Published Documents: Wileman et al. 2011. *Escherichia coli* O157:H7 shedding in vaccinated beef calves born to cows vaccinated prepartum with *Escherichia coli* O157:H7 SRP vaccine, *J of Food Protection.* 74(10):1599-1604, doi: 10.4315/0362-028X.JFP-11-034 – this is the only study available in cow-calf operations that is using the same vaccine.

RESEARCH INQUIRY:
E. coli O157:H7 vaccine to reduce carriage rates in cattle: Efficacious antibody response at intervals using a Siderophore Receptors and Porins (SRP) vaccine at a two-dose regimen.

PRIORITY RANKING: N/A

Notes: Adoption and cost must be considered.

Data/Info Gaps: Ongoing research on antibody response and frequency of vaccination (it doesn't explain shedding outcomes) – Spring 2024.
Ongoing Research: Gabriele Maier, UC Davis School of Veterinary Medicine, Michele Jay-Russell, UC Davis WCFS.
Published Documents: No studies on the serology of long-term use of the vaccine are available.

RESEARCH INQUIRY:
Do animal congregation settings concentrate STEC and introduce STEC to neighboring rangeland grazing cattle and wildlife that share the environment? Does this process allow re-introduction of STEC to the surrounding environment and further spread STEC from a potential source, despite confinement of animals?

PRIORITY RANKING: HIGH

Notes: Broad topic regarding STEC associated with animal congregation, rangeland grazing cattle, and wildlife. Research may want to focus on animal concentration and management practices.
Data/Info Gaps: What is/are the key hypothesis(es) around domesticated and wildlife interfaces and dispersal to environmental reservoirs and crop production sites?
Ongoing Research: CPS and USDA NIFA research projects related to bioaerosol dispersal
Published Documents: Antaki-Zukoski et al. 2021. Understanding the transmission dynamics of *Escherichia coli* O157:H7 super-shedding infections in feedlot cattle. *PeerJ.* 9:e12524. Berry et al. 2015. Effect of proximity to a cattle feedlot on *Escherichia coli* O157:H7 contamination of leafy greens and evaluation of the potential for airborne transmission. *Appl Environ Microbiol.* 81(3):1101-10. Berry et al. 2019. Occurrence of *Escherichia coli* O157:H7 in pest flies captured in leafy greens plots grown near a beef cattle feedlot. *J Food Prot.* 82(8):1300-1307. Bright et al. 2022. CPS funded, unpublished: When the *E. coli* hits the fan! Evaluating the risks of dust-associated produce cross-contamination (CPS Final Report, March 2023 – Bright.pdf (centerforproducesafety.org)).

RESEARCH INQUIRY:
A research topic following from feedlot-related settings is evaluation of whether 1) full implementation of the practices identified in the Beef Quality Assurance (BQA) program, along with 2) utilization of the *E. coli* O157:H7 vaccine, results in a decrease in introduction to nearby rangeland herds and environmental re-introduction rates around feedlots. The research outcome is whether BQA and vaccination efforts are effective when focused on feedlots and other location(s) that have confined animals.

PRIORITY RANKING: No clear connection or priority for BQA practices.

Notes: BQA program focuses on meat quality, animal welfare, residue avoidance from animal drugs, and worker safety and includes education and marketing components. It really does not focus on pathogen shedding from cattle. The only component that is remotely related to *E. coli* O157 is low stress cattle handling, as stress in cattle has been associated with an increase in shedding. Practices associated with pathogen shedding should be considered instead. Question on *E. coli* vaccine use will be difficult to study because multiple participants would be required simultaneously.
Data/Info Gaps: none identified.
Ongoing Research: none identified.
Published Documents: none.

RESEARCH INQUIRY:

Additional research is needed to better characterize livestock–wildlife interactions, and identify risk factors that induce fluctuations in herd prevalence. Such information would help further our understanding and perhaps address introduction and shedding (amplification) of STEC, including risk factors for sporadic "spikes" in prevalence.

Questions include:

- Is the *E. coli* O157:H7 vaccine effective at preventing rangeland introduction between same species animals (cattle to cattle) as new animals are added to the existing herd (stockers, feeders, bulls), if the new animals carry and shed STEC?
- The same question would apply in livestock-wildlife interactions where wildlife populations interact with livestock herds, and those wildlife populations carry and shed STEC: Is the vaccine effective at preventing introduction between different species (wildlife to cattle)?

PRIORITY RANKING: Low priority due to feasibility challenges (long-term plan)

Notes: Reasonable questions, but difficult to research in practice; shedding events are sporadic and unpredictable making such studies extremely difficult (costly, lengthy) to do.
Data/Info Gaps: none identified.
Ongoing Research: none identified.
Published Documents: Benjamin et al. 2015. Risk factors for *Escherichia coli* O157 on beef cattle ranches located near a major produce production region. *Epidemiology and Infection*, 143(1):81-93. Worley et al. 2017. Prevalence and genomic characterization of *Escherichia coli* O157:H7 in cow-calf herds throughout California. *Appl Environ Microbiol.* 83(16):e00734-17. Kilonzo et al. 2013. Fecal shedding of zoonotic food-borne pathogens by wild rodents in a major agricultural region of the central California coast. *Appl Environ Microbiol*, 79(20):6337-44. Navarro-Gonzalez et al. 2020. Carriage and subtypes of foodborne pathogens identified in wild birds residing near agricultural lands in California: a repeated cross-sectional study. *Appl Environ Microbiol.* 86(3):e01678-19. Kauffman MD, LeJeune J. 2011. European starlings (*Sturnus vulgaris*) challenged with *Escherichia coli* O157 can carry and transmit the human pathogen to cattle. *Lett Appl Microbiol.* 53(6):596-601. Cabe PR. 2021. European starlings (*Sturnus vulgaris*) as vectors and reservoirs of pathogens affecting humans and domestic livestock. *Animals* (Basel). 11(2):466. Callaway TR et al. 2014. Isolation of *Escherichia coli* O157:H7 and *Salmonella* from migratory brown-headed cowbirds (*Molothrus ater*), common Grackles (*Quiscalus quiscula*), and cattle egrets (*Bubulcus ibis*). *Foodborne Pathog Dis.* 11(10):791-4. Branham LA et al. 2005. *E. coli* O157 and *Salmonella* spp. In white-tailed deer and livestock. *Curr Issues Intest Microbiol.* 6(2):25-9.

RESEARCH INQUIRY:

Feed: Is there an effect from feed sources and practices (e.g., certain types of supplemental hay or vitamin/mineral supplement barrels on STEC carriage rates for rangeland cattle operations)?

PRIORITY RANKING: Low, many unknowns especially in rangeland cattle.

Notes: Most research is on *E. coli* O157:H7 rather than STEC. STEC would be desirable, but may also be cost-prohibitive. On the other hand, only focusing on *E. coli* O157:H7 could give a false sense of security if not found.
Data/Info Gaps: Forage may lower STEC shedding, but not really much is known.
Ongoing Research: SME – Todd Calloway, Univ of GA.
Published Documents: Not much info on rangeland cattle. Most research focused on feedlots. One older study showed increased shedding with low quality forage, but has never been repeated. However, some strains can survive in low moisture environments – mostly *Salmonella* in flour, peanuts, etc. Distillers' grains and hind gut starch fermentation as a source of STEC shedding has been studied.

RESEARCH INQUIRY:
Feed and feed supplements: Which feed supplements or additives show the greatest effectiveness for reduction of STEC shedding in cattle? Has the effect been demonstrated in rangeland cattle operations?

PRIORITY RANKING: Moderate, especially in confined systems where more concentrate is fed.

Notes: Relatively feasible; depends on funding breadth. This project requires participation from the leafy green industry and the cattle industry collectively to ensure a comprehensive and realistic approach in order to maximize cross-industry benefit.
Data/Info Gaps: Effects of probiotics that work in high grain rations, do they work on rangeland rations? We have no evidence so far.
Ongoing Research: Many ongoing, often proprietary, research efforts, so may not be publicly available.
Published Documents: Many published and ongoing studies on probiotic approaches, including essential oils, organic acids, eubiotics, postbiotics, prebiotics.

RESEARCH INQUIRY:
What is the role of wastewater treatment plants?

PRIORITY RANKING: Moderate – exploratory research needed, feasibility moderate.

Notes: More info needed on the process.
Data/Info Gaps: How do wastewater treatment plants contribute to the ecology of STEC or *E. coli* O157? How do facilities manage the process? Efforts to provide consistent process controls across all wastewater treatment plants would provide growers a system to verify and ensure they understand water quality and comparability amongst treatment facilities for routine processing and measures during times of overflow.
Ongoing Research: *Cyclospora* is being studied by FDA in terms of flooding and wastewater – overflow from flooding – where does it end up? What happens when overflow (e.g., from flooding) goes into waterbodies?
Published Documents: CPS-funded study by Ynez Ortega found no evidence for *Cyclospora* in Salinas River watershed, which is likely to receive wastewater discharge in "normal" and storm-events. This survey provides some indication that the Salinas River watershed is not a major contributor of Cyclospora, but more comprehensive longitudinal surveys would be needed to further characterize Cyclospora prevalence within this watershed.

II. Amplification

RESEARCH INQUIRY:
How does expansion of new and novel fertilizer materials and resulting shifts in soil inputs affect produce safety risk factors including amplification?

PRIORITY RANKING: Moderate

Notes: Other stakeholders' engagement needed considering many products are available (for example, soil inputs suppliers). Biofertilizer and bio-stimulant industries are newer input categories and further assessment is needed to evaluate processing conditions of the inputs to ensure appropriate

pathogen processing conditions are met, and to further explore the potential risk for materials as applied on farm.
Data/Info Gaps: Need information on pre-dilution contamination at distributor, pre-dilution contamination at point of delivery to bulk on-farm holding tanks or in-field injection tanks, or individual application equipment (i.e. sprayer tanks) and amplification potential related to soil inputs, considering more products are becoming available. Check current CDFA efforts.
Ongoing Research: Check current CDFA efforts and suppliers.
Published Documents: Research on Foliar contact applications; CDFA's FREP: https://www.cdfa.ca.gov/is/ffldrs/frep/pdfs/2022_RFP.pdf

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RESEARCH INQUIRY:
Molasses and other carbohydrate sources as a cattle feed supplement. Does it increase the possibility of STEC introduction into wildlife populations by exposing scavengers drawn to undigested material in cattle feces?

PRIORITY RANKING: Low

Notes: Two separate issues: Cattle feed supplements can help reduce STEC shedding while other products can actually increase it. Potential need for more research on probiotics for grazing cattle.
Data/Info Gaps: There is limited information, but likely low residues of molasses in feces; mostly absorbed/digested in rumen / small intestine.
Ongoing Research: N/A
Published Documents: N/A

RESEARCH INQUIRY:
Does use of molasses and other carbohydrate sources increase the possibility for STEC amplification in the agricultural environment?

