Optimizing Human Health and Nutrition: From Soil to Society

Progress and Collaboration Survey Report
December 2024

KANSAS STATE UNIVERSITY | Office of Educational Innovation and Evaluation

Optimizing Human Health and Nutrition: From Soil to Society

Progress and Collaboration Survey Report
December 2024

Background

In 2021, the United States Department of Agriculture National Institute of Food and Agriculture (USDA-NIFA) provided funding for Washington State University (WSU) and its partners for an Agriculture and Food Research Initiative (AFRI) Sustainable Agricultural Systems (SAS) project, *Optimizing Human Health and Nutrition: From Soil to Society* (herein referred to as the AFRI SAS Soil to Society [S2S] project). According to the project's proposal, the long-term goals are to create more nutritious, affordable, and accessible whole grain-based foods through: (1) investigation of the contribution of novel, biofortified crop varieties and food products to human health through clinical and epidemiological evaluations; and (2) development and deployment of nutritious food products made from improved crop varieties grown within sustainable cropping systems.

This multi-institutional and transdisciplinary project employs a Soil to Society pipeline strategy that addresses gaps in current knowledge and traces the flow of nutrients from agricultural systems and food production to human consumption. The strategy will culminate in the synthesis of more sustainable agricultural management strategies and healthy, affordable food products to meet the needs of diverse individuals and communities.

To address short-, medium-, and long-term goals, the project's key objectives are to:

1. Understand and apply the roles of environment, soil, and cropping system management on soil health, farm economics, and the nutritional content of grain for each target crop (Soil Management and Cropping Systems).
2. Develop new varieties of barley, wheat, peas, lentils, quinoa, and buckwheat with enhanced health and nutritive value (Plant Breeding and Genetics).
3. Confirm the impact of nutritionally enhanced varieties on key indicators of human health and assess acceptance using consumer panels (Human Health and Nutrition).
4. Develop a diverse and innovative suite of flavorful, affordable, and nutritious food products that will be accessible to consumers from all income levels (Food Science and Product Development).
5. Conduct population studies to explore impacts on dietary quality by increasing target crop consumption in US diets and assess consumer acceptance and valuation of whole grain- and legume-based foods (Community-based Health and Nutrition).
6. Focus educational capacity on secondary student instruction, teacher professional development, and farmer training (Education).
7. Disseminate knowledge gained and products developed to stakeholders across agriculture; food and health sciences; and communities, schools, and underserved populations through a wide-reaching extension effort (Extension).

Purpose

As part of the project evaluation, the AFRI SAS S2S project leadership contracted with the Office of Educational Innovation and Evaluation (OEIE) to conduct evaluation activities that assess the progress, implementation, and impacts of the project. Project leadership collaborated with OEIE to develop and conduct a web-based survey with project team members to learn about their perceptions of the progress made toward project objectives, implementation, collaboration and integration, and sustainability. This year, OEIE asked team members about project assets to create an asset map. Please see Appendix A for a copy of the survey.

Methods

On September 23rd, 2024, OEIE sent survey invitations to 55 S2S project team members that project leadership identified. The email invitation provided each contact with a personalized link through which they could complete the survey, with a request that they submit their completed surveys by October 7th, 2024. OEIE and project leadership periodically sent email reminders to encourage team members to complete the survey. When the deadline passed, OEIE extended the deadline to October 18th, 2024, to allow additional time for responses.

Analysis

OEIE analyzed the survey data by (1) calculating descriptive statistics on multiple choice and scaled items (i.e., frequencies [*n*], percentages, means [*M*], and standard deviations [*SD*]); and (2) coding qualitative responses for themes, with individual responses coded to multiple themes as applicable. Not all respondents answered all survey items, therefore there is variation in the *n* across survey items. Percentages are based on the number of responses received for that item, not the total number of survey respondents. The number of respondents for each item can be found in Appendix B. Highlights of these analyses appear in this summary. Full results appear in Appendix B, including descriptive statistics and themes derived from qualitative items. Verbatim responses to qualitative items are included in Appendix C. Asset mapping results can be found in Appendix D.

Respondents

The Year 4 Progress and Collaboration Survey received responses from 35 team members, two of whom were dropped for completing 11% of the survey or less, for a total of 33 participants or a 60.0% response rate.

- Most survey participants identified as project leadership, including team leads, or non-leadership (*n*=10; 30.3% for both), followed by students (*n*=7; 21.2%). The remaining participants were postdoctoral researchers and outreach/extension specialists (*n*=3; 9.1% for both).
- Most participants were from Objective 2: Plant Breeding and Genetics (*n*=8; 24.2%), followed by Objective 1: Soil Management and Cropping Systems (*n*=7; 21.2%).
    - Six respondents were from Objective 5: Community-based Health and Nutrition/Population and Social Science (18.2%).
    - Objectives 3: Human Health and Nutrition; 4: Food Science and Product Development; and 6: Education were each represented by four respondents (12.1%).
    - Three participants identified with Objective 7: Extension (9.1%).

Progress and Satisfaction

Respondents rated most objectives as on schedule (*n*=24; 72.7%) or somewhat behind schedule (*n*=10; 30.3%). Objectives 2, 3, and 4 were rated as on schedule while Objectives 1, 5, 6, and 7 were rated as

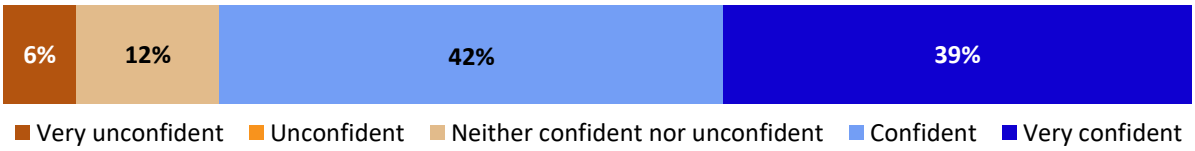
somewhat behind or on schedule. Team members most frequently cited sample processing/analysis delays (*n*=5) and delays in obtaining necessary information or materials from other objective teams (*n*=3) as reasons for being behind schedule. Team members shared mitigation strategies they have or plan to use to address these challenges, as well as support or resources that would aid them in their progress (see Table 1).

Table 1. Mitigation strategies and required resources to address delays in progress (*n*=9).

Support or resources needed
Increased communication and collaboration/engagement across objectives (e.g., more participation in Education and Outreach activities, more organized logistics for transitioning data/materials between objectives) (*n*=4)
Technical support for operating equipment (*n*=1)
Mitigation strategies proposed
Collaborating with team members (e.g., on analysis, on work plans) (*n*=1)
Hiring additional personnel to fill gaps left by students (*n*=1)
Learning from similar projects (*n*=1)

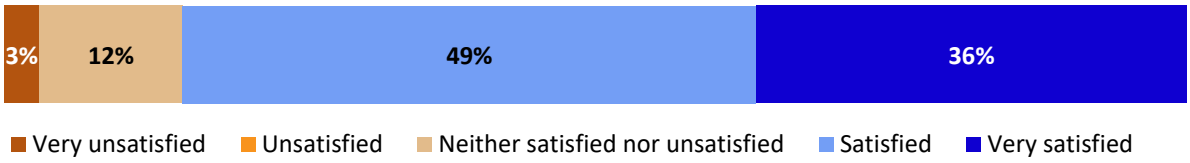
Despite encountering delays and challenges, over 80% of respondents (*n*=27) were confident or very confident that the project can achieve its goals (see Figure 1).

Figure 1. Team member confidence in project's ability to achieve its goals.



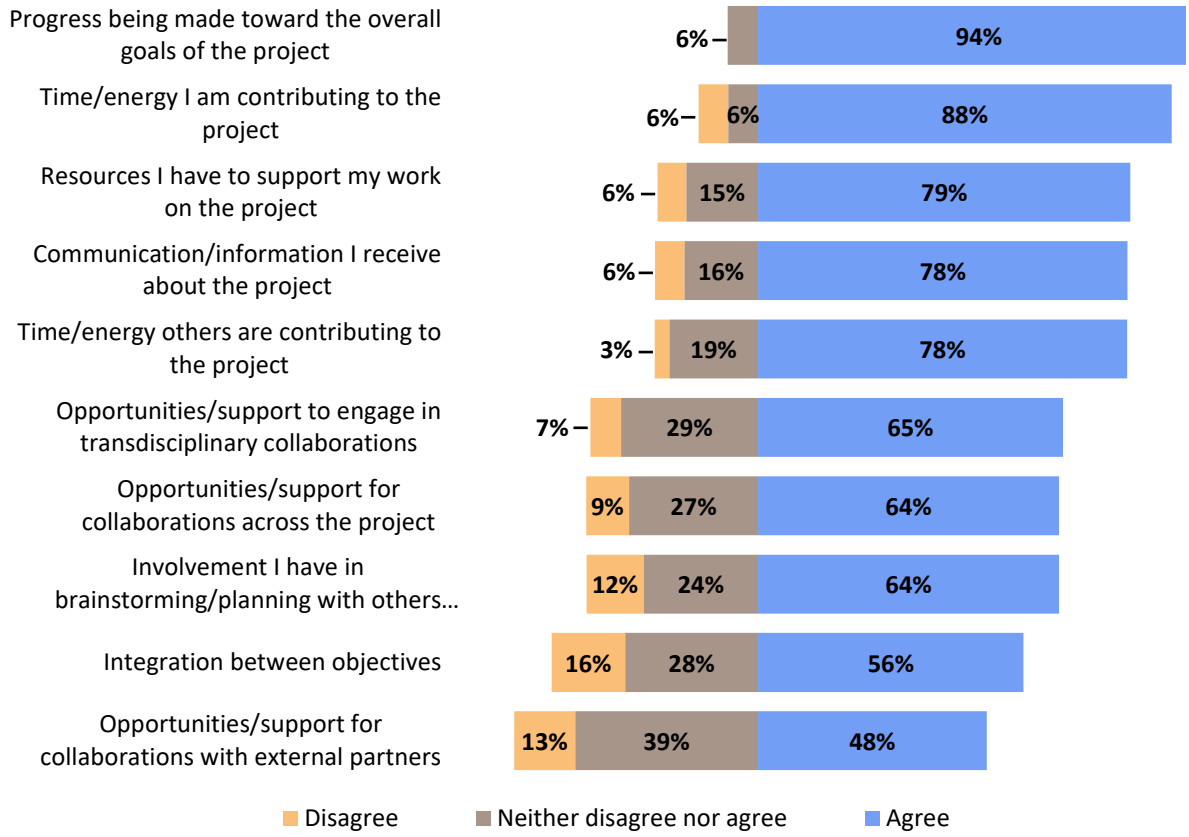
Respondents were even more positive about their satisfaction with project implementation, with 28 respondents (84.8%) satisfied or very satisfied (see Figure 2).

Figure 2. Team member satisfaction with project implementation.



When asked about specific aspects of project implementation, team members were most in agreement on being satisfied with progress being made toward the overall goals of the project and least in agreement with being satisfied with opportunities/support for collaborations with external partners (see Figure 3).

Figure 3. Team member agreement regarding satisfaction with aspects of project implementation.



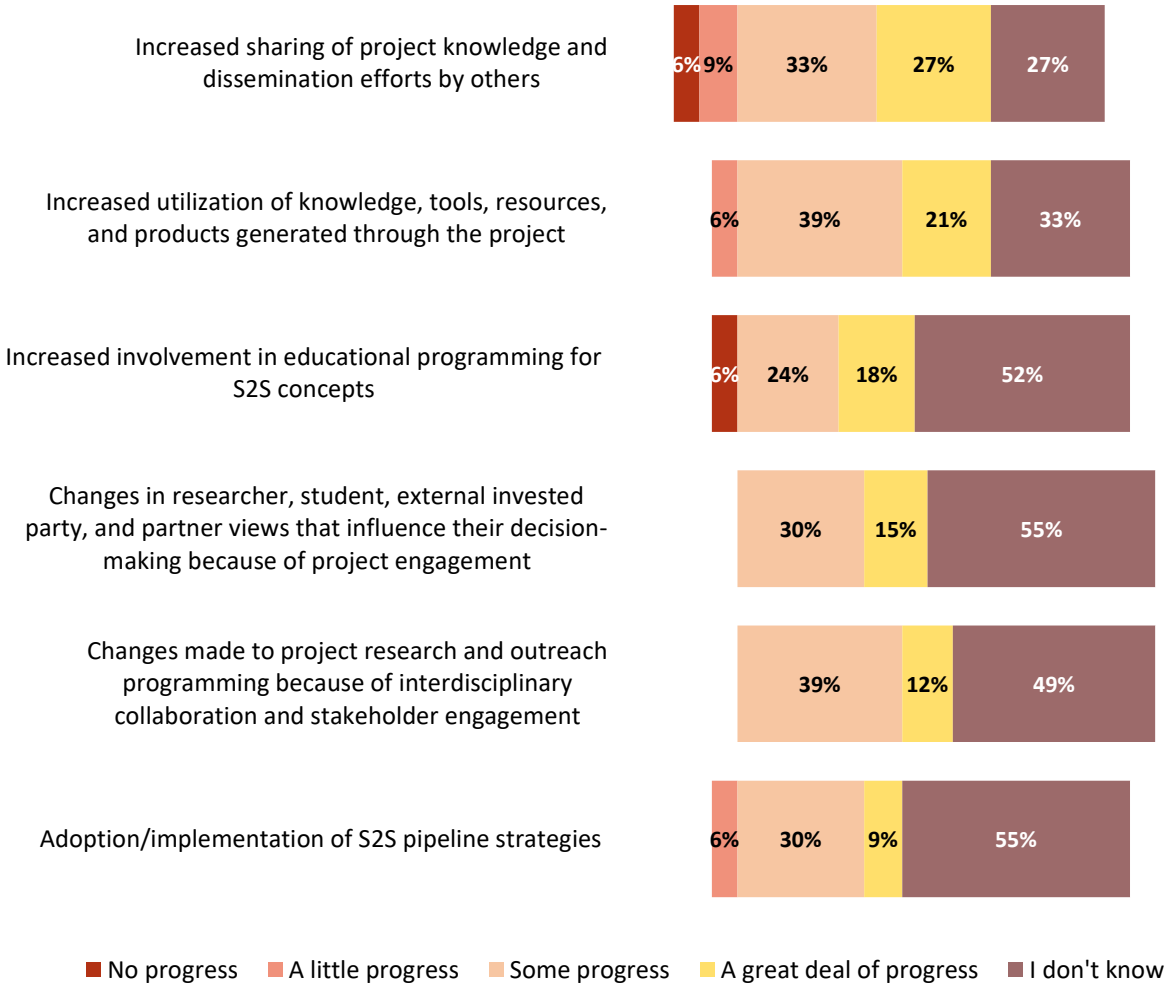
In general, items pertaining to collaboration and integration received the lowest ratings (collaborations with external partners; integration between objectives; opportunities/support to engage in transdisciplinary collaborations; opportunities/support for collaborations across the project; involvement in brainstorming/planning with others), while items pertaining to resources available to support project work; time and energy contributed; and progress toward project goals received the highest ratings.

