Research Practices and Support Services in Agriculture

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1.0 Background and Introduction

In 2016, Auburn University Libraries participated in a nation-wide study that was aimed at studying the research practices of academic and extension faculty in the field of agriculture. Coordinated by Ithaka S+R organization, this study involved a total of 19 universities and research institutions. The study was conducted from June to December 2016. Findings from the 19 institutions will be collated by Ithaka S+R from December 2016 through March 2017 into a nation-wide report of agriculture research practices and support. This is a report of the results from interviews of selected faculty who participated in this study at Auburn University.

Established in 1856, Auburn University is a comprehensive land, sea and space grant institution that serves over 25,000 students. Land-grant colleges or universities are institutions that have been designated by their state legislatures or Congress to receive the benefits of the Morrill Acts of 1862 and 1890. Because of this history, Auburn University has strong programs of study, research and extension service in agriculture and engineering.

The College of Agriculture at Auburn is made up of eight departments: Agricultural Economics & Rural Sociology; Animal Sciences; Biosystems Engineering, Crop Soil and Environmental Sciences; Entomology & Plant Pathology; Horticulture; Poultry Science and the School of Fisheries, Aquaculture and Aquatic Sciences. The study of forestry is offered in a separate unit, the School of Forestry and Wildlife Sciences.

2.0 Study Objectives & Methodology

The objectives of this study were to examine the current and emerging research practices of academic and extension faculty from the field of agriculture in order to identify the resources and services that faculty need to be successful in their research and associated professional duties and activities. Studies similar to this one were being concurrently conducted at nineteen other institutions. A list of participating institutions is shown in Appendix I. Following the selection of the participating institutions, Ithaka S+R provided webinar and an in-person training for project leaders from each institution in April 2016. Included in the training was the qualitative study methodology that all project leaders used in their local study. (Cooper, 2016)

The study methodology recommended a selection of 15 faculty participants from each institution. The selected faculty were asked to participate in a 60-minute in-person interview where they responded to questions on their areas of research; research methodologies used in their research; sources of research information; standard information searching methods and approaches; publication practices; research trends; and challenges that impede the research process. The interview questions shown in Appendix II were used in the study following the given sequence. The interview process allowed re-phrasing of questions for clarity with an openness to any expounding of responses that the interviewee wished to make

Interviews were conducted in the offices of the participating faculty. Responses to the interview questions were audio-recorded and transcribed. Then interview transcripts were then coded to identify the key responses and major themes.

3.0 Limitations of the Study

The field of agriculture is vast encompassing a wide range of research areas in the traditional areas of the culturing of crops, animals, and microorganisms in their respective environments. Agriculture study and research is also highly inter-disciplinary as it overlaps with many closely allied disciplines of biological sciences, engineering, architecture, economics, sociology, business, politics, communication, history, nutrition and food science, environmental sciences, geology and geography, medicine and health, veterinary sciences, and mathematics and statistics to name a few.

Research findings from the study of 15 participating faculty, while valid and important in offering insights into the research practices and processes, may not be representative of all the research areas that exist in agriculture.

Librarians who normally provide research support and information services to faculty on a day-to-day basis were used as project leaders in this study. Although this situation had some advantages such as librarians having a working knowledge of research programs of faculty in the agriculture colleges, it may not have been the ideal situation for obtaining objective information from faculty on desired services. The type of relationship that the librarian has with the study participants may have influenced some of the responses. At Auburn, although participants were overall open in their responses to questions, and exercised the freedom to provide both positive and critical feedback on available services, one wonders if a greater level of objectivity could have been achieved if the interviewer were someone that was not affiliated with the library.

4.0 Research Findings

The fifteen faculty who were interviewed in this study are listed in Table 1 below. These participants include faculty representing all ranks from assistant to full professors. Also included are faculty with research and extension appointments.

Table 1. Study Participants and Research Areas

	Department Affiliation	Research Area 1	Research Areas 2
1	Agricultural Economics	Food regulations and international trade	Behavioral economics and consumer research of food insecure households
2	Rural Sociology	Small scale agricultural food systems: theories and alternatives	Food insecurity in impoverished counties
3	Animal Sciences	Meat science and quality	Animal feed manufacturing
4	Poultry Science	Chemical and microbial food safety	Antimicrobials; food preservation technologies
5	Aquaculture	Fish genetics and breeding	Fish genomics and bioinformatics
6	Horticulture	Physicochemical and antioxidant activity in fruits and vegetables and implications for the control of nutritional diseases	Post-harvest storage of fruits and vegetables
7	Biosystems Engineering	Biomass processing and pre-processing	Food engineering
8	Animal Sciences	Animal nutrition: nutrient requirements of livestock, poultry	In vivo and In vitro cellular components, function and growth factors
9	Agricultural Economics	International fisheries and aquaculture	Economics of agri-production systems in developing countries
10	Biosystems Engineering	Biofuels & bioprocessing	Agricultural waste
11	Plant Pathology	Plant-pathogen interactions	Plant disease resistance
12	Poultry Science	Public health: animal diseases and human diseases	Biosecurity and U.S. Food Supply
13	Aquaculture	Aquaculture industry	Fish diseases
14	Crop, Soil & Environment	Water quality	Climate change
15	Rural Sociology	Adoption of technology	Natural resource management

4.1 Research Focus

The research focus of study participants falls in the broad areas of agriculture that include the study of crop sciences; horticulture; animal sciences; poultry science; fisheries and aquaculture; entomology and plant pathology; biosystems engineering; environmental sciences and agricultural economics and rural sociology. Research topics in these areas overlap with medicine and health; veterinary sciences; biological sciences; biochemistry microbiology; genetics; chemistry; molecular biology; engineering; mathematics and statistics; geology and geography; sociology; politics; law; and business and economics.