PRIORITY RANKING: Low

Notes: Need more information on the use of molasses and other carbohydrate sources as a soil prebiotic. When molasses and carbohydrates are used as fertilizers, they are considered prebiotics as they relate to soil.
Data/Info Gaps: The use of molasses is not new. However, there is limited information on its use and higher use in organic operations; some interest internationally. It doesn't appear to be widely used in conventional US operations. The CA-LGMA has discussed concerns with biofertilizers.
Ongoing Research: Limited research
Published Documents: Danyluk et al. 2008. Survival and growth of *Salmonella* Enteritidis PT 30 in almond orchard soils. *J. Appl. Microbiol.* 104:1391–1399.
https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=62a31c584871a357261e4c9e7c7c18bffb61567a

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RESEARCH INQUIRY:
How does incorporation of organic material such as molasses into drip irrigation water affect the availability/action of chemical treatments such as hypochlorite (bleach)?

PRIORITY RANKING: Low

Notes: This question is specific to molasses. One result of this research might be a switch to apply bio-stimulants (that contain carbohydrates) as a side-dressing rather than through the drip lines.

Application as side-dressing circles back to the question of wildlife attraction and potential for adaptation and naturalization of STEC, during cycles between outdoor and gut environments, to persist or even amplify in the outdoor environment.
Data/Info Gaps: N/A
Ongoing Research: Channah Rock, U of AZ funded by CPS
Published Documents: Agricultural water treatment – Southwest region (CPS Final Report_Rock (AWT) - September 2021.pdf (centerforproducesafety.org))

ADDITIONAL RESEARCH INQUIRIES RAISED BY TV SUSLOW:
What is the potential for amplification during cut-to-cool intervals at different times of the year?
Does amplification within irrigation conveyance and distribution equipment align with patterns of elevated pathogen detection on commodities?
Are there timing/seasonal patterns of outbreaks vs non-outbreak?

III. Survival

RESEARCH INQUIRY:

How do different soil amendments affect soil microbial ecology (including adjacent biofilm formation in the soil such as in drip lines) after exposure to the various amendment formulations? (Note that the "starter" pathogen population might be endogenous (e.g., naturalized or from resident animal populations) or exogenous (e.g., introduced with the chicken pellets).)

PRIORITY RANKING: Moderate to Low

Notes: There is a need to better define the core questions to be addressed relative to industry experience in crop positives affecting marketing and past outbreaks.
Data/Info Gaps: The need for understanding long-term soil health is of a higher priority, but challenging to address.
Ongoing Research: Michele Jay-Russell, UC Davis WCFS (UCANR Desert Research Center in Imperial to study chicken pellets and potential for regrowth of pathogens)
Published Documents: USDA research on soil ecology changes is available.

RESEARCH INQUIRY:

Equipment cleaning and sanitization, existing research demonstrates that cross contamination of pathogens can occur by way of harvest equipment during the harvesting process: What are the biggest risk factors? What is the priority control point to effectively reduce those risks?

PRIORITY RANKING: Low

Notes: Harvest equipment cleaning and sanitation program improvement represents an effort to address opportunities of cross-contamination during harvest. Additional education and training is needed to ensure optimized protocols are adopted, and assistance provided to facilitate effective program criteria across a diversity of harvest equipment and products.
Data/Info Gaps: N/A
Ongoing Research: Industry (company-based studies) and publications (WG review).
Published Documents: N/A

RESEARCH INQUIRY:

Equipment cleaning and sanitization, existing research demonstrates that cross contamination of pathogens can occur by way of harvest equipment during the harvesting process: What are the current best practices, and what are the barriers to improvement?

PRIORITY RANKING: Low

Notes: Cost, practical implementation; logistical considerations.
Data/Info Gaps: N/A
Ongoing Research: Current research is primarily related to implementation issues.
Published Documents: Channah Rock. 2019. CPS Rapid response - Yuma study https://www.centerforproducesafety.org/amass/documents/researchproject/442/CPS%20Final%20Report%20Rapid%20Response_Rock_080719.pdf; Leaman et al. 2023. Fresh produce harvest equipment_a review of cleaning & sanitizing practices & related science. *Food Protection Trends*, 43(2):126-143. Sharma et al. 2022. Advances in emerging technologies for the decontamination of the food contact surfaces. *Food Res Int.* 151. Stone et al. 2020. Sanitizer basics for the food industry. 752. Pacific Northwest Extension Publishing. Oregon. Available at: https://catalog.extension.oregonstate.edu/pnw752; Sansebastiano et al. 2007. Cleaning and disinfection procedures in the food industry general aspects and practical applications. In A. McElhatton, R. J. Marshall (eds) Food Safety., vol. 1. Springer, Boston, MA. Callahan, C. 2020. A guide to cleaning, sanitizing, and disinfecting for produce farms. Burlington. Available at: https://blog.uvm.edu/cwcallah/2020/03/30/clean-sanitize-disinfect/.

RESEARCH INQUIRY:

What specific equipment is, for example, National Sanitation Foundation-certified that it can/has the ability to be cleaned? In some cases, such equipment may not exist or conversion to equipment that incorporates sanitary design might be prohibitively expensive (a long-term investment not a short-term switch). In this case, where are best practices most effectively applied in the near-term? If equipment conversion is determined to be cost prohibitive, could specific infrastructure grants or cost-share dollars be identified as a possible solution?

PRIORITY RANKING: Low

Notes: Cost, practical implementation; logistical considerations.
Data/Info Gaps: A good idea to move forward on - no research needed.
Ongoing Research: National Sanitation Foundation: https://www.nsf.org/
Published Documents: N/A

IV. Movement

The work group consensus was that this topic could be effectively addressed utilizing a quantitative microbial risk assessment (QMRA) framework. The framework would help to organize the variables and utilize information such as probabilities that localized shared roadways may result in contact between STEC in manure or other feces and vehicle tires that enter leafy green fields. A series of specific questions are as follows:

RESEARCH INQUIRY:

What are the relevant variables (e.g., how much manure, source of manure) and probabilities (e.g., production status of nearby fields, like being close to harvest) and are corresponding data available? What is the baseline risk, in comparison to other risk factors, and how best to reduce the risk?

PRIORITY RANKING: Low

Notes: Feasibility needs to consider dialogue between neighbors.
Data/Info Gaps: Understanding risk of ranches adjacent to roadways (traffic issues impact). Need to understand how pathogens move (manure haulers best practices or cattle transportation).
Ongoing Research: Longitudinal study may address some of the questions.
Published Documents: Updates on the CA longitudinal study here.

RESEARCH INQUIRY:

Can a qualitative, less-intensive approach result in the same actionable outcomes? In other words, does it require a QMRA to evaluate whether presence of manure on a road that leads into a growing area should be dealt with?

PRIORITY RANKING: Low

Notes: How to include manure quantity? Is an assessment sufficient? It appears this can be addressed with best practices instead of research. Responsibility is an issue; awareness is needed (trucks on the roadways not entering the field; the ones that enter the field are typically put on a trailer). How much manure is dropped from cattle trailers? They are typically designed to contain manure.
Data/Info Gaps: N/A
Ongoing Research: N/A
Published Documents: N/A

RESEARCH INQUIRY:

The general scope of the topic was further divided into two topic areas: Single issue of shared use of roadways, and the extent to which manure on the roadways is a priority problem. How to appropriately manage equipment/worker risk factors? This topic area references back to points in amplification and survival in the sense that it contains both a strong element of sanitation requirements and would benefit from the use of a QMRA framework.

PRIORITY RANKING: Moderate

Notes: Practical issues with timing, equipment assembly for extensive/deep sanitation (in addition to routine cleaning and sanitation).
Data/Info Gaps: Routine inspections have shown issues associated with worker and cross-contamination (cultural issue), biofilm issues related to poor cleaning (need for SOPs), cultural changes, training and education; GAPs are associated with implementation issues and need for innovation.
Ongoing Research: N/A
Published Documents: Channah Rock. 2019. CPS Rapid response - Yuma study https://www.centerforproducesafety.org/amass/documents/researchproject/442/CPS%20Final%20Report%20Rapid%20Response_Rock_080719.pdf; Leaman et al. 2023. Fresh produce harvest equipment_a review of cleaning & sanitizing practices & related science. *Food Protection Trends*,

43(2):126-143. Sharma et al. 2022. Advances in emerging technologies for the decontamination of the food contact surfaces. *Food Res Int.* 151. Stone et al. 2020. Sanitizer basics for the food industry. 752. Pacific Northwest Extension Publishing. Oregon. Available at: https://catalog.extension.oregonstate.edu/pnw752; Sansebastiano et al. 2007. Cleaning and disinfection procedures in the food industry general aspects and practical applications. In A. McElhatton, R. J. Marshall (eds) Food Safety., vol. 1. Springer, Boston, MA. Callahan, C. 2020. A guide to cleaning, sanitizing, and disinfecting for produce farms. Burlington. Available at: https://blog.uvm.edu/cwcallah/2020/03/30/clean-sanitize-disinfect/.

Appendix 3A

CALIFORNIA AGRICULTURAL NEIGHBORS

Action #3 Work Group: Create a Quantitative Microbial Risk Assessment (QMRA) Framework

CHARTER

Purpose

This charter establishes the California Agricultural Neighbors (CAN) Work Group that will create a Quantitative Microbial Risk Assessment (QMRA) Framework to prioritize filling identified knowledge gaps (WG2) in a systematic way and provide risk managers with a science-based and risk-based means for decision making to maximize the effectiveness of food safety practices/preventive measures. Specifically, the QMRA framework endeavors to identify specific biotic and abiotic factors that affect adverse public health outcomes (*i.e.* illnesses and deaths) caused by late season leafy greens grown in the Salinas Valley being contaminated with pathogenic *E. coli* O157:H7. Long-term, understanding the probability and severity of an adverse public health outcome based on if specific preventive measures are or are not implemented should greatly aid risk managers in setting effective standards and assessing situation specific risks.

Work Group Objectives

This Work Group will build a QMRA Framework based on available research outcomes and identify high priority knowledge gaps requiring further research. The Framework created by this Work Group should also consider research projects currently underway (SCRI, CALS, CPS) and how those findings may fill identified knowledge gaps. The Framework document created by this Work Group will be informed extensively by the Research Roadmap (Work Group #2) and help inform research capacity, research funding and education capacity needs of Work Group #4. Long-term the QMRA is intended to provide risk managers with a science-based and risk-based means for decision making to maximize the effectiveness of food safety practices/preventive measures.

Work Group Background

This Work Group will support the third strategy of CAN as highlighted in the Action Report issued in June 2022: Create a Quantitative Microbial Risk Assessment (QMRA) Framework to support future directions. A Framework such as QMRA allows organization of data in such a way that data gaps become evident. The quantitative aspect of QMRA also lends itself to modeling outcomes based on current knowledge to prioritize action, and sensitivity analysis to better understand when more data is necessary for effective action.

The Food Safety Modernization Act (FSMA) has reshaped our thinking and approach to food safety with a crucial shift of focus from response to prevention when it comes to foodborne illness. FSMA requires individual produce growers to make risk-based assessments and determine what risk management strategies are appropriate for their unique operations. One reoccurring theme in the CAN Dialogue Group was the desire to begin by identifying the science-based facts and knowledge needed by growers and ranchers to have informed good Ag neighbor conversations to enhance produce safety in this localized region.