Team members were asked about their perceptions of the project's progress toward medium-term project outcomes from the project's logic model. Around half the team indicated they did not know the extent of the project's progress on the majority of medium-term outcomes (see Figure 4).

Team members who felt able to answer rated the project as making at least a little progress on all six outcomes. Only two of the six medium-term goals received responses indicating no progress, and in each case, only two respondents reported no progress being made, while other participants rated these goals as making a little to a great deal of progress. These two goals were "increased sharing of project knowledge and dissemination efforts by others" and "increased involvement in educational programming for S2S concepts." Respondents most frequently indicated that the project is making a great deal of progress toward "increased utilization of knowledge, tools, resources, and products generated through the project" (*n*=7; 21.2%). Opinions were most varied regarding the "increased sharing of project knowledge and dissemination efforts by others," with some respondents (*n*=9; 27.3%) indicating the project has made a

great deal of progress toward this objective, while some (*n*=4; 12.1%) reported that the project is making little to no progress in this area.

Figure 4. Team member perceptions of progress toward project medium-term goals.



The survey asked respondents to share the current mechanisms through which their work is integrated with that of other objectives as well as which supports or resources the project could provide that would improve the integration of project work between and across objectives. Team members most frequently cited collaboration and communication as both the mechanisms currently used and areas that could be enhanced to improve existing integration efforts (see Table 2).

Table 2. Current and suggested mechanisms to support integration of project work across objectives.

Current mechanisms used to integrate project work between and across objectives (*n*=22)	Support/resources to facilitate **improved integration** of project work between and across objectives (*n*=18)

Cross-team collaboration and knowledge sharing (*n*=13)	Enhanced communication and updates (e.g., on material needed, critical instrumentation, objective statuses) (*n*=6)
School-based education and outreach activities (*n*=5)	Formal space for collaboration (e.g., more discussion time at annual meetings, more meetings for brainstorming collaborations and integrations (*n*=5)
Data and resource sharing (*n*=4)	Timely, active engagement with team members from other objectives (*n*=3)
Product design and development (*n*=2)	Access to additional material or capital resources (e.g., gas chromatograph and training, better connection to advisory board) (*n*=2)

On support or resources to facilitate integration across objectives:
"More communication and updates on critical infrastructure such as phenotyping instrumentation such that we are better able to accomplish our research goals. More communication regarding the amount of seed and genetic material needed for studies to ensure that we have generated enough grains in the previous field season for others to utilize in their studies."

Graduate Students & Postdoctoral Researchers

Graduate students and postdoctoral researchers were asked for feedback on their perceptions of benefits they receive from project participation. Students (*n*=10) most commonly reported that the project is making a lot to a great deal of impact on increasing their project-related research knowledge and their skills as an integrated research team member. The students least commonly reported that they are building their professional network. However, overall, students perceived that the project is benefiting them a moderate amount to a great deal (see Figure 5).

In addition to these benefits, students and postdoctoral researchers (*n*=7) also noted that because of their participation in the S2S project, they have developed teamwork skills (e.g., collaboration, communication, networking, experience working on large projects) and specialized skills (e.g., analytical techniques, presentation and teaching skills) (*n*=4 for each). One student shared that their project participation has exposed them to systems thinking, while another indicated the project gave students the opportunity to present on and win awards for their project-related research. One student's feedback indicated that students may not have a good understanding of the overall team makeup; they shared that while they are comfortable reaching out to other peers with questions, they do not know which full-time team members to approach for help as they are not familiar with the expertise of individual team members.

"This project has been instrumental in advancing my education and career options, especially the interdisciplinary nature of the project. It has opened my eyes to the ways that researchers can collaborate and approach research with systems thinking in mind. It has introduced me to both academic and industry leaders. It is an opportunity for students to get a well-rounded exposure to their field of study."

Figure 5. Graduate student perceptions of the benefits of project participation.

How much do you think your participation in AFRI SAS S2S has had an impact on...

Statement	None at all	A little	A moderate amount	A lot	A great deal
Advancing your professional/career goals	0%	20%	20%	10%	50%
Building your professional network	0%	10%	40%	10%	40%
Increasing your knowledge of project-related research topics	0%	0%	20%	20%	60%
Increasing your skills for working as an integrated member of a research team	0%	0%	20%	30%	50%
Bringing recognition to the work you are doing on the project	0%	30%	30%	20%	40%

Note. The darker the color, the higher the percentage of responses in that category.

Asset Assessment

S2S team members were asked to consider which assets the project has across four domains:

- Skills/knowledge: skills, abilities, and expertise of project members and external partners
- Social/network: connections with professional networks through partnerships, collaborations, and/or engagement with other institutions, organizations, and/or other invested parties
- Physical: space and facilities, materials, research equipment, and technology
- Capital: human, financial, or political resources; services that would otherwise need to be bought (administrative, legal, accounting, tech support, etc.)

Respondents were asked to share which assets they and other team members bring to the team across these categories. Attendees at the first S2S annual meeting conducted a similar asset-mapping activity, though with slightly different asset categories (see Appendix D for the Year 1 and Year 4 asset mapping activity results). The assets identified as available to the project in Year 4 are similar to those listed by project members in Year 1; team members provide knowledge and skill assets across a number of project research-related disciplines, as well as technical and professional skills. Team members provide social and network assets through connections to other researchers with relevant experience; professional organizations; non-profits; and end users and invested parties, such as schools, farmers, and industry/manufacturing. Respondents also provide physical assets, primarily in the form of laboratories, research and farm equipment, education and meeting spaces, and land for farms or gardens. The project's capital assets include project personnel, funding, and access to external experts in relevant disciplines.

Team members were also asked which assets they need to carry out project goals and objectives that are not currently available. Respondents (n=15) most commonly reported that they do not need additional resources. Other resources that team members could use can be found in Table 3.

Table 3. Assets needed by S2S project members that are not currently available.


Financial resources (to manufacture and distribute products; to carry out more molecular work; for travel) (*n*=3)


More personnel (graduate students, interns, technicians) (*n*=2)


More time (*n*=2)


Opportunities for outside micronutrient analysis and soil sampling (*n*=1)


Specialized equipment (gas chromatograph, PCR, RT-PCR, automated DNA extraction machine) (*n*=1)


Statistical support (*n*=1)


Translator to produce bilingual resources (*n*=1)

Collaboration

Project team members regularly collaborate with other S2S team members and external partners. Respondents most commonly collaborate with other team members weekly (*n*=15; 46.9%) or monthly (*n*=10; 31.3%). Collaborations with external partners are less frequent, with respondents most commonly engaging in these collaborations quarterly (*n*=11; 35.5%) or monthly (*n*=8; 25.8%). Over one-fifth of all respondents noted that they do not collaborate with external partners (*n*=7; 22.6%).

S2S team members were asked to rate their agreement with six statements regarding interdisciplinary collaboration experiences. Respondents generally agreed to strongly agreed that interdisciplinary collaboration improves the quality of project products, that benefits of such collaboration outweigh the inconveniences, and that their experiences have increased their interest in future interdisciplinary collaborations. Participants most strongly agreed that they trust their collaborations (*n*=20; 60.6%) and that collaborating with other disciplines produces a higher quality product than working independently (*n*=19; 57.6%). Respondents most frequently disagreed with the statement that their research questions of interest do not warrant collaboration from other disciplines.

Sustainability

Team members were asked to share their perspectives on what project sustainability means to them and what project efforts have or could be made to promote sustainability. Respondents (*n*=23) most frequently noted the continuation of interdisciplinary and industry collaborations (*n*=11), continuation of research and use of findings and methods (*n*=9), and changes in consumer behavior and knowledge (*n*=7), as well as continuation of sustainable agricultural practices (*n*=3), as important aspects of sustainability. Team members shared that continued knowledge development, such as generating research to influence policies, and serving as leaders in innovation that industry can follow (*n*=5); product development (*n*=5); and securing additional funding (*n*=4) will help promote sustainability efforts.

When asked for additional thoughts on improving sustainability efforts, respondents (*n*=11) most commonly cited continued and enhanced team interactions and collaborations (*n*=3) to promote sustainability. Other ideas included focusing on emerging research needs and future directions for research, increasing stakeholder engagement and integration, beginning to plan for dissemination (who, what, and how), and inviting new speakers to project meetings (*n*=1 for each). Team member feedback indicates that to respondents, sustainability includes an appreciation for the soil ecosystem and understanding of industry adoption of developed products (e.g., how well is this work proceeding, what else is needed), and maintenance of the seed library (*n*=1 for each).

Final Thoughts

When asked to consider the most significant impacts or benefits they have experienced in being part of the S2S project, team members (*n*=28) by far most frequently cited the expanded interdisciplinary collaboration opportunities and experiences (*n*=18) (see Table 4).

Table 4. Significant impacts of project participation most frequently cited by project members.

	Expanding interdisciplinary collaborations (*n*=18)
	Expanding/establishing professional networks (*n*=7)
	Broadening knowledge in project-related research (*n*=6)
	Contributing to impact on end users/invested parties (e.g., by increasing partner and external partner/industry interests and engagement) (*n*=4)
	Funding of graduate students (*n*=4)

Respondents were asked what they consider to be the most successful project aspects related to progress and collaboration. Respondents (*n*=24) noted the project's fostering of collaborations and development of partnerships most frequently as a success (*n*=10), followed most commonly by making progress on project objectives and goals (*n*=5), innovation and creativity in conducting scientific research (*n*=4), and product development (*n*=3). Team members were asked what, from their perspective, the S2S project should prioritize during the remaining time. Respondents (*n*=28) most frequently suggested focusing on dissemination of project research findings (*n*=9); team integration and collaborations (*n*=8); product development and distribution (*n*=5); extension, outreach, and community engagement (*n*=4); and expediting the remaining research (*n*=3).

Observations & Recommendations

"We should look for opportunities to plan dissemination of our findings in a way that increases their uptake/relevance. For example, with the new dietary guidelines coming out soon, there will be a buzz about nutrition and trying to find ways to change diets. We can disseminate into that [buzz]. To do it well will require advance planning."

Overall, feedback received from the team in this year's Progress and Collaboration Survey was positive. Team members are satisfied with implementation and progress and are confident that the project will achieve its goals. Both graduate students and the larger team feel they benefit from project participation and that the project is making some progress toward medium-term objectives, providing evidence toward project fidelity of implementation and impact.

Respondents rated communication and collaboration highly, but as in previous years, the team continues identify these areas as needing the most improvement, particularly in coordinating project work (i.e., ensuring timely sharing of data or materials across teams) and in providing more formalized and structured opportunities for integration (e.g., more collaboration time at annual meetings; more meeting time and collaboration efforts dedicated to cross-objective collaborations and external partners). Such results indicate progress is being made toward the project goals of enhancing project work via transdisciplinary research collaboration. OEIE recommends that project leadership develop a process for moving information and materials through the project as inter-team delays have been cited as a cause of being behind schedule, especially as some team members recommended such a framework as a mechanism for improving integration efforts. During this meeting, leadership could also discuss with objective teams and/or team leads which resources the project can provide to those individual teams that will help their work get back on track.

In addition to the resources that team members have requested to help them stay on schedule, OEIE suggests that project leadership review the assets that respondents reported that they need. The project may have assets available that team members have stated they need but that team members themselves are not aware of or do not know how to access, or the project may have connections that can be leveraged to gain access to such resources. Because of this, the project may benefit from leadership providing the asset map to all team members, facilitating connections between needs and available assets, and discussing needs for the final project years with objective leads if leadership is not already doing so.

Finally, not only did students and the greater team report a host of assets they provide, but they have also developed skills and knowledge through the multidisciplinary and transdisciplinary nature of the project and the research and professional opportunities provided (e.g., presentation, teamwork, and research skills acquired through conference and research opportunities). Such growth provides evidence toward the project goal to develop and deploy nutritious food products made from improved crop varieties grown within sustainable cropping systems. In the same vein, project work and opportunities are most apt to be sustained by team members' suggestions to enhance collaboration with each other, across objectives, and with invested parties. These efforts were reported to continue their already demonstrated growth in knowledge, skills, and research findings, highlighting further the benefits to and development of the workforce. OEIE recommends that leadership consider the suggestions made by team members and the suggestions above regarding support for collaboration to enhance the project's sustainability.

When discussing priorities during the remaining project years and strategies to promote project sustainability, respondents frequently identified the importance of maintaining and enhancing interdisciplinary and industry connections and of emphasizing dissemination efforts. OEIE recommends that project leadership consider developing a repository of collaborators within academia, industry, and related fields that contains contact information for primary collaborators as well as individuals within the project teams who will be responsible for maintaining contact with those collaborators. OEIE also suggests that project leadership meet with objective leads and team members involved in extension, outreach, education, or community engagement to identify key dissemination avenues, both in traditional peer-reviewed academia and through non-traditional social and community avenues, such as podcasts,

infographics, and social media, as well as identifying key dissemination times to maximize impact and relevance. OEIE recommends that project leadership consider appointing a team of project members who will take point in developing these dissemination materials and consider how to best engage students, both graduate and undergraduate interns, in developing and disseminating project materials.