By starting with a Research Roadmap (Work Group #2) and then enhancing that model with the use of a QMRA Framework, these tools help to break intractable problems into subcategories to help with research planning, milestones, and outcomes that build collective progress. Specific steps identified in the CAN Report include:

3.1. Assess the current state of sponsored research underway and supported by various entities including CPS, USDA, FDA Center for Food Safety and Applied Nutrition (CFSAN), UC Davis Western Center for Food Safety, and CDFA. Compilation of ongoing research and research needs represented by those entities is a first step on the research roadmap.

3.2. Apply a QMRA framework to organize the data and ongoing research efforts to help prioritize research needs based on identified knowledge gaps where there is little to no working knowledge to populate the QMRA. The QMRA would also provide insights into the value of data gained through

research in specific areas. The vast quantity of data currently available, augmented by data that might be collected, requires a structure with which to understand the applied value of the information and to identify data gaps.

QMRA is typically described by a sequence of steps: hazard identification; exposure assessment; dose-response assessment; risk characterization; risk management; and feedback and/or re-evaluation.

Work Group Goals

- The first goal of this effort is to identify the problem statement in which a QMRA framework would aim to address. Variables include: pathogen of focus being pathogenic *E. coli* O157:H7, the growing region of the Salinas Valley, and the effort being centric to leafy greens.
- The second goal is to apply the QMRA framework.
- Use the QMRA to help identify key research gaps and help prioritize research needs so as to facilitate development of high priority procedures, policies, and practices that are likely to reduce adverse public health outcomes.

Work Group Team

The Work Group will consist of Strategic Partners from federal, state and local agencies, associations, private industry, academia, nonprofit, advocacy groups, as well as farmers (growers), ranchers, vineyard managers, and compost suppliers.

Chair: De Ann Davis, WGA
Co-chair: TBD

Work Group Operations

The Work Group chair and co-chair will define the approval mechanism for project objectives.

This Work Group will meet regularly to formulate concepts, ideas, and recommendations into a working draft document.

The charge to the Work Group will be to propose a draft QMRA framework to the CAN Steering Committee. This will include providing monthly updates to the SteeringCommittee during the development process.

Assumptions:

- Current research may be present but lacking the specificity to address current needs.
- Non-traditional, unique expertise may need to be consulted.
- A QMRA framework for some of California's needs may already be occurring.
- Efforts of Work Group #3 are closely tied to Work Group #2 and #4.
- Others?

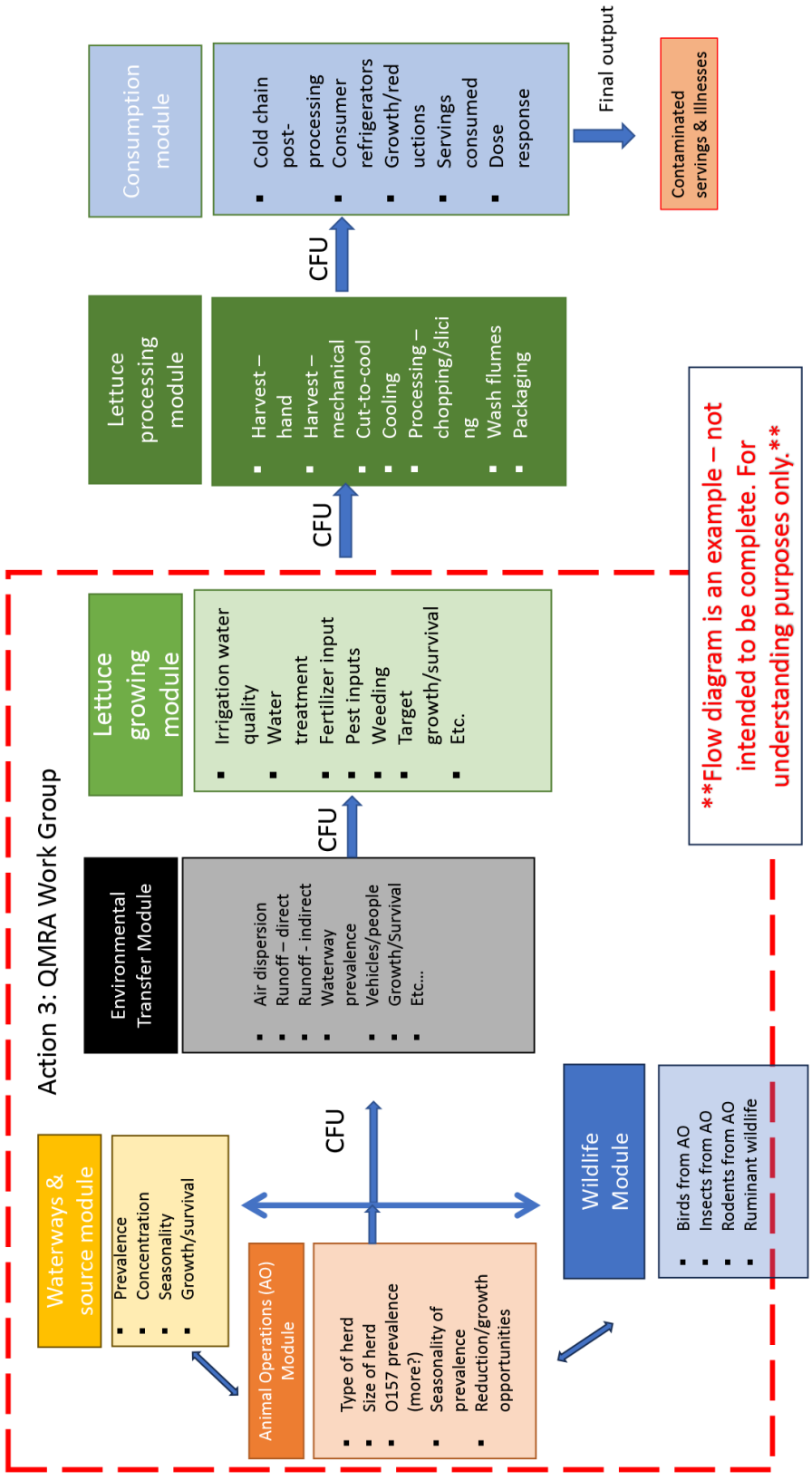
Strategies if the Assumptions Above Are Determined to be True:

- Engage with non-traditional expertise including, University and industry expertise (growers, ranchers, climate experts, equipment manufacturers, etc.).
- Notate opportunities for collaboration with Work Group #2 and #4.
- Others?

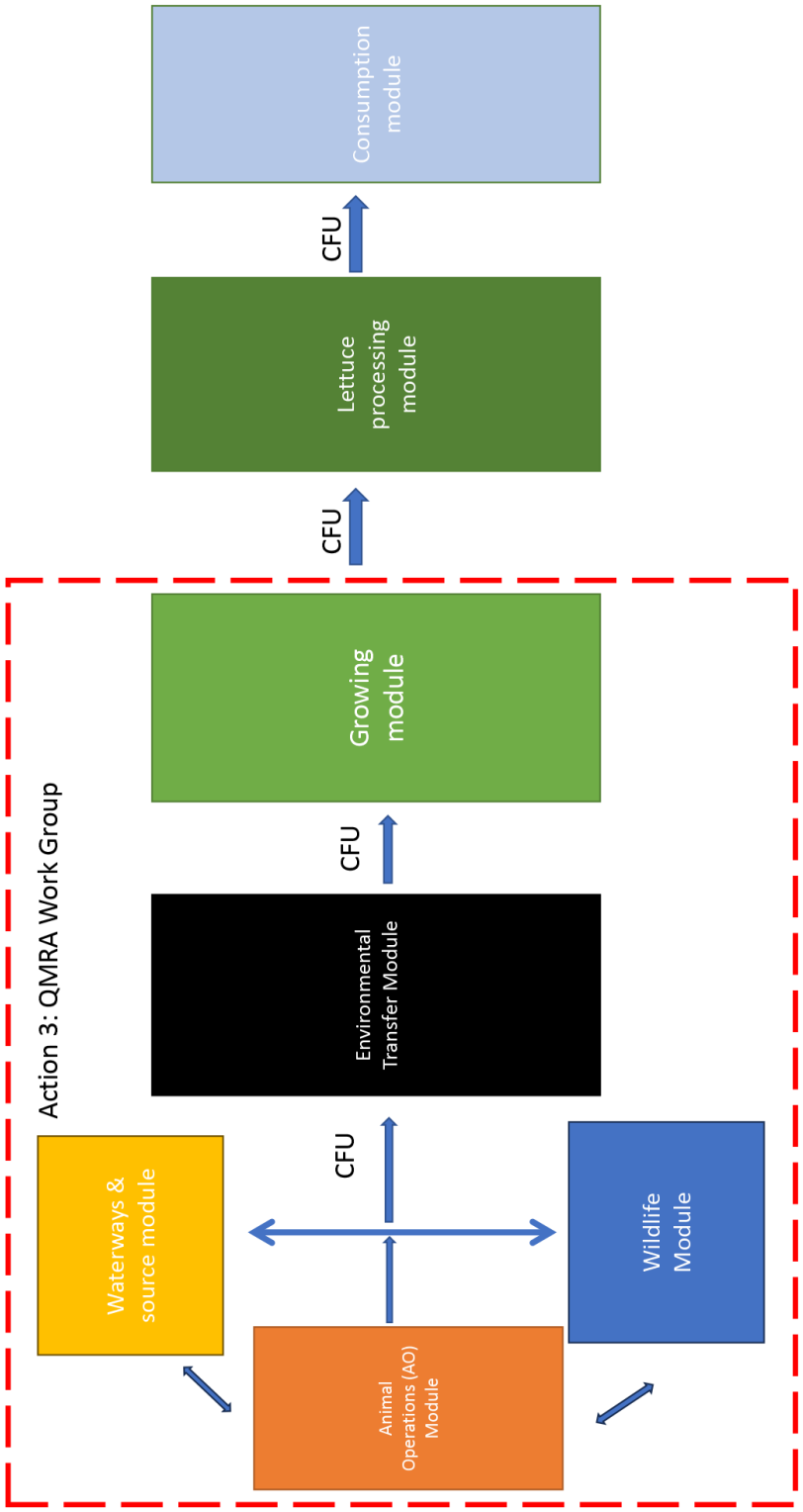
Work Group Deliverables

- A draft QMRA framework will be presented to CAN Steering Committee at the TBD meeting for final approval with interim updates leading up to the final discussion.
- Implementation plan of the QMRA framework to a broader group of stakeholders.

Appendix 3B


Action 3: QMRA Work Group
Waterways & source module
Prevalence
Concentration
Seasonality
Growth/survival
Animal Operations (AO) Module
Type of herd
Size of herd
O157 prevalence (more?)
Seasonality of prevalence
Reduction/growth opportunities
CFU
Environmental Transfer Module
Air dispersion
Runoff – direct
Runoff - indirect
Waterway prevalence
Vehicles/people
Growth/Survival
Etc…
CFU
Lettuce growing module
Irrigation water quality
Water treatment
Fertilizer input
Pest inputs
Weeding
Target growth/survival
Etc.
Wildlife Module
Birds from AO
Insects from AO
Rodents from AO
Ruminant wildlife
CFU
Lettuce processing module
Harvest – hand
Harvest – mechanical
Cut-to-cool
Cooling
Processing – chopping/slicing
Wash flumes
Packaging
CFU
Consumption module
Cold chain post-processing
Consumer refrigerators
Growth/reductions
Servings consumed
Dose response
Final output
Contaminated servings & Illnesses
Flow diagram is an example – not intended to be complete. For understanding purposes only.

Continued – **Appendix 3B**



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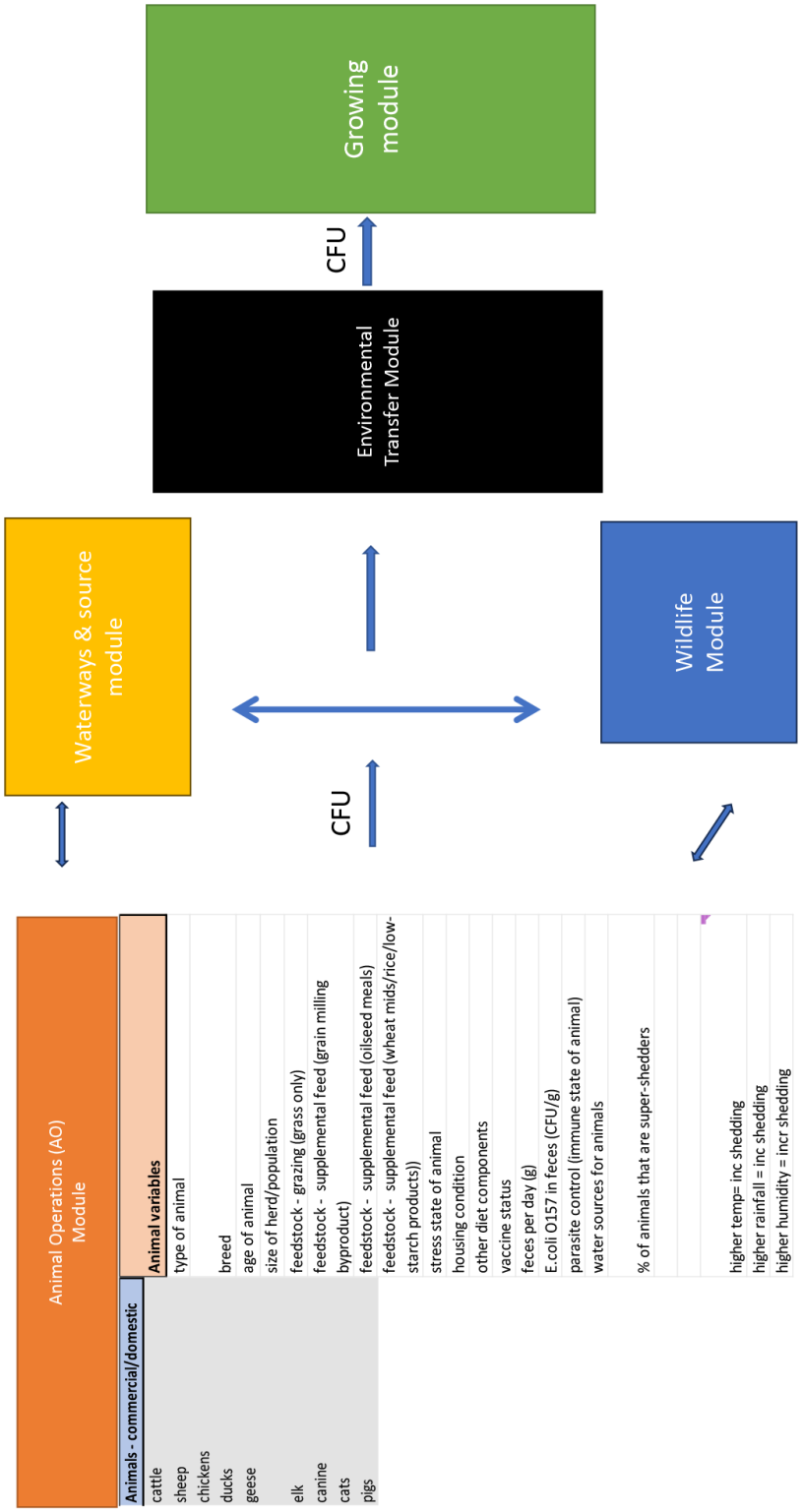

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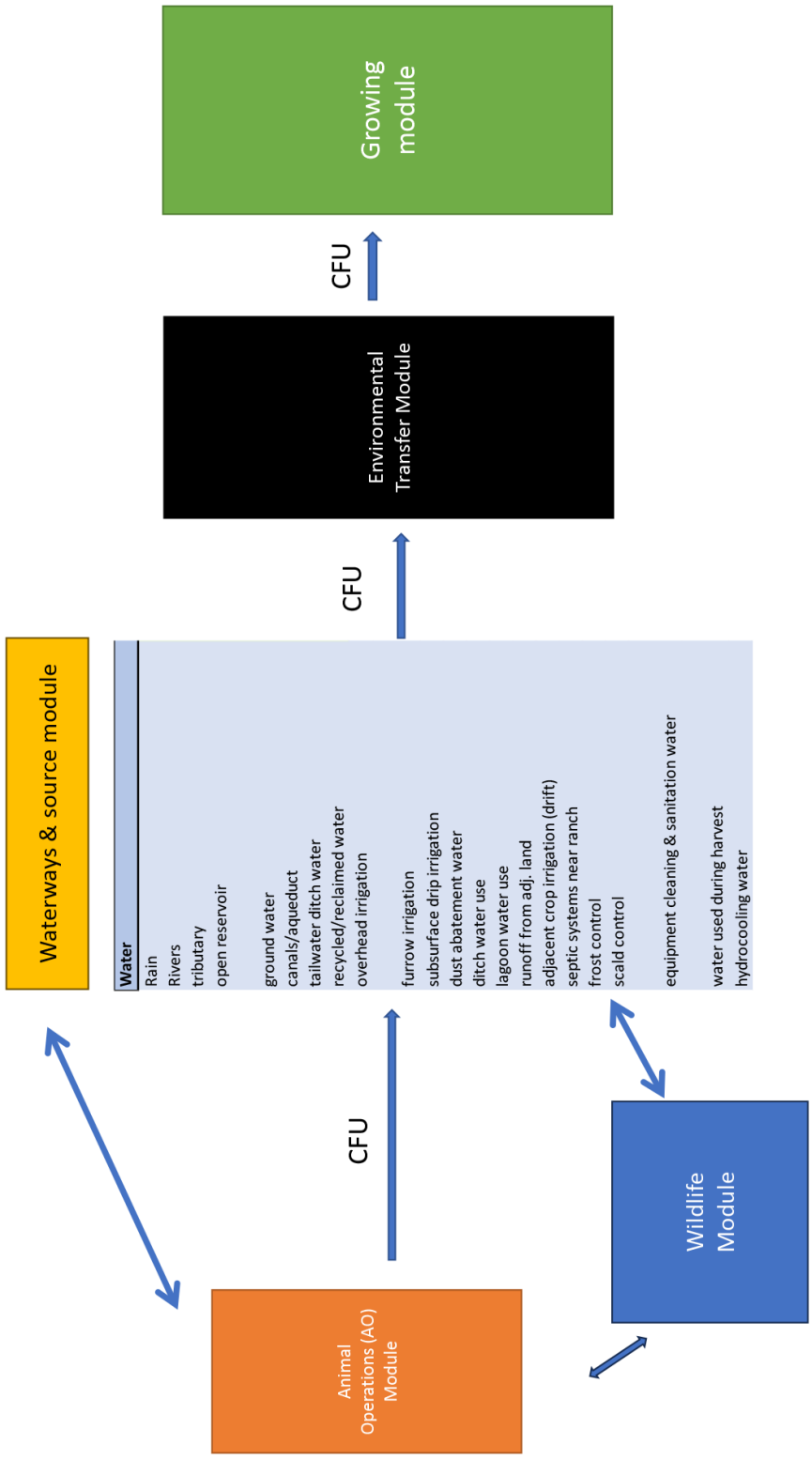

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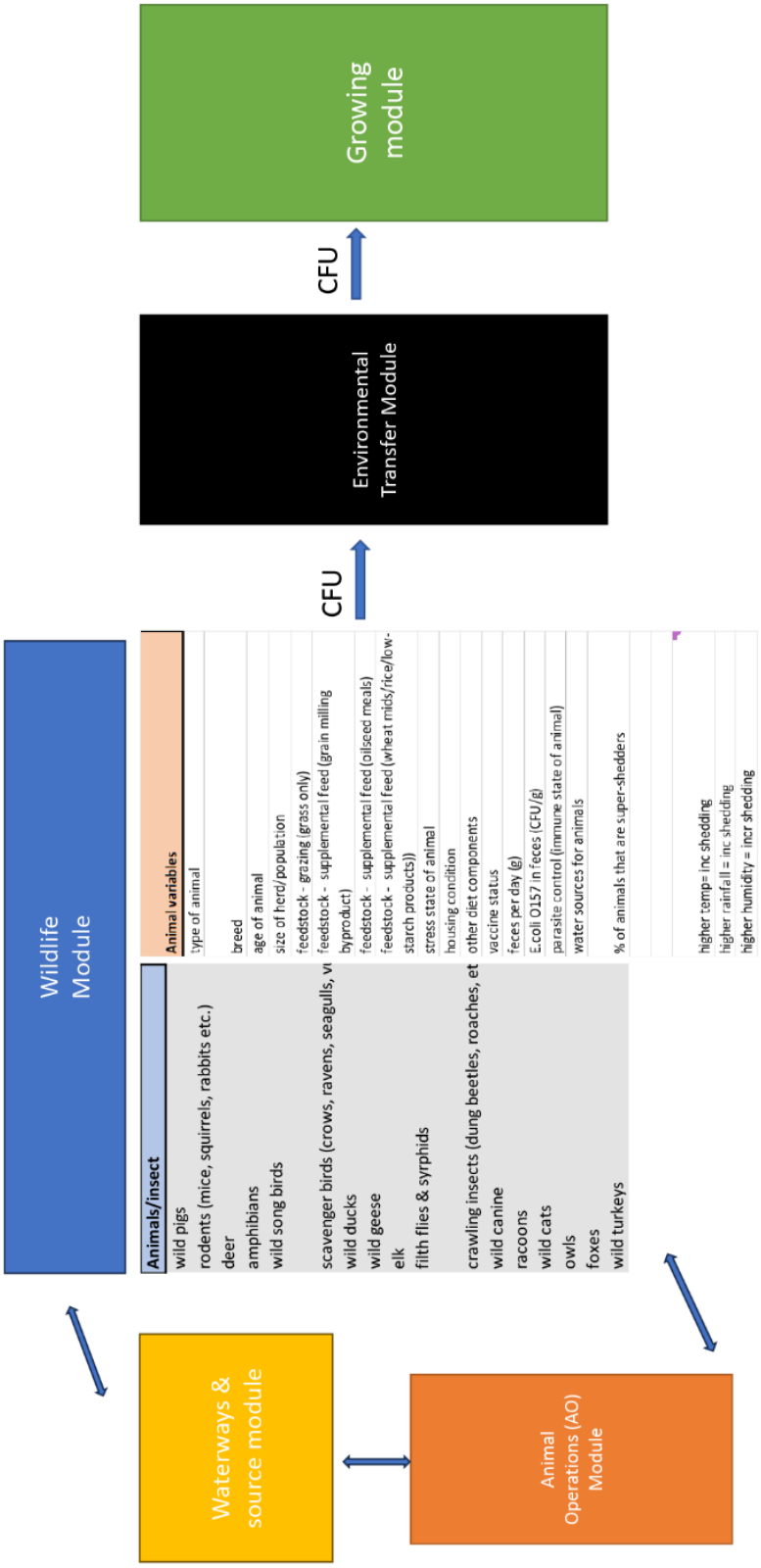