Optimizing Human Health and Nutrition: From Soil to Society
Year 4 Progress and Collaboration Survey Report
Appendix A – Copy of Survey

AFRI SAS Soil to Society Year 4 Progress & Collaboration Survey (2024)

AFRI SAS Soil to Society Project Progress & Collaboration Survey (Year 4) The purpose of this survey is to gain your experiences with and feedback on progress made by and collaboration within the AFRI SAS Optimizing Human Health and Nutrition: From Soil to Society (AFRI SAS Soil to Society) project.

Your participation is voluntary, and your responses to survey questions will be kept confidential to the extent that your responses will not be tied to your name in the reporting of results. Responses from all participants, including text comments, will be combined with those of other survey respondents and reported to the AFRI SAS Soil to Society team for their use with project planning and reporting. Information shared will not be used or distributed for any other purpose.

We ask that you please complete this survey by **October 18, 2024**. The survey should take approximately 15-20 minutes to complete. Your feedback is important, as your responses will contribute to successful project implementation and reporting to the AFRI SAS Soil to Society team. For technical assistance related to the survey or questions about the evaluation, please contact the evaluation team members Adrienne L. McCarthy (mccarthya@ksu.edu) or Laurel Schmidt (lrschmidt@ksu.edu).

Questions about the project and the evaluation can also be directed to Kevin Murphy, AFRI SAS Soil to Society Project Director. You may also contact Lisa Rubin (rubin@ksu.edu) of the Research Compliance Office at Kansas State University with questions about the evaluation.

Thank you,

Adrienne L. McCarthy, Laurel Schmidt, Mukesh Bhattarai, and Kristin Wright
AFRI SAS Soil to Society External Evaluation Team
Office of Educational Innovation and Evaluation (OEIE)
Kansas State University

Q1*** **CONSENT** Please indicate your consent to participate in this survey. By selecting "I agree to participate," you are providing your consent to participate in this survey. If you would like a copy of the consent form, please print this page for your own records.

- ○ I agree to participate.
- ○ I prefer to not participate.

Q2 Please indicate your role in the AFRI SAS Soil to Society project:

- ○ Project Leadership (including team leads)
- ○ Faculty (non-leadership)
- ○ Post-Doc
- ○ Student
- ○ Outreach/education
- ○ Other (Please specify) _____

Q3 Please indicate which AFRI SAS Soil to Society objective(s) you are a part of (select all that apply).

- ☐ Objective 1: Soil Management & Cropping Systems
- ☐ Objective 2: Plant Breeding & Genetics
- ☐ Objective 3: Human Health & Nutrition
- ☐ Objective 4: Food Science & Product Development
- ☐ Objective 5: Community-based Health & Nutrition
- ☐ Objective 6: Education
- ☐ Objective 7: Extension
- ☐ Other (Please specify) _____

Q4 For each objective you are a part of, please rate the current status of progress made toward the goal of this objective this year.

	Significantly behind schedule	Somewhat behind schedule	On schedule	Somewhat ahead of schedule	Significantly ahead of schedule
Objective 1: Soil Management & Cropping Systems	○	○	○	○	○
Objective 2: Plant Breeding & Genetics	○	○	○	○	○
Objective 3: Human Health & Nutrition	○	○	○	○	○
Objective 4: Food Science & Product Development	○	○	○	○	○
Objective 5: Community-based Health & Nutrition	○	○	○	○	○
Objective 6: Education	○	○	○	○	○
Objective 7: Extension	○	○	○	○	○
Other (Please specify)	○	○	○	○	○

Q5 For each objective that you indicated is significantly behind schedule or somewhat behind schedule, please describe which parts of the objective(s) are behind and why.

_____
_____
_____
_____
_____

Q6 For each objective that you indicated is significantly behind schedule or somewhat behind schedule, please identify the support and/or resources you need to get back on schedule and describe any mitigation plans you may have.

_____
_____
_____
_____
_____

Q7 How confident are you that the project can achieve its goals?

- ○ Very unconfident
- ○ Unconfident
- ○ Neither confident nor unconfident
- ○ Confident
- ○ Very confident

Q8 Overall, how satisfied are you with the implementation of the AFRI SAS Soil to Society project?

- ○ Very unsatisfied
- ○ Unsatisfied
- ○ Neither satisfied nor dissatisfied
- ○ Satisfied
- ○ Very satisfied

Q9 What could be improved to increase your satisfaction with project implementation over the final two years of the project?

_____
_____
_____
_____
_____

Q10 Think about your experiences with the AFRI SAS Soil to Society project. Rate your level of agreement with each statement below.

I am **satisfied** with the amount of...

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Communication/information I receive about the project	○	○	○	○	○
Resources I have to support my work on the project	○	○	○	○	○
Time/energy I am contributing to the project	○	○	○	○	○
Time/energy others are contributing to the project	○	○	○	○	○
Integration between objectives	○	○	○	○	○
Involvement I have in brainstorming/planning with others working on the project	○	○	○	○	○
Opportunities/support for collaborations across the project (i.e., between internal S2S members)	○	○	○	○	○
Opportunities/support for collaborations with external partners (i.e., collaborators not part of the internal project team)	○	○	○	○	○
Opportunities/support to engage in transdisciplinary collaborations	○	○	○	○	○
Progress being made toward the overall goals of the project	○	○	○	○	○

Q11 From your perspective, please rate the progress made toward the following medium-term project outcomes

	No progress	A little progress	Some progress	A great deal of progress	Don't know
Changes made to project research and outreach programming because of interdisciplinary collaboration and stakeholder engagement	○	○	○	○	○
Changes in researcher, student, external invested party (stakeholder), and partner views (trust, perceptions) that influence their decision-making because of project engagement	○	○	○	○	○
Increased utilization of knowledge, tools, resources, and products generated through the project	○	○	○	○	○
Adoption/implementation of S2S pipeline strategies (e.g., companies produce and market healthy foods and meals, plant breeders adopt agriculture management practices, farmers adjust practices due to research results)	○	○	○	○	○
Increased involvement in educational programming for S2S concepts (e.g., high school students pursuing agriculture careers, undergraduates applying knowledge in agriscience careers)	○	○	○	○	○
Increased sharing of project knowledge and dissemination efforts by others (i.e., citations, tweets, retweets, shares, posts, re-posts, etc.)	○	○	○	○	○

Q12 Please describe any work being done to integrate work from your objective(s) with other objectives' work this year.

_____

Q13 What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work?

_____

Q14 How much do you think your participation in AFRI SAS Soil to Society has had an impact on...

	None at all	A little	A moderate amount	A lot	A great deal
Advancing your professional/career goals	○	○	○	○	○
Building your professional network	○	○	○	○	○
Increasing your knowledge of project-related research topics	○	○	○	○	○
Increasing your skills for working as an integrated member of a research team	○	○	○	○	○
Bringing recognition to the work you are doing on the project	○	○	○	○	○

Q15 Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your professional or academic career goals.

_____
_____
_____
_____
_____

Q16 For the next set of questions, consider the S2S project's needs moving forward and the assets available to meet those needs to support progress toward achieving project goals and objectives. The process of identifying available assets and gaps in assets can assist project improvement efforts and help address project-related challenges. Assets are any resource available to the project that could be used to help move the project toward a particular outcome. Keep in mind that there are different kinds of assets including:

Skills and knowledge assets: specific skills, abilities, and expertise of project members and external partners
Physical assets: Space and facilities, materials, research equipment and technology **Social/Network Assets:** Connections to professional networks through partnerships with other institutions and organizations
Capital assets: Human, financial, or political resources; services that would otherwise need to be bought

During Year 2-3, what key assets have you contributed to the project that have been utilized by you and/or others in working towards project goals? Please be specific and list up to 5 assets that you contributed

○ **Skills and Knowledge Assets** (i.e., food science/cooking/baking, grant writing, nutrition knowledge, mentorship, HPLC expertise)

_____

○ **Physical Assets** (farmland, farming equipment, data, statistical software, greenhouses, classroom/education facilities, computing resources, LARC building kitchen, anaerobic chamber)

_____

○ **Social/Network Assets** (Farmer connections, soil scientists, plant breeders, Organic Seed Alliance, corporate donors)

_____

○ **Capital Assets** (student workers, grant funds, seed grants, staff/personnel)

_____

Q17 For the next set of questions, consider the S2S project's needs moving forward and the assets available to meet those needs to support progress toward achieving project goals and objectives. The process of identifying available assets and gaps in assets can assist project improvement efforts and help address project-related challenges. Assets are any resource available to the project that could be used to help move the project toward a particular outcome. Keep in mind that there are different kinds of assets including:

Skills and knowledge assets: specific skills, abilities, and expertise of project members and external partners

Physical assets: Space and facilities, materials, research equipment and technology **Social/Network Assets:** Connections to professional networks through partnerships with other institutions and organizations
Capital assets: Human, financial, or political resources; services that would otherwise need to be bought

During Year 2-3, what key assets did other team members or external partners contribute that have been essential to your work on the S2S project? Please be specific and list 5 assets other team members or external partners contributed that have been essential to your work

○ Skills and Knowledge Assets (specific skills, abilities, and expertise of project members and external partners) _____

○ Physical Assets (specific space and facilities, materials, research equipment and technology) _____

○ Social/Network Assets (specific connections to professional networks through partnerships with other institutions or organizations) _____

○ Capital Assets (specific human, financial, or political resources; services that would otherwise need to be bought) _____

Q18 What key assets do you need to carry out project goals and objectives that are not currently available? (Consider: What other resources do you need? What types of resources are needed to overcome any barriers or challenges you are facing in making progress towards your goals and objectives?)

_____

Q19 On average, how frequently do you collaborate with...

	...other team members for this project?	...external partners for this project?
	Select one	Select one
Daily	○	○
Weekly	○	○
Monthly	○	○
Quarterly	○	○
Annually	○	○
N/A, I do not or have not collaborated with these folks	○	○

Q20 Please rate your level of agreement with these statements about your collaboration experiences on the AFRI SAS Soil to Society project.

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
The benefits of collaboration among scientists from different disciplines usually outweigh the inconveniences and costs of such work.	○	○	○	○	○
Collaborating **with other disciplines** on this project is producing a higher quality product than working individually.	○	○	○	○	○
Collaborating with **other disciplines** on this project is producing a higher quality product.	○	○	○	○	○
In general, I trust my collaborators.	○	○	○	○	○
My experiences on this project have increased my interest in interdisciplinary collaboration on future projects.	○	○	○	○	○
I tend to be more productive working on research projects **as a member of a collaborative** team rather than independently.	○	○	○	○	○
The research questions I am often interested in generally **do not** warrant collaboration from other disciplines.	○	○	○	○	○

Q21 What does project sustainability mean to you and what project efforts have you observed (if any) have been made towards that sustainability (i.e., continuation of project research, collaborations, connections to industry, changes in consumer behavior and knowledge, adoption of whole grain products into commercial food systems)?

_____

Q22 Please provide any additional thoughts or suggestions that may be helpful to project leadership to improve their sustainability efforts of the Soil to Society project.

_____

Final Thoughts

Q23 What have been the most significant benefits or impacts for you in being a part of the AFRI SAS Soil to Society project?

_____
_____
_____
_____
_____

Q24 Considering progress and collaboration, what aspects of this project are most successful?

_____
_____
_____
_____
_____

Q25 What do you think the project should prioritize over the next project year as the project enters its final years?

_____
_____
_____
_____
_____

Q26 Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project's progress or collaboration efforts.

_____
_____
_____
_____
_____

Optimizing Human Health and Nutrition: From Soil to Society
Year 4 Progress and Collaboration Survey Report
Appendix B - Compiled Results

Note. The sum of frequencies for certain tables may exceed 100% or the total n if they are for questions in which respondents could select multiple responses or are open-ended questions that may be coded for multiple themes.

Table 1. Please indicate your consent to participate in this survey. By selecting "I agree to participate," you are providing your consent to participate in this survey. If you would like a copy of the consent form, please print this page for your own records. (*n* = 33)

Response Option	Frequency	Percent
I agree to participate	33	100%
I prefer not to participate	-	-
Total	33	100%

Progress and Satisfaction:

Table 2. Please indicate your role in the AFRI SAS Soil to Society project. (*n* = 33)

Response Option	Frequency	Percent
Project Leadership (including team leads)	10	30.3%
Faculty (non-leadership)	10	30.3%
Student	7	21.2%
Post-Doc	3	9.1%
Outreach/education	3	9.1%
Other (please specify)	-	-
Total	33	100%

Table 3. Please indicate which AFRI SAS Soil to Society objective(s) you are a part of (select all that apply). (*n* = 33)

Response Option	Frequency	Percent
Objective 1: Soil Management and Cropping Systems	7	21.2%
Objective 2: Plant Breeding and Genetics	8	24.2%
Objective 3: Human Health and Nutrition	4	12.1%
Objective 4: Food Science and Product Development	4	12.1%
Objective 5: Community-based Health and Nutrition	5	15.2%
Objective 6: Education	4	12.1%
Objective 7: Extension	3	9.1%
Other (please specify)	1	3.0%

Note. “Other” response was “Objective 5: Population & Social Science.”

Table 4. For each objective you are a part of, please rate the current status of progress made toward the goal of this objective this year.

Statement	Significantly behind schedule	Somewhat behind schedule	On schedule	Somewhat ahead of schedule	Significantly ahead of schedule	Total (*n*)	*M* (*SD*)
Objective 1: Soil Management and Cropping Systems	-	4 (57.1%)	3 (42.9%)	-	-	7	2.4 (0.5)
Objective 2: Plant Breeding and Genetics	-	1 (12.5%)	6 (75.0%)	1 (12.5%)	-	8	3.0 (0.5)
Objective 3: Human Health and Nutrition	-	-	4 (100.0%)	-	-	4	3.0 (0.0)
Objective 4: Food Science and Product Development	-	1 (25.0%)	2 (50.0%)	1 (25.0%)	-	4	3.0 (0.8)
Objective 5: Community-based Health and Nutrition	-	1 (20.0%)	4 (80.0%)	-	-	5	2.8 (0.4)
Objective 6: Education	-	2 (50.0%)	2 (50.0%)	-	-	4	2.5 (0.6)
Objective 7: Extension	-	1 (33.3%)	2 (66.7%)	-	-	3	2.7 (0.6)
Other (please specify)	-	-	1 (100.0%)	-	-	1	3.0 (0.0)

Note. Individuals were only asked to rate those objectives in which they had previously indicated they are a part of. Means are on a scale from 1 = Significantly behind schedule to 5 = Significantly ahead of schedule. "Other" response was "Population & Social Science."