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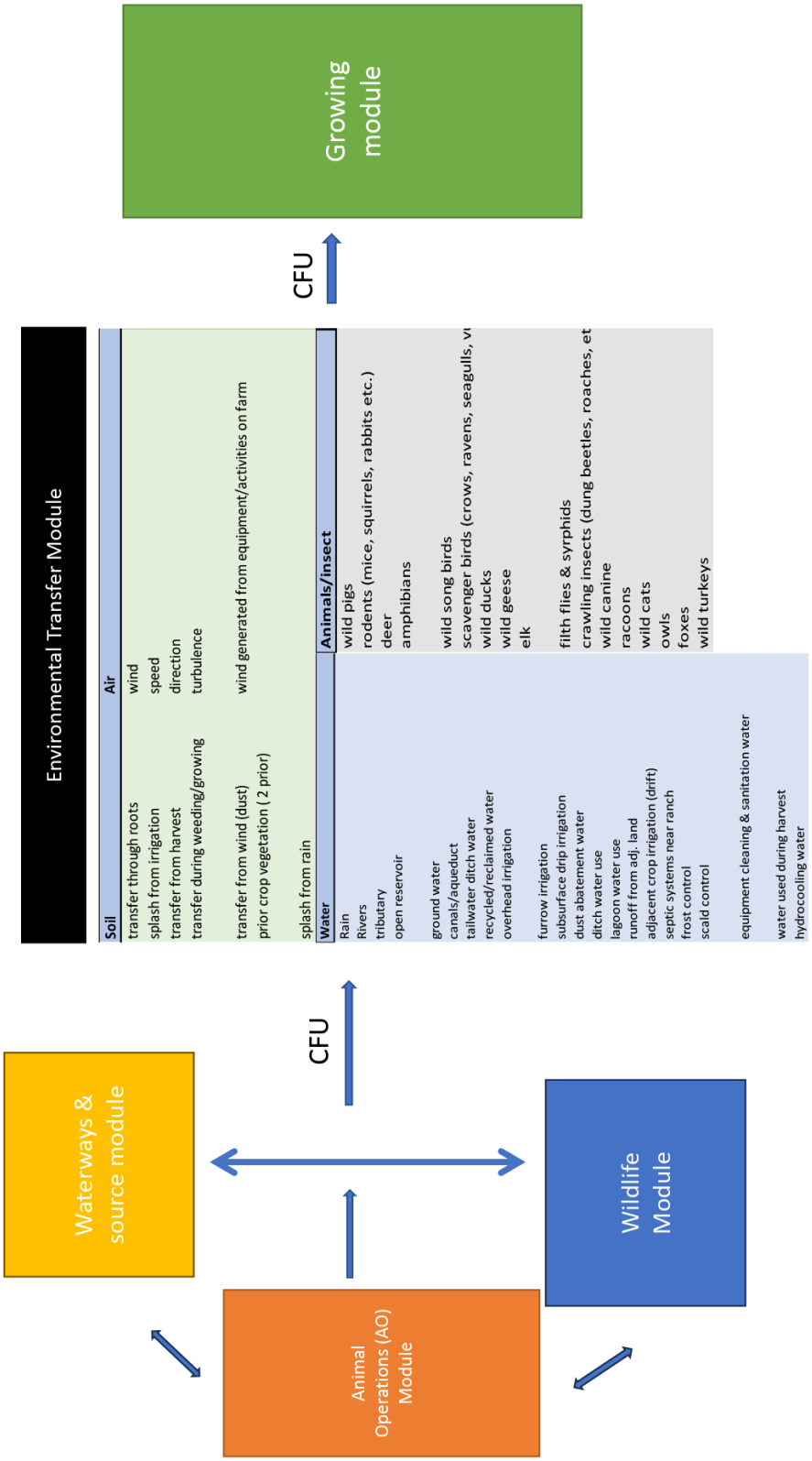
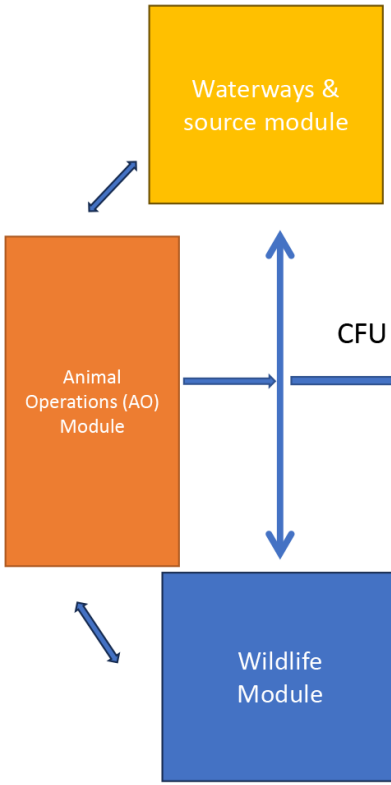
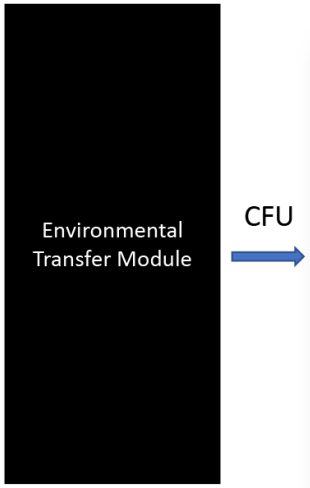


Action 3: QMRA Work Group





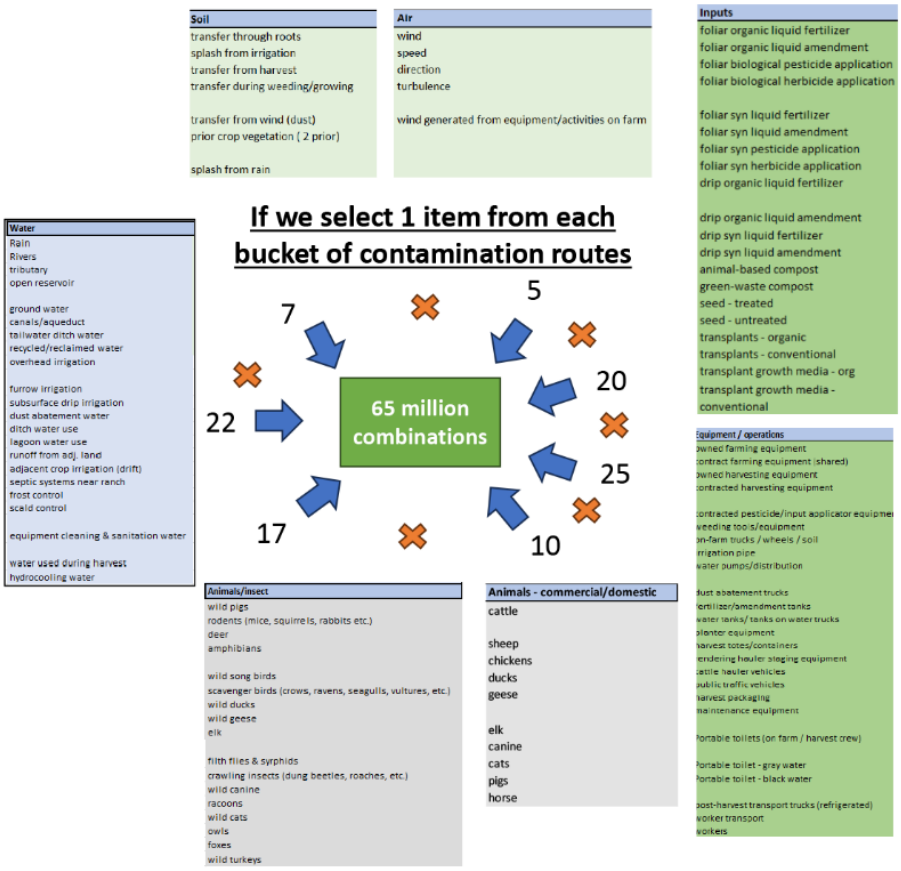
CFU

Growing module

Inputs	Equipment / operations
foliar organic liquid fertilizer	owned farming equipment
foliar organic liquid amendment	contract farming equipment (shared)
foliar biological pesticide application	owned harvesting equipment
foliar biological herbicide application	contracted harvesting equipment
foliar syn liquid fertilizer	contracted pesticide/input applicator equipment
foliar syn liquid amendment	weeding tools/equipment
foliar syn pesticide application	on-farm trucks / wheels / soil
foliar syn herbicide application	irrigation pipe
drip organic liquid fertilizer	water pumps/distribution
drip organic liquid amendment	dust abatement trucks
drip syn liquid fertilizer	fertilizer/amendment tanks
drip syn liquid amendment	water tanks/ tanks on water trucks
animal-based compost	planter equipment
green-waste compost	harvest totes/containers
seed - treated	rendering hauler staging equipment
seed - untreated	cattle hauler vehicles
transplants - organic	public traffic vehicles
transplants - conventional	harvest packaging
transplant growth media - org	maintenance equipment
transplant growth media - conventional	Portable toilets (on farm / harvest crew)
	Portable toilet - gray water
	Portable toilet - black water
	post-harvest transport trucks (refrigerated)
	worker transport
	workers

Caveats

- There may be more than 1 item per group at 1 time
- Within group interactions possible
- Not all items are independent, relationships would need to be linked/applied
- Each point may have additional variables to be considered



Appendix 4A

CALIFORNIA AGRICULTURAL NEIGHBORS

Action #4 Work Group:

Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

CHARTER

Purpose

This charter establishes the California Agricultural Neighbors (CAN) Work Group that will develop an actionable framework to facilitate and support the progress of research programs and teams in the multiple disciplines needed for effective produce safety research as well as the infrastructure for knowledge generation, transfer, and applied practice.