Table 5. For each objective that you indicated is significantly behind schedule, please briefly describe which parts of the objective(s) are behind and why. (*n* = 9)

Theme	Frequency
Processing/analysis delays (e.g., difficulty in optimizing protocols, soil sample analysis, analyze samples for barley beta glucans, grain micronutrient concentration, and wheat baking quality)	5
Curriculum development and teacher training	2
Product development efforts	1
Extension and outreach efforts	1
Reason	
Delays in obtaining necessary information or materials from other teams (e.g., information, seeds, access to facilities)	3

Theme	Frequency
Reason	
Additional experiments added	1
Late hiring/onboarding of staff	1
Logistical constraints (e.g., travel required for sample analysis)	1
Sampling delayed due to drought	1
Technological/equipment Issues (EDXRF equipment failure, machinery and scheduling conflicts)	1

Note. Individuals were only asked about objectives in which they indicated they participate.

Table 6. For each objective that you indicated is significantly behind schedule or somewhat behind schedule, please identify the support and/or resources you need to get back on schedule and describe any mitigation plans you may have. (*n* = 9)

Theme	Frequency
Support and/or resources needed	
Better inter-objective communication/coordination (e.g., need responses for participation in career-based videos for the curriculum, more organized way to get the harvested seeds for product development efforts)	4
Technical support (e.g., help to calibrate discrete gallery analyzer)	1
Mitigation plans	
Collaborate with team members (e.g., on work plans, on analysis)	1
Establish connections to learn from similar projects	1
Hire a non-student worker to replace vacancies left by students	1
No support or mitigation needed (e.g., equipment has been repaired, progress not significantly behind)	2

Note. Individuals were only asked about objectives in which they indicated they participate.

Table 7. How confident are you that the project can achieve its goals? (*n* = 33)

Response Option	Frequency	Percent
Very unconfident	2	6.1%
Unconfident	-	-
Neither confident nor unconfident	4	12.1%
Confident	14	42.4%
Very confident	13	39.4%
Total	33	100.0%

Note. Means are on a 5-point scale (1 = Very unconfident to 5 = Completely confident). *M* = 4.1, *SD* = 1.0

Table 8. Overall, how satisfied are you with the implementation of the AFRI SAS Soil to Society project? (*n* = 33)

Response Option	Frequency	Percent
Very unsatisfied	1	3.0%
Unsatisfied	-	-
Neither satisfied nor dissatisfied	4	12.1%
Satisfied	16	48.5%
Very satisfied	12	36.4%

Response Option	Frequency	Percent
Total	33	100.0%

Note. Means are on a 5-point scale (1 = Not at all satisfied to 5 = Completely satisfied). *M* = 4.2, *SD* = 0.9

Table 9. What could be improved to increase your satisfaction with project implementation over the final two years of the project? (n = 1)

Response
The coordinator needs to coordinate and communicate with the group. We do not need one more frantic "hey everyone we need an update by Wednesday" and then a week later get a summary that looks rushed and is basically many voices not linked together and not helpful.

Note. Only one response was provided for this question, therefore, no themes could be found.

Table 10. Think about your experiences with the AFRI SAS Soil to Society project. Rate your level of agreement with each statement below. I am satisfied with the amount of…

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (*n*)	*M* (*SD*)
Communication/ information I receive about the project.	1 (3.1%)	1 (3.1%)	5 (15.6%)	18 (56.3%)	7 (21.9%)	32	3.9 (0.9)
Resources I have to support my work on the project.	-	2 (6.1%)	5 (15.2%)	14 (42.4%)	12 (36.4%)	33	4.1 (0.9)
Time/energy I am contributing to the project.	-	2 (6.3%)	2 (6.3%)	16 (50.0%)	12 (37.5%)	32	4.2 (0.8)
Time/energy others are contributing to the project.	1 (3.1%)	-	6 (18.8%)	13 (40.6%)	12 (37.5%)	32	4.1 (0.9)
Integration between objectives.	-	5 (15.6%)	9 (28.1%)	13 (40.6%)	5 (15.6%)	32	3.6 (0.9)
Involvement I have in brainstorming/planning with others working on the project.	1 (3.0%)	3 (9.1%)	8 (24.2%)	15 (45.5%)	6 (18.2%)	33	3.7 (1.0)
Opportunities/support for collaborations across the project (i.e., between internal S2S members).	-	3 (9.1%)	9 (27.3%)	15 (45.5%)	6 (18.2%)	33	3.7 (0.9)
Opportunities/support for collaborations with external partners (i.e., collaborators not part	-	4 (12.9%)	12 (38.7%)	12 (38.7%)	3 (9.7%)	31	3.5 (0.9)

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (*n*)	*M* (*SD*)
of the internal project team).							
Opportunities/support to engage in transdisciplinary collaborations.	-	2 (6.5%)	9 (29.0%)	16 (51.6%)	4 (12.9%)	31	3.7 (0.8)
Progress being made toward the overall goals of the project.	-	-	2 (6.5%)	21 (67.7%)	8 (25.8%)	31	4.2 (0.5)

Note. Means are on a scale from 1 = Strongly disagree to 5 = Strongly agree.

Table 11. From your perspective, please rate the progress made toward the following medium-term project outcomes.

Statement	No progress	A little progress	Some progress	A great deal of progress	I Don't know	Total (*n*)	*M* (*SD*)
Changes made to project research and outreach programming because of interdisciplinary collaboration and stakeholder engagement.	-	-	13 (39.4%)	4 (12.1%)	16 (48.5%)	33	3.2 (0.4)
Changes in researcher, student, external invested party (stakeholder), and partner views (trust, perceptions) that influence their decision-making because of project engagement.	-	-	10 (30.3%)	5 (15.2%)	18 (54.5%)	33	3.3 (0.5)
Increased utilization of knowledge, tools, resources, and products generated through the project.	-	2 (6.1%)	13 (39.4%)	7 (21.2%)	11 (33.3%)	33	3.2 (0.6)
Adoption/implementation of S2S pipeline strategies (e.g., companies produce and market healthy foods and meals, plant breeders adopt agriculture management practices, farmers adjust practices due to research results).	-	2 (6.1%)	10 (30.3%)	3 (9.1%)	18 (54.5%)	33	3.1 (0.6)

Statement	No progress	A little progress	Some progress	A great deal of progress	I Don't know	Total (*n*)	*M* (*SD*)
Increased involvement in educational programming for S2S concepts (e.g., high school students pursuing agriculture careers, undergraduates applying knowledge in agriscience careers).	2 (6.1%)	-	8 (24.2%)	6 (18.2%)	17 (51.5%)	33	3.1 (1.0)
Increased sharing of project knowledge and dissemination efforts by others (i.e., citations, tweets, retweets, shares, posts, re-posts, etc.).	1 (3.0%)	3 (9.1%)	11 (33.3%)	9 (27.3%)	9 (27.3%)	33	3.2 (0.8)

Note. Means are on a scale from 1 = No progress to 4 = A great deal of progress. Means do not incorporate "I don't know" answers.

Table 12. Please describe any work being done to integrate work from your objective(s) with other objectives' work this year. (*n* = 22)

Theme	Frequency
Cross-team collaboration and knowledge sharing (interns placed across objectives, collaboration on follow-up research about consumer acceptance)	13
School-based (K-12) education/outreach work (e.g., HS interns, recipe development, sharing of knowledge of school food service preferences)	5
Data/resource sharing (data from one objective used in curriculum)	4
Product design/development	2
Testing varieties and breeding lines from each crop	2
Creating videos for curriculum development	1
Field days	1
Sampling and analysis	1
Project work does not integrate well with other teams	1
Not sure	1
N/A or None	3

Table 13. What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work? (*n* = 18)

Theme	Frequency
Enhanced communication and updates (e.g., on material needed, on critical instrumentation, on other objectives' statuses, building online databases that all can access)	6
Formal space for collaboration (e.g., annual meeting has helped facilitating integration, more discussion time at annual meetings, more meetings brainstorming on collaborations/integrations)	5
Timely, active engagement from other teams (e.g., in seed sharing, sample processing, in participating in E/O)	3

Theme	Frequency
Access to additional material or capital resources (e.g., Gas chromatograph, more connection with advisory panel)	2
Not sure	2
N/A; currently receive required resources and support	2

Graduate Students/Postdoctoral Researchers:

Table 14. How much do you think your participation in AFRI SAS Soil to Society has had an impact on...

Statement	None at all	A little	A moderate amount	A lot	A great deal	Total (*n*)	M (*SD*)
Advancing your professional/career goals.	-	2 (20.0%)	2 (20.0%)	1 (10.0%)	5 (50.0%)	10	3.9 (1.3)
Building your professional network.	-	1 (10.0%)	4 (40.0%)	1 (10.0%)	4 (40.0%)	10	3.8 (1.1)
Increasing your knowledge of project-related research topics.	-	-	2 (20.0%)	2 (20.0%)	6 (60.0%)	10	4.4 (0.8)
Increasing your skills for working as an integrated member of a research team.	-	-	2 (20.0%)	3 (30.0%)	5 (50.0%)	10	4.3 (0.8)
Bringing recognition to the work you are doing on the project.	-	1 (10.0%)	3 (30.0%)	2 (20.0%)	4 (40.0%)	10	3.9 (1.1)

Note. Means are on a scale from 1 = None at all to 5 = A great deal.

Table 15. Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your professional or academic career goals. (*n* = 7)

Theme	Frequency
Developed specialized skills (e.g., curriculum creation, teaching skill, analytical techniques, presentation skills)	4
Developed teamwork skills (e.g., collaboration, communication, networking, experience with large project)	4
Exposure to systems thinking	1
Challenges in navigating the overall project team make up is hindering advancing professional or career goal	1
Received recognition and academic exposure	1

Asset Assessment:

For tables 16-18 and details on the asset mapping assessment, please see Appendix D.

Collaboration:

Table 19. On average, how frequently do you collaborate with other team members for this project? (*n* = 32)

Response Option	Frequency	Percent
Daily	5	15.6%
Weekly	15	46.9%
Monthly	10	31.3%
Quarterly	6	18.8%
Annually	3	9.4%
N/A, I do not or have not collaborated with these folks	2	6.3%

Table 19a. On average, how frequently do you collaborate with external partners for this project? (*n* = 31)

Response Option	Frequency	Percent
Daily	-	-
Weekly	6	19.4%
Monthly	8	25.8%
Quarterly	11	35.5%
Annually	5	16.1%
N/A, I do not or have not collaborated with these folks	7	22.6%

Table 20. Please rate your level of agreement with these statements about your collaboration experiences on the AFRI SAS Soil to Society project.

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (*n*)	*M* (*SD*)
The benefits of collaboration among scientists from different disciplines usually outweigh the inconveniences and costs of such work.	-	-	4 (12.5%)	15 (46.9%)	13 (40.6%)	32	4.3 (0.7)
Collaborating with **other disciplines** on this project is producing a higher quality product.*	-	-	4 (12.5%)	10 (31.3%)	18 (56.3%)	32	4.4 (0.7)
In general, I trust my collaborators.	-	-	2 (6.1%)	11 (33.3%)	20 (60.6%)	33	4.6 (0.6)
My experiences on this project have increased my interest in interdisciplinary collaboration on future projects.	-	-	2 (6.3%)	18 (56.3%)	12 (37.5%)	32	4.3 (0.6)
I tend to be more productive working on research projects **as a member of a**	-	1 (3.0%)	6 (18.2%)	11 (33.3%)	15 (45.5%)	33	4.2 (0.9)

Statement	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	Total (*n*)	*M* (*SD*)
collaborative team rather than independently.							
The research questions I am often interested in generally **do not** warrant collaboration from other disciplines.	5 (15.6%)	16 (50.0%)	7 (21.9%)	2 (6.3%)	2 (6.3%)	32	2.4 (1.0)

Note. Means are on a scale from 1 = Strongly disagree to 5 = Strongly agree.
*This question was repeated with only a minor difference ("…higher quality product than working individually"), the distinction of which was found to be confusing, therefore, this version of the question remains and the other was deleted. Both questions had the same means with 0.1 difference in *SD*).