Work Group Objectives

This Work Group will help to right-size the needed depth and breadth of experts in order to fully support farmers, ranchers, viticulturalists, and the balance of agriculture neighbors in the Salinas Valley. The Work Group will also consider that experts will need to have a multi-disciplinary approach to collectively foster food safety, food security, and environmental sustainability with an Interdisciplinary approach to achieving target health outcomes.

Work Group Background

This Work Group will support the fourth strategy of CAN as highlighted in the Action Report issued in June 2022: Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice. This will be accomplished bybuilding a collaborative network necessary for collective input and impact, including the research capacity as well as outreach and education essential for continuous learning and focused local action.

The need for shaping and encouraging a culture of food safety has never been more profound. Implementation of the Food Safety Modernization Act (FSMA) has challenged us in more than one way. Sets of rules can be readily implemented, but fostering behavioral change is a longer endeavor. Food safety work is a process of continual improvement based on knowledge gained, insights implemented, and processes refined. In order to bolster a learning continuum that is lasting to meet modern-day needs, the following key areas must be considered:

4.1. Research Capacity. Many key scientists who for decades have investigated topics relevant to produce safety are retired or are likely to retire soon. This creates concern that, despite many exceptional scientists entering in the field, there may not be enough backfill for those who leave the field. The research capacity outcome includes effort to right-size the needed depth and breadth of experts in order to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley. It also considers that experts will need to have a multidisciplinary approach in order to collectively foster food safety, food security, and environmental sustainability with a One Health goal of achieving target health outcomes.

4.2. Research Funding Sources. As the known list of research needs is identified and continues to be identified by way of the research roadmap, typical and non-typical funding sources and partnerships need to be pursued to support produce-specific research efforts. Typical partnerships may be more apparent, but non-typical partnerships may include U.S. Geological Survey (USGS) Water Resources Research Institutes, National Science Foundation Environmental Research and Education program, and U.S. Environmental Protection Agency (U.S. EPA) grant programs. The multidisciplinary needs of these Salinas Valley research efforts means that researchers from allied fields of study/specializations should be actively engaged, particularly specialists in climate and weather patterns that might impact produce safety in the Salinas Valley and researchers who are able to study wildlife populations, migration patterns, and STEC carriage rates.

4.3. Capacity to Transfer Knowledge. Agricultural extension has long been relied upon to provide not only research capacity, but also to provide advisors who translate research findings into applied recommendations and communicate those science-based recommendations to industry. Extension partners at land-grant universities, including in particular historically Black State colleges and universities and Tribal colleges, are valuable partners in these efforts. Non-traditional partners such as industry trade organizations should continue to be encouraged to fulfill this role.

The Salinas Valley has a diversity of crops produced, beyond leafy green crops, and the proximity of different agricultural land uses to each other is one factor that may account for the history of produce safety outcomes. There is a long-standing spirit of neighborly cooperation in the Salinas Valley evidenced by the strong family farm and ranch traditions spanning multiple generations. The Salinas Valley is known as a leader in food safety efforts related to leafy green production; providing this opportunity for dialogue and collaboration bridged the informational gap between various facets of production agriculture.

Work Group Goals

- The goal of this Work Group is to develop a White Paper that identifies and prioritizes the needs and opportunities in three key areas: 4.1 building multidisciplinary research capacity to enhance Interdisciplinary approach outcomes; 4.2 identifying research partners to build depth and breadth into expertise; and 4.3 identify ways to build capacity to transfer knowledge into applied field practice.

Work Group Team

The Work Group will consist of Strategic Partners from federal, state and local agencies, associations, private industry, academia, nonprofit, advocacy groups, as well as farmers (growers), ranchers, vineyard managers, and compost suppliers.

Chair: Geetika Joshi CDFA
Co-chair: TBD

Work Group Operations

The Work Group chair and co-chair will define the approval mechanism for project objectives. This Work Group will meet regularly to formulate concepts, ideas, and a White Paper noting actions that can be incorporated into next steps.

The charge to the Work Group will be to propose a draft White Paper to the CAN Steering Committee. This will include providing monthly updates to the Steering Committee during the development process.

Assumptions:

- The depth and breadth of research needs has expanded given the ever-growing complexity of agriculture and the changing systems of farming and ranching.
- There is a growing need for subject matter experts and system-based experts within agriculture production.
- A growing need exists to provide outreach and education in order to help influence food safety culture.
- A greater focus on Interdisciplinary approach efforts will be a driver in the future.
- Small scale producers may not have ample best practice resources readily available to them.

Strategies if the Assumptions Above Are Determined to be True:

- Leverage opportunities to engage in Interdisciplinary discussions and constructive solutions. Often this topic is not well understood across agriculture disciplines.
- Survey what the agricultural community needs most urgently and work to that end systematically.
- Determine best ways to document deficiencies in order to address needs.
- A multi-year effort must be considered in order to address solutions in a phased-in approach given limitations on funding opportunities and/or human capital.

Work Group Deliverables

- First Work Group meetings will begin in Fall 2023.
- Draft White Paper will be presented to CAN Steering Committee at March 2024 meeting for final approval.

Appendix 4B

CALIFORNIA AGRICULTURAL NEIGHBORS

Action Item #4 Work Group:

Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

Contents

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Introduction

California Agricultural Neighbors (CAN) was established in 2021 in response to a series of *Escherichia coli (E. coli)* O157:H7 outbreaks associated with leafy greens grown in the California coastal region (CDFA, 2022). The California Department of Food and Agriculture (CDFA) and the Monterey County Farm Bureau (MCFB) have led efforts to foster collaboration and discussion to protect public health through efforts shared among the production, processing, retail industry, agricultural industry, and regulatory entities to address the following action items:

Action 1: Foster Neighbor-to-Neighbor Interactions and Conversations
Action 2: Build a Research Roadmap for the Salinas Valley
Action 3: Create a Quantitative Microbial Risk Assessment (QMRA) Framework
Action 4: Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice

CAN helped create the foundation for a food safety framework in California by enhancing communication among the agricultural communities through scientific insights and enhanced food safety education and action. The goal of this Work Group is to support the agricultural industry in California by fostering produce safety, nutritional security, and environmental sustainability through education, outreach, and research funding. The Work Group discussed strategies on how to strengthen the translation of research on produce safety to applicable farm support, through avenues such as university extension and other relevant entities.

Problem Statement

The need for shaping and encouraging a culture of food safety has never been more profound. Implementation of the Food Safety Modernization Act (FSMA) has challenged growers in more than one way. Sets of rules can be readily implemented, but fostering behavioral change is a longer endeavor. Food safety work is a process of continual improvement based on knowledge gained, insights implemented, and processes refined. To bolster a learning continuum that is lasting to meet modern-day needs, California needs scientists with multidisciplinary research expertise, funding sources to adequately fund necessary produce safety research, and agricultural extension advisors who translate and communicate research findings into applied recommendations. CAN Work Group #4 sought to identify and prioritize needs and opportunities in these key areas to advance produce safety culture in California into the long-term.

Background

Work Group #4 was tasked with developing the fourth action item of CAN titled "Build and Maintain Capacity to Transfer Knowledge from Research into Applied Practice" as highlighted in the 2022 CAN Action Report. The goal was to establish a collaborative produce

safety network and applied research capacity as well as outreach and education efforts essential for continuous learning and focused local action, and adoption of enhanced practices.

The Food Safety Modernization Act (FSMA) Produce Safety Rule established, for the first time, science-based regulations for the safe growing, harvesting, packing, and holding of fresh produce grown for human consumption nationwide (FDA, 2024). Work Group #4 focused on identifying key challenges associated with implementing robust, interdisciplinary produce safety systems throughout California and aimed at developing a roadmap to support farmers, ranchers, viticulturalists, and produce experts throughout the state. This multi-disciplinary, systems-thinking strategy uses the One Health approach to achieve target health outcomes while collectively accounting for produce safety, nutritional food security, environmental sustainability, and diverse ecosystems (WHO, 2022).

As mentioned in the 2022 CAN Action Report, Work Group #4 addressed three key challenges: research capacity, research funding, and knowledge transfer. These three topics guided the Work Group efforts to address capacity gaps, develop a produce safety plan, and establish consistent funding for multidisciplinary expertise over the next decade.

Methodology

Work Group #4 sought to gather responses from a set of participants utilizing targeted interview questions. Participants were selected with a goal of representing subject matter experts from the various sectors and organizations active in the area of produce safety throughout California. (See Appendix A) Facilitators developed a series of interview questions keeping in mind the following assumptions:

- The depth and breadth of research needs has expanded due to the ever-growing complexity of agriculture and the changing systems of farming and ranching.
- There is a growing need for subject matter and system-based experts within agricultural production.
- There is a growing need to provide outreach and education to help foster produce safety culture.
- A greater focus on interdisciplinary approach efforts will build the roadmap for produce safety needs in the future.
- Small scale producers may not have ample best practice resources readily available to them.

The objective of these interviews was to evaluate the mechanisms potentially needed to restructure the training and education approaches in agriculture and produce safety, define the roles of each sector or entity, and identify funding allocation and distribution necessary and appropriate for short and long-term objectives.

Work Group #4 held a kick-off meeting in December 2023. Work Group goals and expectations for future interviews were discussed. During the winter of 2023-24, twenty-one participants were individually interviewed online through video conferencing technologies. The interview process began with an introduction to the Work Group objective and a display of the ten interview questions. (See Appendix B). The facilitator captured responses by taking notes while participants addressed the questions.

Upon completion of each interview, responses were reviewed and organized into four main categories: Gaps, Goals, Funding, and Roles. These categories identified common responses as well as novel ideas.

The individual interview method offered an opportunity for candid responses based on participant experience allowing for the exclusion of input or biases from other members of the Work Group. Challenges with the individual interview method included time constraints limited to a 45-minute slot to capture a wide range of topics.

Participants

The participant list was determined by the CAN Dialogue and Steering committees. Once selected, those individuals were invited to participate in the Work Group. Additional interviewees were suggested and selected based on approval from the Work Group chair. Participants ranged from state and federal regulators, technical assistance staff, and industry representatives (Figure 1). Multiple participants from University of California Agriculture and Natural Resources (UC ANR) were interviewed due to their Cooperative Extension roles dedicated to assisting growers implement produce safety practices and translate food safety research. The University of California Cooperative Extension (UCCE) is a division within the UC ANR system that acts as the bridge between local growers and the research conducted at the universities through on-farm assistance and education (University of California, 2024).

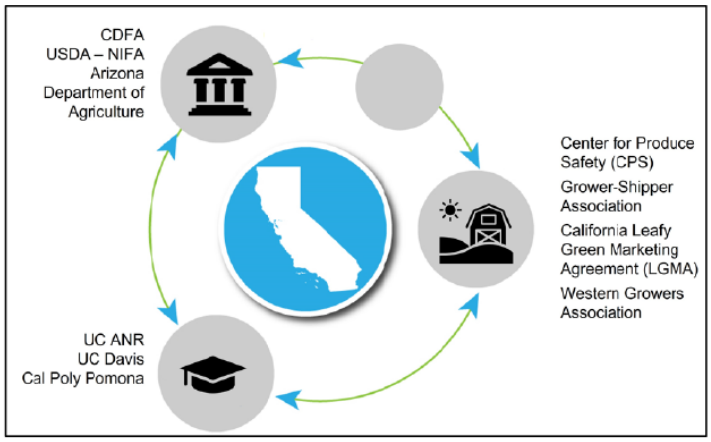

Figure 1. Work Group 4 participants. Participant organizations were selected keeping in mind the important interactions necessary for Work Group 4 action items, i.e., academia, industry, and government entities.

Results

Interview responses were organized into four distinct categories: Gaps, Goals, Funding and Roles. Despite participant responses ranging in topic and personal experience, trends were identified in the responses received within each category.

Gaps	Roles
Lack of Staffing/Resources (62%)	CDFA as facilitator (28%)
Lack of Specific and Applied Research (43%)	UCCE as facilitator (19%)
Goals	**Funding**
Restructure UCCE (52%)	Dedicated CE specialist staffing for produce safety (29%)
Define Incentive (33%)	$10 million suggested initial funding amount (29%)

Table 1. Top two participant responses to interview questions by category.

Interview responses indicated the lack of adequate resources and staffing challenges for UCCE due to declining funding revenues. Within the scope of lacking staffing and resources was the deficiency of interdisciplinary agricultural education provided to university students and UCCE staff. The second most common challenge expressed by participants referenced knowledge gaps and the lack of available research regarding *E. coli* outbreak causation and transmission. According to participants, the research gap also referred to the challenges of real-world implementation since much of the existing produce safety data cannot be easily applied on a typical farming operation.

52% of responses indicated a potential goal for a more interdisciplinary agricultural education system. Suggestions included a requirement to introduce food safety modules into existing agricultural courses throughout the University of California and California State University systems. 33% of responses suggested it may be helpful to identify and define a marketing-based incentive for complete adoption of produce safety by agricultural entities in California (for example, commodity-specific or buyer-mandated private food safety audits currently in place).

When participants were asked which entity could take the role of a produce safety facilitator, the responses were closely split between CDFA (28%) and UCCE (19%), indicating there is a role for both organizations to collaborate closely on this subject. While CDFA has experience hosting multiple agricultural programs and can facilitate collaboration between the different programs that would be needed to achieve an interdisciplinary approach, UCCE has significant experience managing the funding and outreach grants for growers and a strong collaboration with industry stakeholders. Suggestions included CDFA acting as the organizer of researchers and educators and facilitating communication between various entities. It was also noted that UCCE is viewed as a neutral entity with a reputation of credibility, robust and rigorous research, and objective work. Therefore, both organizations have specific strengths needed to advance produce safety in California.

The topic of funding resulted in more varied responses, but the most frequent response (28%) suggested at least $10 million as an initial annual level of funding to achieve the goal of inter-disciplinary agricultural education for California. That $10 million was further divided into the following buckets of approximately equal importance:

- More funding for UC ANR staff; specifically, produce safety specialists dedicated to the different growing regions throughout the state.
- Secure research grants from USDA National Institute of Food & Agriculture (NIFA), specialty crop, Farm Bill, etc. to ensure on-going funding for applied research.
- Dedicate funds for grassroots research projects that address the specific needs of growers and farmers.
- Funding dedicated to communication, outreach, and education.
- Funding and assistance for disadvantaged or underserved growers.

Recommendations

Figure 2 serves as a visual representation of the recommendations offered by the participants of Work Group #4. Recommendations were grouped into short-term, medium-term, and long-term schedules. Recommendations were applied to "entities" which refer to participating organizations such as USDA NIFA, CDFA, UCANR, multiple industry groups, as well as entities yet to be assigned or created. (See Appendix A).

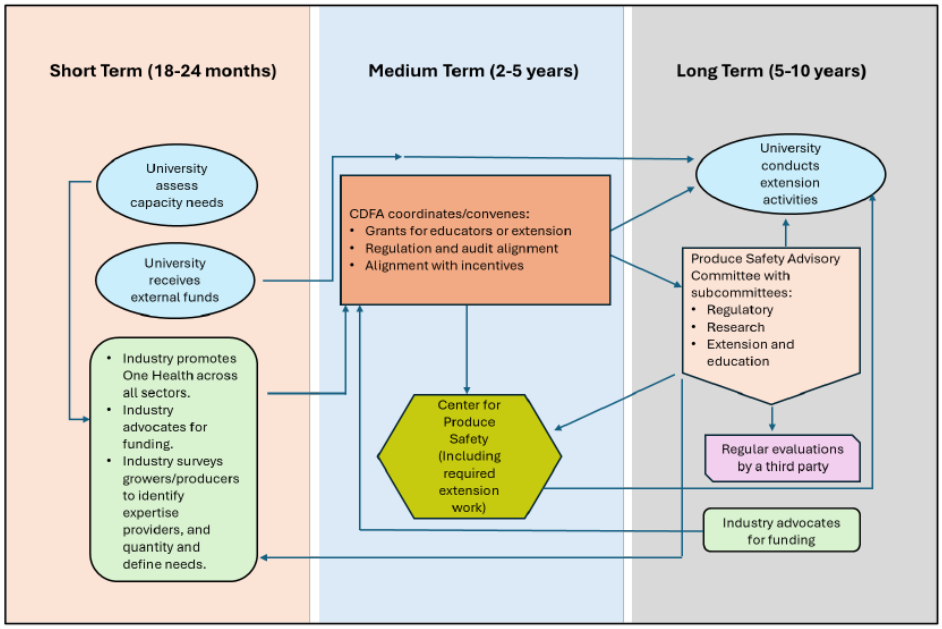

Figure 2. Display of goals and their relationships suggested by Work Group #4.

Short-Term Recommendations

The short-term timeline, tentatively scheduled for 18 to 24 months, included recommendations that could be accomplished in the near future. The first recommendation for the UC ANR program prescribed an evaluation to establish the need for produce safety researchers and staff positions. In the short-term, UC ANR could evaluate its potential alignment with existing agronomic and environmental research and would need to determine and define its capacity for dedicated interdisciplinary produce safety staff and activities.

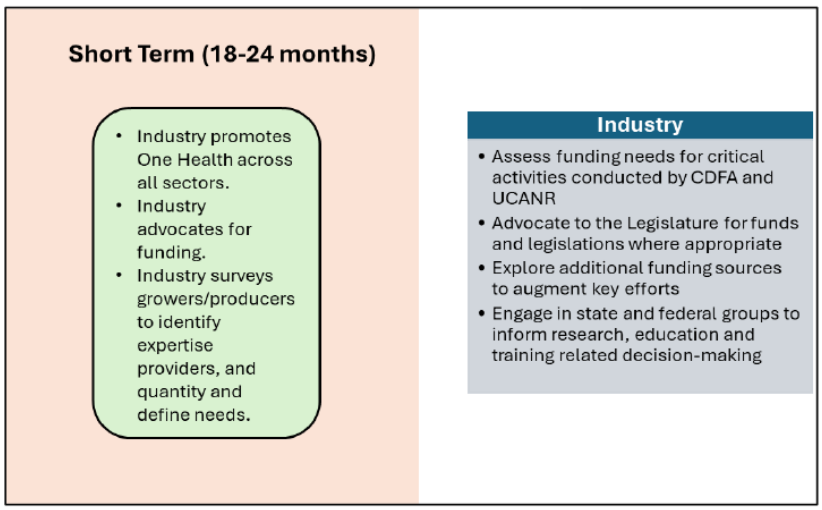

Figure 3. Highlight of short-term goals pertaining to UCANR

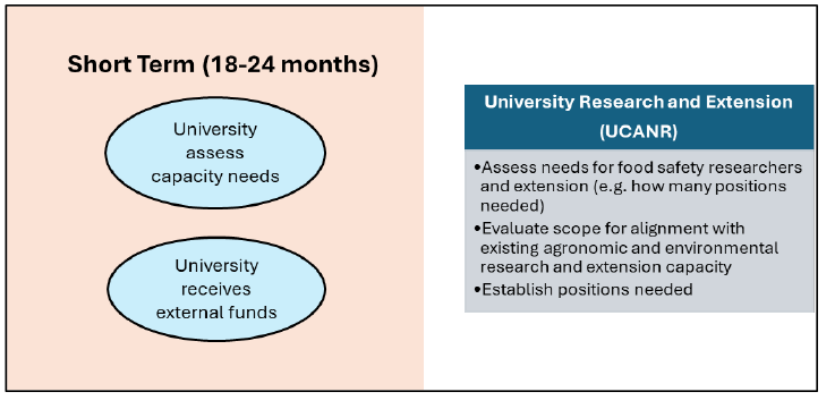

Figure 4. Highlight of short-term goals pertaining to agricultural produce industry.

A dedicated coalition of agricultural industry groups could promote the funding needs for produce safety activities conducted by CDFA and UC ANR as well as explore novel funding sources to advocate for their members. Industry could collaborate with CDFA and FDA to steer research, education, and training efforts to represent the needs of their members. Industry pl ays an important role by influencing the market standards and can enact quantifiable change by promoting produce safety standards and One Health principles. By promoting and incorporating the holistic approach of One Health, agricultural industries and stakeholders could experience shared benefits with practices supporting health, produce safety, and shared ecosystems (WHO, 2022).

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Medium-Term Recommendations

The medium-term timeline, scheduled for a timeframe of two to five years, would continue to build on the foundational efforts of the short-term recommendations and bolster the CAN goal of establishing longevity in a robust produce safety culture throughout California agriculture. These recommendations focus on CDFA acting as the facilitator of a centralized produce safety clearinghouse. A key recommendation from Work Group #4 included the development of a Produce Safety Advisory Committee (PSAC) dedicated to guiding public health and measures for produce safety, discussed further under Long-Term Recommendations. CDFA would continue to perform regulatory functions and with efforts to align with government audits such as GAP etc. CDFA could collaborate with existing departmental agricultural programs such as Animal Health and Produce Safety Services (AHFSS), Office of Environmental Farming & Innovation (OEFI), the Specialty Crop Block Grants Program (SCBGP), etc. and utilize existing incentive programs as opportunities to insert produce safety where applicable. Since 2023, PSP team has initiated collaborations with CDFA's Climate Smart Agriculture Technical Assistance grant program and Farm to School program to create produce safety cross-training opportunities for service providers funded by these programs.