Table 21. What does project sustainability mean to you and what project efforts have you observed (if any) have been made towards that sustainability (i.e., continuation of project research, collaborations, connections to industry, changes in consumer behavior and knowledge, adoption of whole grain products into commercial food systems)? (*n* = 23)

Theme	Frequency
Sustained/increased interdisciplinary and industry collaborations (e.g., with industry, with end users, with external partners)	11
Continuation of research, use of findings & methods	9
Changes in consumer behavior and knowledge	7
Continued knowledge development (e.g., to influence policies, lead innovation that industry can follow)	5
Product development	5
Securing additional funding/extending funding	4
Continuation of sustainable agricultural practices	3
Not enough experience on project to answer	1

Table 22. Please provide any additional thoughts or suggestions that may be helpful to project leadership to improve their sustainability efforts of the Soil to Society project. (*n* = 11)

Theme	Frequency
Continued/enhanced team collaboration efforts	3
Develop appreciation among team for soil ecosystem	1
Focus on emerging research needs/future research direction (e.g., nutrition and gut health related research)	1
Increased stakeholder engagement/integration	1
Invite new speakers to meetings	1
More information on industry adoption of whole grain products (e.g., metrics, projection of success)	1
Seed library	1
Start thinking about dissemination (e.g., who, what, how)	1
Not applicable/Unsure	3

Final Thoughts:

Table 23. What have been the most significant benefits or impacts for you in being a part of the AFRI SAS Soil to Society project? (*n* = 28)

Theme	Frequency
Expanded interdisciplinary collaborations	18
Expanded/established professional networks and connections	7
Broadened knowledge in agriculture and nutrition	6
Funded graduate students	4
Project impact on end users/invested parties (e.g., by increasing farmer and external partners/industry interests and engagement)	4
Enhanced systems thinking and big picture perspective (e.g., food supply)	3
Increased confidence in achieving goal of making broader impact	2
Activity to promote career advancement (e.g., tenure and promotion)	1
Overall project is very good, just need to pull it together somehow	1

Table 24. Considering progress and collaboration, what aspects of this project are most successful? (*n* = 24)

Theme	Frequency
Fostering collaboration and partnership development (e.g., interdisciplinary approach)	10
Successful progress on objectives and project goals	5
Innovation/creativity in conducting science	4
Product development	3
Extended outreach (e.g., social media, festivals, events)	2
Internship program	1
New projects funded	1
Well-chosen advisory board	1
Unknown/TBD	4

Table 25. What do you think the project should prioritize over the next project year as the project enters its final years? (*n* = 28)

Theme	Frequency
Dissemination of project findings/knowledge sharing (e.g., in ways that increase their uptake and relevance)	9
Team integration and continued collaboration (prioritize networking, increase meeting frequency, synthesize data from across the objectives)	8
Product development and distribution	5
Extension, outreach, and community engagement	4
Expediting research (e.g., expedite breeding process, data collection efforts and analysis)	3
Integrate adoption of improved practices within the ag and food industries (e.g., through translation-oriented projects)	2
Continue to seek funding	1
Develop plan for project sustainability	1
Human health experimentation	1
Provide access to necessary resources/equipment to finish the project in time	1
Stay the course	1

Theme	Frequency
Student support and recruitment (e.g., recruit undergraduate students for new major, help grad students disseminate their work, help graduate students finish research and graduate)	1
Unknown/Not Sure	1

Table 26. Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project's progress or collaboration efforts. (*n* = 4)

Theme	Frequency
Enjoyed working with collaborative team	1
Hope team receives necessary equipment soon	1
Improve communication with mentors from the leads on the internship program (to recruit and vet potential interns)	1
Increase outreach and public engagement to amplify the project's impact	1
N/A	1

Optimizing Human Health and Nutrition: From Soil to Society
Year 4 Progress and Collaboration Survey Report
Appendix C - Responses to Qualitative Items

Please note that comments have been edited to protect confidentiality and enhance readability. The numbering corresponds to the table number in Appendix B.

Progress and Satisfaction:

Q5. For each objective that you indicated is significantly behind schedule, please briefly describe which parts of the objective(s) are behind and why. (*n* = 9)

- Analyzing economic impacts of environment, soil, and cropping system management.
- I have worked to make progress on the commitments under Objective 7.3; in particular, related to connections to school districts, assessment of capacities for trialing/integrating products developed in this grant, and related in-school education connections. Having onboarded partway through this grant, we are working behind the originally-anticipated schedule/timeline. However, based on the conversations I've had with various grant partners, it seems to be good timing to start gaining momentum on this part of the grant objectives.
- One of our objectives is to assess the effects of crop management on soil biodiversity. Some of the planned sampling had to be postponed due to weather conditions (drought), and identification of organisms takes longer because of taxonomical issues we ran into. At the same time, we added experiments to the study that were not planned originally and those are going very well.
- Product development efforts with the harvested crops, mainly because we have not received the seeds from the last harvest. We only received barley seeds of different varieties.
- Sample processing took time to get processed and currently are being analyzed. I think we are a little behind because it took some time to schedule a visit to the Sustainable Seed Systems lab to get samples processed due to machinery and schedule conflicts. The first visit has occurred, most samples have been processed, and analysis is starting.
- The analysis of soil samples from over the years still needs to be done. We are not able to analyze those samples in Pullman and will have to travel to Mount Vernon to do that analysis. Also, we still need to analyze samples for barley beta glucans, grain micronutrient concentration, and wheat baking quality.
- The curriculum development/teacher training.
- The internship portion of our objectives is on point. The curriculum is a bit behind as we are pulling information from other parts of the team and they are also behind. The training for the curriculum is behind since the curriculum is not complete.
- The micronutrient analysis portion was behind as the EDXRF did not work for a long time. We are working with the Discrete Gallery analyzer for developing protocol of beta glucan analysis in barley. But there has not been more work done in this. We are having a hard time optimizing the protocols.

Q6. For each objective that you indicated is significantly behind schedule or somewhat behind schedule, please identify the support and/or resources you need to get back on schedule and describe any mitigation plans you may have. (*n* = 9)

- Data from other objectives. Video footage of other teams (video filming is in the process of being scheduled).
- I am working on optimizing the protocols. It would be great if I could get anyone who is familiar with the discrete gallery analyzer and help me to calibrate it for my analysis. I am continuously reaching out to people but not having much luck.
- I think the equipment needed for sample analysis has been repaired and "tuned up" so I do not think there will be any issues any time soon.
- I will be traveling to Mount Vernon to analyze soil samples. Also, I will develop a work plan with a team member to get grain micronutrient analysis done for all of my samples.
- Mainly, we need a more organized way to get harvested seeds for product development efforts.
- The student who was going to work on this dropped out of the program; The new student who was going to join the program didn't. I am looking to hire a non-student to work on this with me.
- Thus far, making connections with [name redacted] of [name redacted], as well as others they worked with on the similar objectives of that project, has been particularly helpful to me. I believe the most effective way for me to get/stay on schedule is gleaning knowledge and lessons learned from similar research projects and efforts.
- We are not significantly behind.
- We are working hard at creating a concrete plan for the curriculum. We have plans to complete it before our next semester starts so we can get people on board to test out the curriculum. We need people to respond to emails about participating in our career-based videos that we are creating for the curriculum.

Q9. What could be improved to increase your satisfaction with project implementation over the final two years of the project? (*n* = 1)

- The coordinator needs to coordinate and communicate with the group. We do not need one more frantic "hey everyone we need an update by Wednesday" and then a week later get a summary that looks rushed and is basically many voices not linked together and not helpful.

Q12. Please describe any work being done to integrate work from your objective(s) with other objectives' work this year. (*n* = 22)

- Continual selection of appropriate varieties through discussion with breeders. Participation in events focused on management, variety selection, and culinary uses.
- Currently working on creating videos of individuals working on this project to add value to our curriculum.
- Determined the effect of quinoa, elderberry, and bread samples on human gut microbiome. There is a need to perform gut microbial metabolites analysis.
- Food processing provided by researchers in Objective 4 is supporting a project within Objective 5.
- Growth and distribution of grain, germplasm, and genetic material for use in nutrition studies.
- Held a Field Day about growing grains for small farmers.
- Interns placed in teams from some objectives. Some objectives have not provided internship options. [Have been able to gather] data from one objective to work into the curriculum.
- Meeting with [researchers from other disciplines].
- My project is a collaboration between researchers in our objective and a different objective.
- My research is closely connected with the projects on human health.

- N/A.
- None at the moment.
- Not sure.
- Our work is unique in a way and we mostly collaborate with members of the Soils and Crops team. Our part of the project does not integrate well with other teams.
- Since joining the team, we have had initial conversations with several of those working on the food science side of things, as well as with the Bread Lab, regarding possible recipe development for use in school food service settings. The Bread Lab is also planning on collaborating on some school education efforts around grains in the garden this fall and next spring, with the goal of developing small resource kits to be offered to interested districts.
- Varieties and breeding lines from each crop are being tested by the Food Science and Human Health teams. Varieties are also being used by the Cropping Systems/Soils teams in various trials. Seeds from two cropping system trials have been evaluated for nutrition in the Sustainable Seed Systems Lab and by the Periodic Table of Food Initiative. The Education team is working with faculty from other teams, including Plant Breeding, and are working on high school internships.
- We are collaborating between Objectives 3 and 5 to integrate qualitative follow-up research after the consumer acceptance product trial on convenience.
- We are collaborating with the John Hopkins team to analyze soil health indicators alongside soil macrofauna analysis. We coordinate the timing of sampling so that the analysis will be done on the same samples.
- We have initiated a new study following up participants in their trial and looking at the longer-term impacts of participating in the trial. This may not be a separate objective (not sure), but it was not initially planned and emerged from discussions about collaboration.
- We have reached out to others in regards to product design/formulation in an attempt to inform these teams on what we understand are preferences from the school food service perspective.
- Worked with high school students this summer.
- Working with the agronomy team and the nutrition team together.

Q13. What support or resources would help facilitate the integration of work from your objective(s) with other objectives' work? (*n* = 18)

- Additional time at annual meetings to engage in inter-group discussions.
- All is going well.
- Clear communication and plans.
- I am looking forward to hearing updates from those working on other objectives at the annual gathering to better understand how we might collaborate.
- I don't know.
- I enjoy learning at the annual meetings about the work on the other objectives, it would be great to have a more formal brainstorming about how our work could intersect.
- Meetings held by each objective directed at collaboration and suggesting opportunities for collaboration.
- More communication.
- More communication and updates on critical infrastructure like phenotyping instrumentation such that we are better able to accomplish our research goals. More communication regarding the amount of seed and genetic material needed for studies to ensure that we have generated enough grains in the previous field season for others to utilize in their studies.
- More connection with the stakeholder advisory panel and updates from other teams.
- More regular updates from other objectives' teams.

- More streamlining of the seeds harvested - maybe build an online database that all can access.
- Not sure.
- The annual meeting is a great opportunity for this!
- Their participation in the videos or sources for someone who might able to participate in them is really helpful.
- Timely processing of samples by other collaborators.
- We need a gas chromatograph to determine the changes in gut microbial metabolites.
- We receive resources and support from the Soils and Crops Team.

Q15. Please describe the ways that you believe your involvement in the AFRI SAS Soil to Society project has helped advance your career. (*n* = 7)

- As a student, this project has been instrumental in advancing my education and career options, especially the interdisciplinary nature of the project. It has opened my eyes to the ways that researchers can collaborate and approach research with systems thinking in mind. It has introduced me to both academic and industry leaders. It is an opportunity for students to get a well-rounded exposure to their field of study.
- Being able to work on creating curriculum is an extremely important asset for me to add to my toolbox. I have my teaching degree but went straight to graduate school rather than getting a job. I hope to become an agricultural educator when my degree is complete, so this project is the perfect place for me to cultivate my teaching skills.
- I have presented my project data at various national and international conferences. Additionally, based on the kind of work students are doing, students received multiple awards.
- I think it has allowed me to work with people with different academic backgrounds. Additionally, it has allowed me to make better relationships with other students and faculty involved in the project.
- I've learned and applied new nutritional analytical techniques that are helpful for both the professional and academic setting. This has also helped me learn more about nutrition in quinoa and wheat varieties.
- My involvement in the AFRI SAS Soil to Society project provided me an opportunity to work with a diverse team of this project. I have learned more about teamwork and collaboration.
- I am not very familiar with the people or students, however, I am currently reaching out to other fellow students. But I am not sure who are the experts or professionals with whom I can seek help with regarding my project from the SAS network.

Please see Appendix D – Asset Mapping for qualitative responses to Tables 16-18

Q21. What does project sustainability mean to you and what project efforts have you observed (if any) have been made towards that sustainability (i.e., continuation of project research, collaborations, connections to industry, changes in consumer behavior and knowledge, adoption of whole grain products into commercial food systems)? (*n* = 23)

- $3.3M has been secured to keep the buckwheat component of the project going. This is critically important as buckwheat is by far the most underfunded and under researched crop that we work with on this project. Also, King Arthur Baking Company developed a Climate Blend pilot as a whole wheat flour project that is their commercial product line. Whole wheat/buckwheat 50/50 flour blends are being included in Farm-to-School breakfast pancake mixes in several school districts in Washington State.
- Adaptable, long-term project.

- Applying (and receiving) additional funding through OREI and WRF, applying for these grants with others on this grant (proving that individuals enjoyed this transdisciplinary experience, or at least found it beneficial), strengthening our connections to industry, and connecting with a greater breadth of industry partners.
- Collaborations, changes in consumer behavior and knowledge, and adoption of whole grain products into commercial systems.
- Continuation and development of projects through continuation of funding. The SAS team has pursued several funding opportunities that build on current relationships and research questions.
- Continuation of project goals. Breeding is longer than a 4-year endeavor. Most of our other objectives are also longer term.
- Continuation of project research and collaborations.
- Developing knowledge that influences policies (e.g., public support for these crops, education interventions to change consumer behavior and preferences), developing products that people like and are willing to buy
- Development of ideas, data, germplasm, and products that will continue into future research projects and collaborations, which in turn will continue into new avenues of research, knowledge, germplasm development, and use in product development and adoption by consumers, ultimately leading to a healthier diet.
- I would say I'm too new to this project to give effective feedback as to what I've seen within the context of this project.
- Innovative research projects continuation and collaboration with internally different disciplines and external sources like food industries too. To educate people about healthy whole grain products and their effect on overall human health.
- Long-term work continues even after this grant funding is completed.
- Need to lead industry, not follow them. Show what is possible more directly.
- Networks and connections between partners should foster lasting improvements.
- Outreach events such as Buckwheat Fest increased public awareness of alternative whole grain options.
- Partnerships/collaborations, farming practices, and products that are created as a result of this work continue into the future.
- Project sustainability means that a continued focus on sustainability in our food systems, even if the nature of the work changes over time. Also, sustainability of partnerships and collaborations beyond the end of the project is critical, at the individual and system level, in order to eliminate historical silos in higher ed.
- Project sustainability to me means having a strong business continuity plan involving all personnel, equipment, facilities, funding, and training involved to be successful long-term. It is collaboration amongst people with no one person being a gatekeeper of information. As far as efforts I've seen regarding this topic, I cannot think of any in particular. It may be reflective of my level of involvement with our project (minimal compared to others).
- Refining of knowledge gaps, follow-up work as needed, strengthened collaborations; none yet.
- Successful grant writing on particular crops involved in the project (i.e., buckwheat) with some overlap in project leadership and team members. Strong connections with end users and external partners.
- Sustainability in my field is to ensure that the ability of soil to provide ecosystem services (in this case crop production) and other functions is maintained in the long run without damaging the environment.