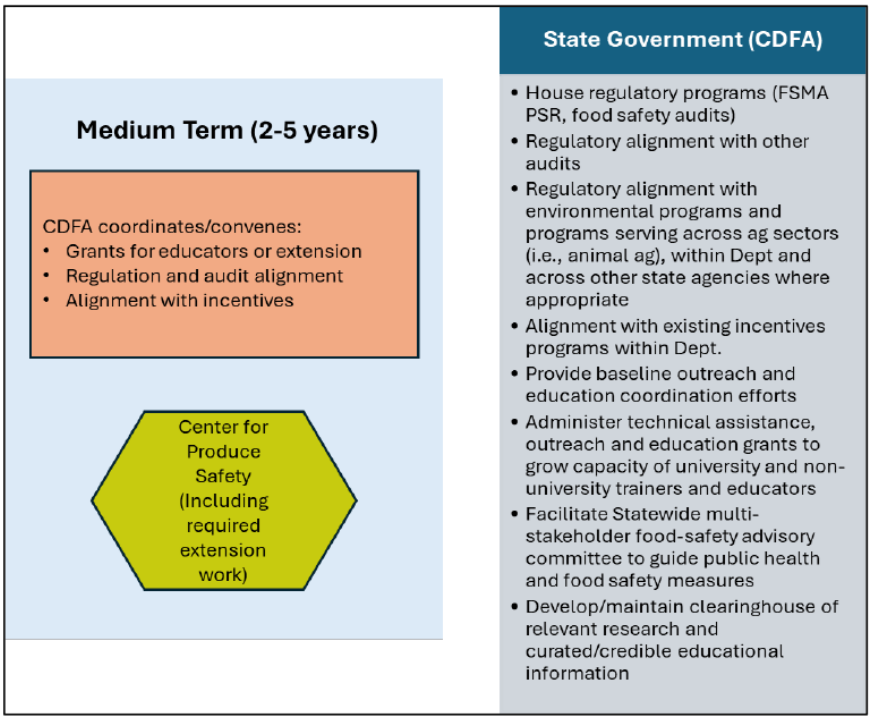

Figure 5. Highlight of medium-term goals pertaining to CDFA.

One specific facilitator role would require the development and maintenance of a platform to house research and credible educational information surrounding produce safety. This platform would house curated data, applicable research, catalog funded research, and serve as a library for access by all agricultural entities.

Organizations such as the Center for Produce Safety (CPS) are recommended to continue funding practical, industry-specific research. CPS and similar entities utilize public and

private sources to fund ongoing produce safety research projects. These funded research projects are awarded to universities around the world, as well as government research facilities. It was recommended that non-academic organizations utilize state awarded grant opportunities to relieve the educational burden on UCCE by adopting the role of educators and providers of technical assistance in conjunction with UCCE, thus building additional capacity.

Long Term Recommendations

The long-term timeline, scheduled for five to 10 years, will provide recommendations based on the foundation of effort from CAN in the short and medium-term timelines while allowing flexibility and innovation to continue forward progress. The long-term recommendations for UCCE are to bolster extension activities such as conducting research, translate that research for easy digestion by growers through certified training programs, provide technical assistance, and provide educational materials and resources maintained in a clearinghouse of relevant research. Historically, the focus of UCCE has shifted from agricultural extension activities to research publications. This has changed the nature of collaboration between county-based advisors and extension specialists, and how the latest scientific developments are incorporated into learning objectives of university courses. A shift of focus for extension advisors from academic publication requirements to farmer communication, education and technical assistance may be needed recognizing that in order to achieve this vision, additional staffing to

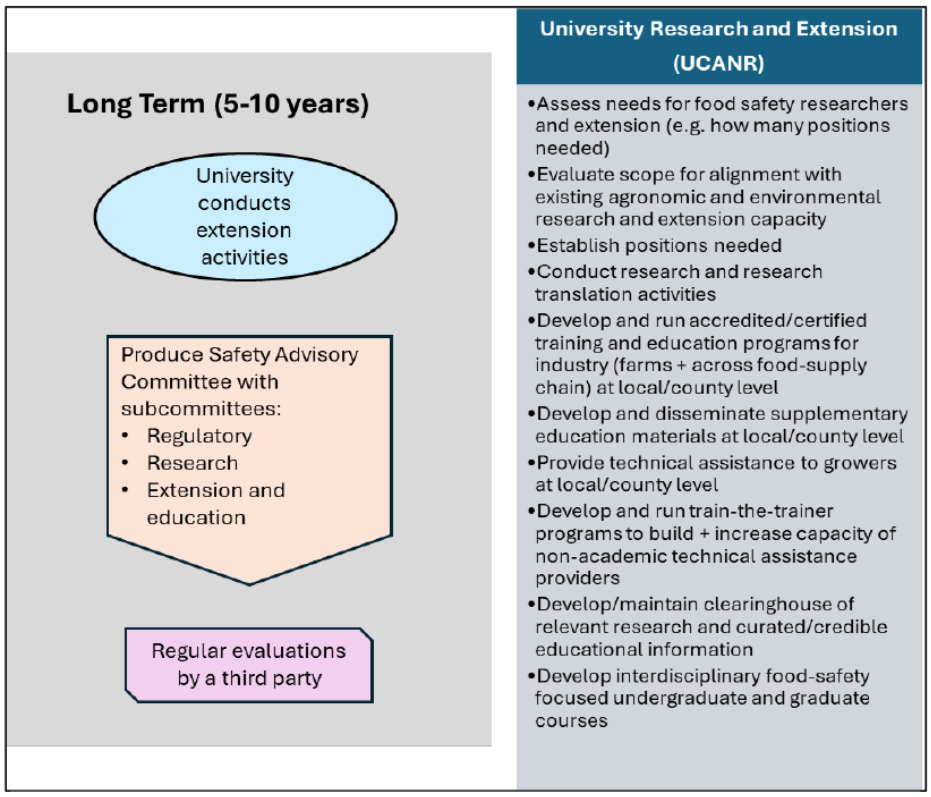

Figure 6. Highlight of long-term goals pertaining to UCANR and the Produce Safety Advisory Committee (PSAC).

meet industry needs would be necessary.

An important part of these efforts must include the capacity building component of extension. UC ANR could establish ongoing training for non-academic technical assistance providers. Cross-training would increase the capacity and demand for an integrated and interdisciplinary food-safety and One Health focused academic system.

As previously noted under Short-Term Recommendations, a Produce Safety Advisory Committee (PSAC) would need to be established to facilitate a statewide interdisciplinary effort toward produce safety. There could be multiple subcommittees focusing on the following priorities: regulatory, research, and extension and education. The committee and subcommittees would be organized by CDFA, and activities would be prioritized by regulatory data and extension demands. The PSAC would act as the centralized produce safety authority for all agricultural entities throughout the state and would advise UCCE extension activities, align with industry interests, and support the Center for Produce Safety (CPS) research and funding projects. Efforts to obtain resources, such as dedicated staffing and leadership, to initiate and sustain the PSAC would make this a long-term activity.

Another long-term goal for CAN would be to establish an evaluation component for the PSAC. This third-party entity would evaluate how the PSAC is conducted and review its recommendations to determine their efficacy, efficiency, and overall impact. The auditors could develop a weighting system to determine the value of a given set of audit requirements. The recommendation for the evaluative body suggested utilizing a non-profit or consulting firm experienced in evaluating government programs. And finally, it was recommended that industry entities identify funding sources and the associated funding authority to further encourage produce safety activities by CDFA and the PSAC.

Miscellaneous Recommendations

This section will catalog participant responses of novel suggestions, actions, recommendations, and ideas. These items will be memorialized and addressed in the future when the PSAC capacity and funding allow.

- Integrate data sharing amongst farms to encourage continuous improvements in produce safety. Growers could be able to upload and integrate data such as pest applications, animal operations, adjacent land use, records, water sources, etc. onto a platform or forum for shared access and validation of produce safety adoption into business practices.
- Utilize artificial intelligence to mine through existing research applicable to produce safety, best practices, pathogen characteristics, etc. and house that research in a library or database on one website for easy access by all entities to maximize efficiency, prevent redundancy of research efforts, and prevent unnecessary research funding.
- Develop a portal that hosts all audit requirements (farm maps, records,

certificates, pesticide usage, training, verification, etc.) and make available to growers as a way to reduce redundancies.

- A facilitating entity is established in the short to medium-term timelines in collaboration with industry and universities, but those roles may change in the future. The facilitator entity in partnership with other subject matter experts could offer workshops, blogs, webinars, etc. to present peer-reviewed research publications for interested agricultural entities.
- Conduct a survey to identify the existing produce safety resources currently available for producers. This survey can also highlight the existing gaps in produce safety resources.
- Explore the idea of an Endowed Chair role for Food Safety in order to address the needs for expertise capacity building and funding for the multi-disciplinary needs of Produce Safety as it relates to One Health.
- Integrate produce safety into the UC academic system systemically from leadership to staff level at UC ANR. CDFA and UC ANR leadership should collaborate to identify and quantify resources and cooperative extension specialist positions specifically dedicated to produce safety to meet industry demands for technical expertise and assistance.
- UCCE positions must require a knowledge transfer component, such as inter-disciplinary teaching activities as well as professional trainings/development activities for new hires, to ensure that the knowledge and science of food borne illness prevention continues to grow, and mechanisms for research translation to producers are sustained into the long-term.
- UCs and CSUs could integrate produce safety into the learning objectives of each agricultural studies course and allot one week (three hours of interdisciplinary instruction) dedicated to produce safety. CDFA could advocate the importance of produce safety and help alter the courses by:
    - Creating the essence of material (neglected areas of focus).
    - Developing courses and negotiating time in syllabus.
    - Formally changing the syllabus and learning objectives.
    - Petition to Deans, committees, chair, college, etc. for adoption.
    - Develop a list of subject matter experts to deliver in-practice experiences.
- Petition to USDA-NIFA the importance of an extension component with any awarded research grant.

Conclusion

CAN Work Group #4 sought to help right-size the required breadth of experts in order to fully support farmers, ranchers, and the balance of agriculture neighbors in the Salinas Valley, while also considering the need for a multidisciplinary approach to foster produce safety, nutritional food security, and environmental sustainability with a One Health approach of achieving target health outcomes. It became clear that there is no

one office, person, or entity championing food safety, which has resulted in a scatter-shot approach and a capacity deficiency. CAN Work Group #4 has attempted to build the roadmap for food safety across California and attempted to fill in the gaps over a long-term timeline.

A separate and distinct Coalition, resulting from the needs assestment of Work Group #4 will continue this work by advocating for consistent baseline funding for long-term benefits. Efforts from Work Group #4 must be reviewed on a regular basis to ensure efficacy and efficiency, and the efforts must continuously align with the goals of what it means to be a part of California Agricultural Neighbors now and into the future.

Addendum A: CAN Work Group #4 Participant List

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Addendum B: CAN Work Group #4 Interview Questions

1. What gaps or challenges exist today that stand in the way of progress towards an integrated and interdisciplinary produce safety framework for CA?

2. To better integrate produce safety culture into the farm business structure, what approaches or tools need to be developed to operationalize produce safety as "good business"?

3. What are some approaches/relationships that must be considered to ensure experts with existing relationships (e.g. RCDs, CE specialists, etc.) with farmers are properly cross trained?

4. How do we better disseminate information to the masses?

5. What are some models or programs you all have seen and recognized as successful?

6. What are the types of roles each organization can take to achieve an interdisciplinary approach to achieving knowledge generation, transfer, and application of produce safety culture?

7. Which organization (or combination of organizations) in your opinion would be the ideal place for a "one-stop-shop" or a facilitator of activities/funds?

8. Are you willing to suggest an initial level of funding necessary to start this work that the group can consider when looking for funding opportunities?

9. Is there appetite in the universities to combine these areas of focus and advocate for positions necessary to support this work?

10. Is there anything else that you would like to add?

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