- This project means a lot to me as I'm very interested in sustainable agriculture practices. The youth deserve to grow up in a world that cares about these practices. Since I'm still new to the project, I haven't seen much yet.
- To me, sustainability of the project relates to (1) continued use and perceived relevance of our findings and even our methods by others, (2) continuation of our work past this current funding cycle, and (3) ultimately, greater consumption of whole grains by the U.S. population.

Q22. Please provide any additional thoughts or suggestions that may be helpful to project leadership to improve their sustainability efforts of the Soil to Society project. (*n* = 11)

- Continue to have us meet and bounce ideas off each other. Continue to look for additional funding opportunities.
- I am confused about what "sustainability" means in this context.
- I just working on this project but I'm pretty excited to see where it goes.
- I'm really interested in learning about the "adoption of whole grain products into commercial food systems." How is that going? How is that being measured? What is the projection of this in the supply chain?
- Keep up the good work, invite new speakers to meetings.
- My role in this project does not overlap with the work of many other groups. By the end of the project, I would like all participants to appreciate the tremendous variety of life forms in the soil and why it is important for soil health.
- N/A.
- Solid project overall and appreciate the team meetings and the connections being made; more integration with relevant stakeholders needed; continued efforts to seed cross-disciplinary collaborations.
- The seed library.
- There is a lot more nutrition and gut health related research that needs to be done by targeting different individual grains and I believe this will improve the sustainability efforts of this SAS project.
- We should start thinking more about dissemination of findings - who do we want to make use of them and what are the best ways of disseminating findings in a way that reaches them?

Q23. What have been <u>the most significant</u> benefits or impacts for you in being a part of the AFRI SAS Soil to Society project? (*n* = 28)

- Being part of and learning about a team of passionate individuals who want to better understand the science and nutrition behind farm-to-fork is exciting and inspiring.
- Building new collaborations and strengthening the links between agriculture and human nutrition and health at WSU
- Collaborating with other educational professionals has been the most significant benefit for me.
- Collaboration with various other researchers; completion of a project.
- Collaborations.
- Established collaboration with many food and agriculture researchers, allowing for seamless sample transfer.
- Exposure to cross collaboration between disciplines and a systems thinking approach to research and outreach.
- Farm-to-school whole wheat/buckwheat flour mixes deployed in schools. The Juntos program. The buckwheat new variety release, 'Tinker'. Graduate students conducting nutrition-related transdisciplinary research. High school internships.

- Funding grad students. Grants activity towards tenure and promotion.
- Funds to support research and graduate students. Connections with other researchers doing good work.
- Great connections. The collaboration with Washington State University has been really beneficial. It has led to a follow-up study collaboration to the consumer acceptance trial and outside of S2S has led to collaboration on a new set of activities related to the US Government's VACS initiative.
- I always enjoy being part of a bigger project as it broadens my horizons and I learn a lot. The budget also provided full support for graduate students and some salary for faculty/staff. My collaborators in my team are wonderful. I appreciate this, because I was part of other projects when this was not the case.
- I had many learning opportunities that helped me grow personally and professionally.
- I would say working in a collaborative team.
- Increased connections between farmers and researchers. Farmers being able to explore grains and integrating small grain and legume production into their systems.
- Increased interest from both farmers and school food service personnel in this effort.
- It has been useful to have the time to do the research right; to work out the questions we asked and to strategize on ways that our research can fill important gaps. I have learned so much from the other groups, bouncing ideas off them and learning about their work.
- Our team is an integrated bridge between farm-to-table.
- Overall, the project is very good, we just need to pull it together somehow.
- Partnerships on an individual and systems level.
- The comprehensive goal of the project has enabled me to think about the big picture impact of the project
- The connections I've made with researchers and Extension personnel in other disciplines, as well as with farmers.
- The increased confidence that we are producing products that will benefit both humans and the environment, not just one or the other.
- The knowledge and collaborations that led to understanding the genetics underlying nutrient accumulation in grains and translating this to the field.
- The most significant benefit of being part of the AFRI SAS Soil to Society project is that I am finally on the way to my goal. I believe that I will be able to make significant impacts in agriculture, particularly by providing the best seeds that are more nutritious, productive, and resilient to harsh climatic conditions.
- The project is definitely expanding my understanding of and interest in the opportunities for grain/legume products in our local schools. It is also weaving a tighter network of relationships among our local/regional partners doing Farm-to-School work. In addition, this project provides opportunities to bring together food service directors for collaboration and discussions on local purchasing - something that hasn't happened as frequently since COVID.
- Thinking closely about the quality of the food supply.
- Working with people who are trying to create a food system that provides nutritious food and is accessible to most people.

Q24. Considering progress and collaboration, what aspects of this project are <u>most successful</u>? (*n* = 24)

- Ali and Kevin do a great job fostering positive collaboration and creative ideas.
- Collaboration between food processing and human health.
- Collaboration, communication, and advertisement presence on social media platforms.
- Collaborative experiments.

- Each objective is achieving its goals, so a tremendous amount of good work has been achieved.
- From the Soil and Cropping Systems perspective, we have worked together between the Pullman site, Mt. Vernon, and John Hopkins.
- From what I have seen so far, everyone seems to be willing to work together. Not to mention the willingness to be flexible.
- Identification of promising varieties and evaluation through non-agronomic approaches.
- I'm not sure as far as the overall project; I think we are making good progress in each of the groups and we have chosen advisory board members who will be able to help us a lot at the next stage of work.
- I'm not sure.
- Implementation of research trials.
- Internship program.
- New relationships and projects funded by external agencies.
- Not sure.
- Opening folk's minds to a little different way to do research. Showing them that there are other ways to conduct science than how it has been done (at least at WSU) previously.
- Partnership development.
- Partnerships!
- Product development - WW/buckwheat pancake mix collaborative was developed and deployed using locally grown buckwheat and WW varieties. The gut microbiome lab has been testing varieties from plant breeders and cropping systems researchers and products from food scientists. This is very exciting and it will be great to see publications come out soon. Buckwheat Festivals with Organic Seed Alliance. Variety showcases with the Culinary Breeding Network.
- Successfully completing small projects and their publications.
- TBD.
- The development of more nutritional grains for use and consumption by consumers.
- The interdisciplinary approach.
- Unknown.
- We are coordinating our sampling efforts and collecting complementary data. This allows us to have a more integrated view and better understanding of soil conditions under these management practices.

Q25. What do you think the project should prioritize over the next project year as the project enters its final years? (*n* = 28)

- All the projects will be successful on time if we have all the resources like a gas chromatograph, PCR, RT-PCR, and an automated DNA extraction machine along with complete setup. This will not only speed up the experiments, but it will save a lot of time.
- Because of the nature of our work, it takes time to collect data and see potential differences among treatments. We are slowly getting there and thus next year we hopefully can spend more time discussing data and writing papers.
- Collaboration that makes sense.
- Community engagement.
- Compiling the results and dissemination of the research findings.
- Continued funding efforts. Ways to integrated adoption of improved practices.
- Decide on representative and very promising varieties/foods for each grain and carry-on in-depth evaluation.

- Disseminate the results to the public and plan for testing of whole grain products to a large population.
- Expediting the breeding process to get new germplasm in the hands of the product design team and expedite the process of delivering these grains to seed dealers, producers, and end users.
- Extension, outreach, and human health experimentation!
- Fast data collection.
- Focus on synthesizing data from across the objectives.
- How to sustain the project goals.
- I think we should look for opportunities to plan dissemination of our findings in a way that increases their uptake/relevance. For example, with the new dietary guidelines coming out soon, there will be a buzz about nutrition and trying to find ways to change diets. We can disseminate into that and to do well it will require planning in advance.
- I would say pushing more information out there from the project. I hadn't heard a lot about it until I decided to go to grad school and I think it would be worthwhile.
- Increased frequency of meetings across all collaborators/contributors would further help in connecting the dots in the project, which in turn will help in dissemination of findings.
- Integration of teams and developing sustainable collaborations.
- More communication and networking with professionals and students in this team.
- Our group has started organizing around publications and I think more of this would be good to make sure we are on time with deliverables.
- Product design and distribution.
- Recruiting undergraduates for the new AFS major: Human Nutrition and Food Systems. Transdisciplinary collaboration. Publication in scientific and extension journals. More workshops, classes, and meetings to share research with partners and consumers. Helping graduate students share their work in scientific meetings. Helping graduate students finish their research and graduate on time.
- Stay the course.
- The application of research findings into the development of practical products that align with school district needs/desires, as well as the determination of what is needed to make these products available, affordable, and supportive of local farmers/manufacturers.
- Thinking about communicating and disseminating the body of research as a collective contribution of knowledge, drawing connections across objectives related to findings and implications.
- Translation-oriented projects that have to do with agricultural practices, food policy, and food industry.
- Trying to put together data and data analysis to show next meeting.
- Unknown.
- Ways to maintain collaborations.

Q26. Please share any additional comments or feedback you may have related to the AFRI SAS Soil to Society project's progress or collaboration efforts. (*n* = 4)

- Community engagement is a big factor in seeing the impact of everyone's efforts. I'm not sure if this is being done since my contributions have been small compared to others, but co-op workshops, library talks, retirement home workshops, K-12 guest speakers, etc. with people from

Soil to Society who WANT to engage with the public and educate others about the importance of whole grains will have a ripple effect.

- It's always been wonderful to work in a collaborative team. I hope the nutrition and gut health team will get some equipment related resources soon.
- N/A.
- The high school internship program was difficult this year. Not great communication with mentors from the leads on the internship program, so it was hard to recruit and vet potential interns and to align their projects with what was going on in the class.

Optimizing Human Health and Nutrition: From Soil to Society
Year 4 Progress and Collaboration Survey Report
Appendix D – Asset Mapping

Year 4 Assets

Note: Qualitative responses have been lightly edited to enhance readability. The number next to each theme represents the frequency of responses related to this theme. Note that the number of responses (e.g., n=15) refers to the number of participants that submitted a response. The frequencies sum to more than the number of responses (n) because participants could provide multiple responses to question prompts.

Figure 1. Four major categories of assets identified by the AFRI SAS Soil to Society project team members.

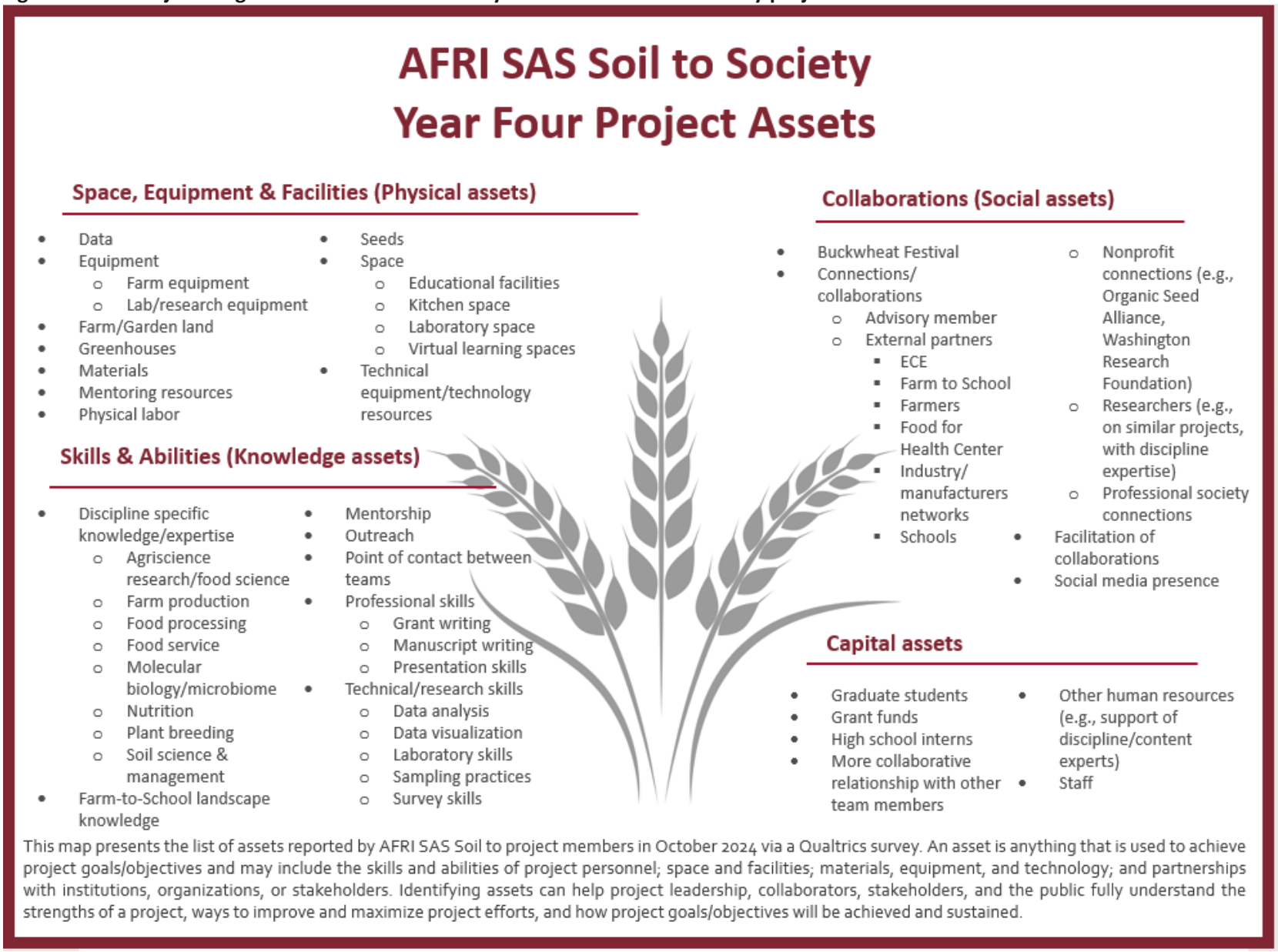


Figure 2. Four major categories of assets identified by Soil to Society team members as assets they contributed personally to the team.

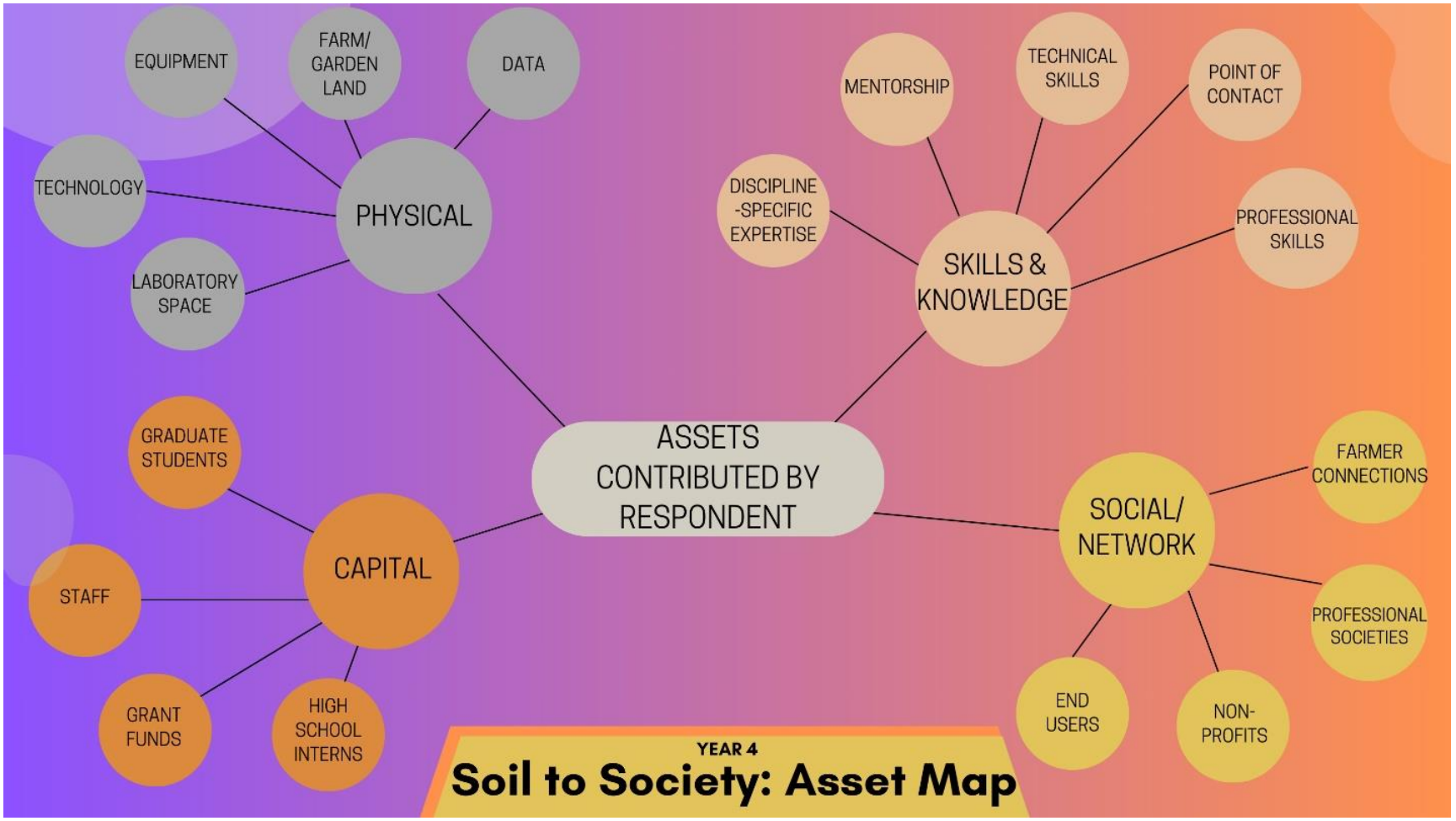
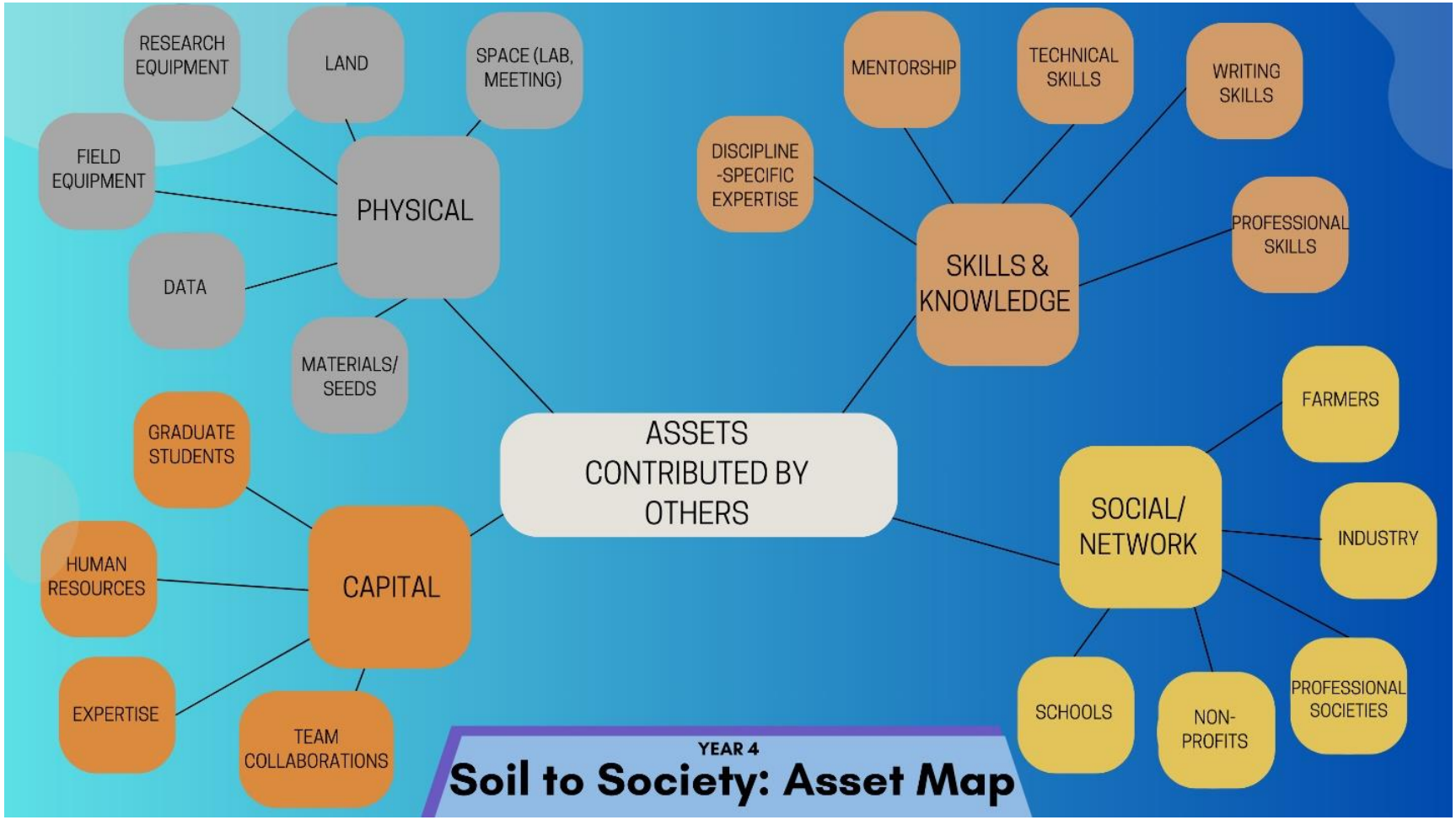


Figure 3. Four major categories of assets identified by Soil to Society team members as assets they perceived others contributed to the team.



Asset Assessment

Table 16. During Year 2-3, what key assets have <u>you contributed</u> to the project that have been utilized by you and/or others in working towards project goals? Please be specific and list <u>up to 5 assets that you contributed.</u>

Theme	Frequency
Skills and Knowledge Assets *(i.e., food science/cooking/baking, grant writing, nutrition knowledge, mentorship, HPLC expertise) (n*=21)	
Mentorship	7
Nutrition knowledge and analysis	5
Agriscience research/food science knowledge	4
Point of contact between teams	4
Laboratory skills (e.g., sample analysis)	3
Grant writing	2
Plant breeding knowledge	2
Data visualization	1
Farm production skills	1
Farm-to-School landscape knowledge	1
Food Service Knowledge	1
Food processing technology knowledge	1
Molecular biology/Microbiome knowledge	1
Nationally represented survey and follow-up survey	1
Outreach	1
Presentation skills	1
Soil science and management knowledge	1
Physical Assets *(farmland, farming equipment, data, statistical software, greenhouses, classroom/education facilities, computing resources, LARC building kitchen, anaerobic chamber)* (*n*=21)	
Agricultural land (e.g., farmland, school gardens)	7
Equipment (e.g., filming equipment, molecular biology equipment, farm equipment)	6
Data	5
Laboratory space	5
Technological assets (e.g., statistical software, analytical and processing systems)	3
Educational facilities	2
Greenhouses	2
Mentoring resources	2
LARC building kitchen	1
Physical labor	1
Virtual learning spaces	1
Social/Network Assets *(Farmer connections, soil scientists, plant breeders, Organic Seed Alliance, corporate donors)* (*n*=16)	
Farmer connections	6
Professional society connections	5
Collaboration facilitation	4
Nonprofit connections (e.g., Organic Seed Alliance, Washington Research Foundation)	2
Plant breeders	2
School connections	2

Theme	Frequency
Social/Network Assets *(Farmer connections, soil scientists, plant breeders, Organic Seed Alliance, corporate donors)* (*n*=16)	
Social media presence	2
Advisory member	1
Buckwheat Festival	1
Manufacturer connections	1
N/A	1
Capital Assets *(student workers, grant funds, seed grants, staff/personnel)* (*n*=15)	
Graduate students/Student workers	12
Staff	9
Grant funds	3
High school interns	2

Skills & Knowledge Assets

- Agriscience research; mentoring mentors.
- Data.
- Farm production skills; data analysis; mentorship; outreach and communication.
- Farming technical assistance.
- Food processing technology.
- Food science; extrusion; baking.
- Food science; nutrition knowledge.
- Grant writing; baking; nutritional knowledge and testing.
- Human capital on nationally representative survey and follow-up survey and qualitative work with participants in the consumer acceptance trial of convenience foods.
- Knowledge of food service department needs/workings; experience working with school districts; knowledge of local farm to school landscape.
- Lab analysis methods; project management; mentorship.
- Mentorship for my graduate student. I am also a member of the S2S Leadership Team and contribute in regular meetings.
- Mentorship.
- Mentorship; plant breeding expertise.
- Molecular biology; microbiome knowledge; food chemistry.
- Nutrition analysis.
- Nutrition knowledge.
- Nutrition knowledge; phenotype and genotype data generation; genetic characterization.
- Point of contact between research teams.
- Presentation skills.
- Sample digestion; in vitro fermentation; fecal sample processing and storage; microbial DNA extraction and analysis; teaching new lab members to perform microbial fermentation work; use of anaerobic chamber; sample preparation and experimental design.
- Soil science and management knowledge; grant writing; mentorship; data visualization.

Physical assets

- Anaerobic chamber; molecular biology equipment.
- Analytical and processing systems.
- Data. (2)
- Data; physical labor.
- Farmland and equipment; germplasm.
- Farmland; education facilities.
- Farmland; farm equipment; lab space; lab equipment.
- Farmland; farming equipment; classroom/meeting space.
- Filming and recording equipment; Canvas spaces for virtual classes; mentoring resources.
- Greenhouses; statistical analyses.
- Gut microbiome data.
- Laboratory.
- Land; lab; greenhouses.
- LARC Building Kitchen; pilot-scale microwave system.
- My lab to prepare experiments and microscopy work.
- School garden spaces via local partnerships; facilities for gathering partners.
- Soil analysis facilities; access to land for trials.
- Statistical analysis; field work.
- TDF expertise.
- Variety and breeding line sharing.

Social/network assets

- Advisory member; recruitment of students for internship through school and teacher connections.
- Facilitated opportunities for collaboration; quarterly newsletter; social media maintenance; teams.
- Farmer and school connections.
- Farmer connections.
- Farmer connections; connections with soil scientists; bridging the gap between the two.
- Farmer connections; professional society connections.
- N/A. (3)
- Networking with scientists in similar projects; meeting with relevant multistate hatch members.
- None.
- Organic seed alliance; farmers; Canadian Soil Society members; local farmers; chefs.
- Producers; plant breeders.
- Relationships with local school districts, food service directors, and teachers/staff; connections to farm to school and farm to ECE programs across the region; connections to local farmers/producers as well as manufacturers of local value-added products.
- Social media; Organic Seed Alliance; Buckwheat Festival; Washington Research Foundation; Participatory Plant Breeding.
- We used whole grains provided by the seed breeding groups.

Capital Assets

- Grad students (both funded by grant and other resources).
- Grant funds; student workers.
- Grant funds; student workers; staff.
- Helping my graduate students to write funds.
- Received OREI $3.3M grant for buckwheat; hired a .50 FTE participatory plant breeder; new graduate students.
- Staff/personnel. (3)
- Staff/personnel; students.
- Student.
- Students; staff. (3)
- Student workers; high school interns. (2)

Table 17: During Year 2-3, what key assets other team members or external partners contribute that have been essential to your work on the S2S project? Please be specific and list 5 assets other team members or external partners contributed that have been essential to your work.

Theme	Frequency
Skills and Knowledge Assets *(i.e., food science/cooking/baking, grant writing, nutrition knowledge, mentorship, HPLC expertise) (n*=21)	
Discipline-specific knowledge (e.g., agronomy, food engineering, grain production, nutritional evaluation, plant breeding, soil science)	15
Physical resources (e.g., data, equipment, facilities, seeds)	3
Funds	1
Grant writing	1
Human capital to conduct survey	1
Manuscript writing	1
Mentorship	1
Sampling and data analysis	1
Physical Assets *(farmland, farming equipment, data, statistical software, greenhouses, classroom/education facilities, computing resources, LARC building kitchen, anaerobic chamber)* (*n*=18)	
Research/field equipment (Illumina Mi-seq, Ankom fiber analyzer, plot combine, planter, EDXRF, NIR, MP-AES, seed scanning)	12
Space (e.g., lab space, meeting space)	4
Seeds	3
Data for curriculum	1
Land	1
Materials (unspecified)	1
N/A	1
Social/Network Assets *(Farmer connections, soil scientists, plant breeders, Organic Seed Alliance, corporate donors) (n*=15)	
Industry networks	4
Non-profits (New grains NW, WRF, food for health center, Periodic Table of Food Initiative)	4

Theme	Frequency
Social/Network Assets *(Farmer connections, soil scientists, plant breeders, Organic Seed Alliance, corporate donors) (n*=15)	
Similar AFRI projects	2
K-12/school related connections (e.g., Farm-to-School, ECE, OSPI, ESD)	2
Farmers	1
Methodology expertise	1
Professional societies (e.g., WSAS, CSSA)	1
None or N/A	4
Capital Assets *(student workers, grant funds, seed grants, staff/personnel) (n*=10)	
Discipline-specific expertise (HPLC expertise, Human resource and expertise, expertise in pulses, knowledge of consumer perceptions)	3
Graduate students to mentor interns	1
Meeting space	1
Promotes collaborative relationships with other team members	1
None or N/A	1

Skills & knowledge assets

- Agronomy and plant breeding knowledge.
- Different soil sampling and seed sampling practices; types of tests to run to look at micronutrient analysis; how to get data from the USDA for population nutrition analysis.
- Expertise.
- Expertise in grain production; variety trials.
- Expertise in other program areas.
- Facilities.
- Food engineering and innovation; plant breeding.
- Have appreciated learning from [name redacted] about their study and approaches used in their feeding trial as part of our collaboration and feedback on our survey design during last year's annual meeting (which greatly influenced our study).
- Human capital on nationally representative survey and follow-up survey and qualitative work with participants in the consumer acceptance trial of convenience foods; inviting us to join the consumer acceptance trial as co-investigators for a follow-up study.
- Knowledge of variety selection and potential end uses.
- Lessons learned from past similar project [name redacted]; knowledge of grain varieties for planting at school gardens (Bread Lab partners); knowledge of OSPI and other possible outlets for surveying; knowledge of grain/legume purchasing patterns [name redacted].
- Manuscript writing; grant writing.
- Mentorship of interns; content knowledge of their research project.
- Nutrition research expertise.
- Nutritional data; germplasm; mutant lines; genotyping data.
- Nutritional evaluation; planting and harvesting for other team members; variety knowledge and dissemination in the field and labs.
- Nutritional sciences; recipe development for healthy meals.

- Seeds; funds; equipment; expertise with lab equipment.
- Soil science.
- Specific skills.
- USDA Beltsville collaborator provided taxonomical knowledge; ongoing consultation with collaborator on molecular work.

Physical assets

- Ankom fiber analyzer; Mi-Seq sequencer.
- Continuingly improving lab resources at WSU Spokane's campus.
- Data for curriculum.
- Equipment.
- Illumina Mi-seq from Pullman.
- Lab space; field equipment.
- Lab space; research equipment and tech.
- Land; equipment.
- Materials and research equipment.
- N/A.
- Our university has given us convening space in their new office for an upcoming meeting that we are hosting.
- Plot combine; planter; EDXRF; NIR; MP-AES; seed scanning.
- Research equipment. (2)
- Seeds. (3)
- USDA Beltsville collaborator provided special microscopy facilities.

Social/network assets

- Appreciated being connected to King Arthur Flour and meeting with them to get their perspectives on the knowledge gaps/their priorities.
- Collaborating with [name redacted] to better understand how to bridge the disciplines.
- Connected with Washington Research Foundation; Washington State Academy of Sciences; Crop Science Society of America; Periodic Table of Food Initiative.
- Connections to additional industry networks.
- Connections to farmers and food companies.
- Connections to past grant participants [name redacted]; connections to Farm-to-School and ECE partners; connections to OSPI and ESD staff.
- Connections to previous similar AFRI project related to school outreach surveys and products developed.
- Connections with commercial grain growers.
- Food For Health Center [name redacted].
- Methodology expertise.
- N/A. (3)

- None.
- Recruiting/promoting internship through local school connections.

Capital assets

- Grad student time to mentor interns.
- HPLC expertise.
- Human resources including baking and milling time and expertise; planting and harvest expertise.
- Meeting space.
- More collaborative relationship with WSU Breadlab.
- N/A. (3)
- None.
- Sought and received additional support from [name redacted] to support our survey, which enabled us to add additional questions related to pulses and perceptions about protein.

Table 18: What key assets do you need to carry out project goals and objectives that are not currently available? (Consider: What other resources do you need? What types of resources are needed to overcome any barriers or challenges you are facing in making progress towards your goals and objectives?) (*n* = 15)

Theme	Frequency
Financial resources	3
Time	2
Manpower	1
Opportunities for outside micronutrient analysis and soil sampling	1
Specialized equipment (e.g., gas chromatograph, PCR, RT-PCR, automated DNA extraction machine)	1
Statistical support	1
Translator to make bilingual resources	1
No additional needs	6

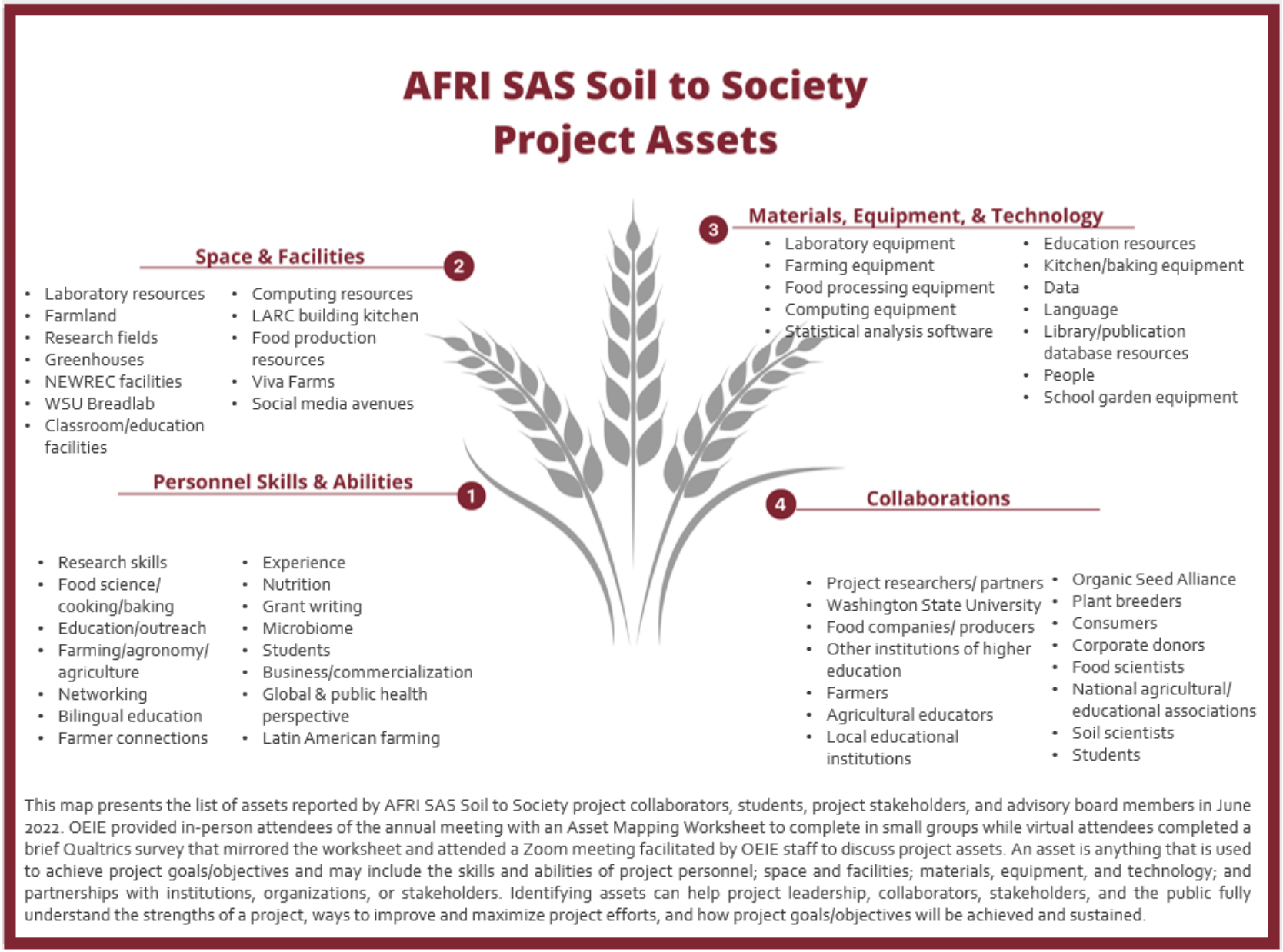
- As products get closer to development, we will need to figure out from a financial perspective how samples will be manufactured and distributed. Resources/funds to cover manufacturing, sampling, and distribution costs to interested districts/schools could be key in participation.
- Financial support to carry out more molecular work. This was not planned in the original proposal; thus, it is not budgeted. However, we think it would add to the value of our work.
- Firstly, we need some specific equipment like gas chromatographs, PCR, RT-PCR, and automated DNA extraction machine and overall setup. Secondly, we need more manpower (graduate students, short-term interns national or international, technicians) to run multiple projects simultaneously and rapidly.
- Honestly, bandwidth and time to be able to better engage with other disciplines.
- I think we are on track as far as our plans for project goals and objectives. Next year I think we will want to focus a great deal on dissemination and will need to think about how to best do that together, but we do have assets in DC that we can use to host meetings if we need to.
- More time (I know this isn't what you need to know but it's the main limitation).

- N/A. (2)
- None. (3)
- Potentially more opportunities for outside micronutrient analysis and soil sampling to help us through the backlog and get seed to the food products team faster.
- Statistical support.
- Translator to make bilingual resources.
- Travel funding would be helpful but will need to come from outside sources.

Year Two Assets

Note: Qualitative responses have been lightly edited to enhance readability. The number next to each theme represents the frequency of responses related to this theme. Note that the number of responses (e.g., n=24) refers to the number of participant/participant groups that submitted a response but does not equal the number of participants, as in-person participants completed the Asset Mapping Worksheet in small groups and virtual attendees provided individual responses. The frequencies sum to more than the number of responses (n) because participants could provide multiple responses to question prompts.

Figure 4. Four categories of AFRI SAS Soil to Society assets identified by participants in Year 2.



Personnel Skills & Abilities

What skills, abilities, training, or expertise do you bring to the project? (*n*=24)

Theme	Frequency
Research skills General (e.g., statistical analysis, field research trials, handling large data sets) (*n*=7) Plant breeding (*n*=5) Soil/water science (*n*=5) Laboratory work (*n*=2) Gut microbiome (*n*=1)	9
Food science/cooking/baking	8
Education/outreach	6
Farming/agronomy/agriculture	6
Networking/collaboration	5
Bilingual education	4
Farmer connections	4
Experience/knowledge of field	3
Nutrition	3
Grant writing	2
Microbiome	2
Students	2
Business/commercialization	1
Global & public health perspective	1
Latin American farming	1

Space & Facilities

What space and/or facilities do you use to complete project tasks? (*n*=16)

Theme	Frequency
Laboratory resources	9
Farmland	5
Research fields	5
Greenhouses	4
NEWREC facilities	4
Breadlab	2
Classroom/education facilities	2
Computing resources	2
Food production resources (e.g., school gardens, school kitchens)	2
Other spaces (e.g., storage, office, event, collaboration spaces)	2
Program/project visits	2
Viva Farms	2
LARC building kitchen	1
Social media avenues	1

Materials, Equipment, & Technology

What materials, equipment, or technology do you use to work on this project? (*n*=22)

Theme	Frequency
Laboratory equipment	13
Farming equipment	5
Food processing equipment	5
Computing equipment	4
Statistical analysis software	3
Education resources (e.g., Canvas, Office suite, Academic Outreach & Innovation)	2
Kitchen/baking equipment	2
Data	1
Language	1
Library/publication database resources	1
People	1
School garden equipment	1

Collaborations

Which institutions, organizations, and stakeholders have you collaborated with or engaged in your work on this project? (*n*=20)

Theme	Frequency
Project researchers/partners	8
Washington State University	6
Food companies/producers	5
Other institutions of higher education	5
Farmers	4
Agricultural educators	2
Local educational institutions	2
Organic Seed Alliance	2
Plant breeders	2
Consumers	1
Corporate donors	1
Food scientists	1
National agricultural/educational associations	1
Soil scientists	1
Students	1

Additional Opportunities

Considering what you learned and shared about the project's assets, what additional opportunities may be present in your geographical area or discipline? (*n*=19)

Theme	Frequency
Collaborations with local schools/communities	7
Incorporating indigenous & other cultural agricultural and cooking practices	5
Clinical trials	3
Collaboration with other food companies or producers	3
Developing accessible consumer recipes/commercial food products	3
Commercial/professional kitchens	2
Develop small-scale/scale-appropriate seed & grain processing	2
Expand collaborations with WSU	2
Identify additional assets (e.g., research venues, survey platforms)	2
Improve accessibility/approachability of whole grains	2
Improve existing research practices (e.g., quinoa calibration)	2
Additional analysis of soil composition	1
Economic analyses	1
Identifying gaps in decision-making around food behaviors	1