Table 1 shows some brief descriptions of a sampling of research topics. In agricultural economics, rural sociology and agribusiness, the research areas include: agri-food systems; small-scale local food movements; sustainable agriculture; food insecurity in impoverished counties; food regulations; international food trade; food waste; food choices; food banks; fisheries and aquaculture economics; climate change; environmental sciences and natural resources. In animal and crop sciences and production, the research areas include: food microbiology; food safety; antimicrobial products; fish genomics and informatics; livestock production; meat science and quality; plant and animal breeding for disease resistance; nutrient requirements of poultry, fish and livestock; fish and livestock feed; biofuels and bioprocessing; molecular biology and food technology.

4.2 Research Methods

Faculty in agricultural research employ a variety of research methods. A mixture of socio-scientific quantitative and qualitative methods are often used for agricultural economics, rural sociology and agribusiness research including: E-Mail, mail, telephone, intercept survey techniques; focus groups; face-to-face interviews; content analysis of media and government documents; collection and analysis of current and historical agricultural commodity production and trade data. Data sources that are used include: FAOSTAT; OECD, UN Comtrade International Statistics Data; federal and state agricultural statistical data sources such as the USDA, NASS, Foreign Agricultural Service and NOAA for climatological data. Representative of researchers in these fields, one researcher states:

'I just depend on the use of mixed methods depending on the research being conducted. Sometimes, my research will use the traditional telephone survey. This generates data from a regional survey, for example, that is done through a bank of technicians that use a random digit dial phone where they dial people to obtain information. I also use intercept surveys. This involves intercepting a subject, for example, at a grocery store or farmers and obtaining quantitative or qualitative data. Some of my other research has used focus group or face-to-face interviews. Lastly, for some of my studies I use content analysis of the media or documents such

as government documents and reports. My research methods span and utilize a wide range of techniques. I am not attached to any particular method.'

Statistical analyses of collected data and data modeling are done using SAS, SPSS or STATA software, for example. Research on consumer food values and choices also use the Becker, DeGroot, Marschak (BDM) mechanism for ascertaining potential customers' perceived values of a commodity.

Research methods used in the animal and crop sciences and Biosystems engineering are just as varied too depending on the research topic. In general scientific laboratory or field experiments are designed to gather quantitative data for a formulated hypothesis. Researchers studying agricultural and biological process engineering borrow their research methods from chemistry, chemical technology and other engineering disciplines in addition to the standard biosystems engineering research methods. And in this field, mathematical modeling is an important method for making predictions. Agriculture researchers in animal and plant sciences rely heavily on biological experimental methods including those from human bio-medical procedures. Cellular and molecular biological research methods are used to study cellular functions. For example, a researcher in this area states:

'*Well, the majority of what we analyze involves cell biology. It is molecular biology involving quantification of things like messenger RNA transcription, measuring concentrations. We use Real Time PCR to do this. There is also the protein side where we use western blotting and quantitative multiplex fluorescent gene expression assays to look at quantification of cells within tissues. Cryohistology, immunofluorence and traditional histology methods are all in use. Cell culture is another big area. In addition to taking tissue samples, we can also isolate the cells of interest from the tissue, for example, gut cells or muscle cells. We can then ask questions in vitro to look at how the cells function in an artificial environment as opposed to those inside the cell. This allows us to study both in vitro and in vivo cellular biology.'*

Similar methods are used in food microbiology such as: the use of antimicrobial assays, zone of inhibition tests for antimicrobial activity, agar disk –diffusion testing methods and antimicrobial gradient method, as well as methods that test for listeria, E-coli, Salmonella and campylobacter are all useful. '*Unfortunately, when reviewing the literature and data, some authors do not provide specifications in their materials and methods. I spend considerable time looking for specific methods and I find that most studies do not provide enough detail in their methodology.'*

For the cutting edge research in genetics, this response gives some insight into some of the research methods used: '*My research area is genomics and informatics. All plant, animal and microorganism life forms are genome-based. For the species that we study, we want to know how much DNA is in there, the composition, the sequences and then determine what kinds of genes determine function such as growth, disease resistance, oxygen tolerance of a given species. Genomics is a relatively new branch of science of not more than 30 years, given that 1986 was the start of the Human Genome Project. The methods used are very standard from a genomics approach. DNA sequencing is a large part of it. These days, we call it next generation sequencing. That involves using those new technologies that are fast and efficient for*

sequencing. RNA sequencing is another part. Then another large branch is called bioinformatics. These methodologies draw on the expertise of molecular biologists, cell biologists, basic animal scientists, computer scientists, statisticians and mathematicians are collaborating together.'

4.3 Research Data

For social-scientific research fields, the studies generate quantitative and qualitative survey data, focus group data, digitized data, digitized documents, maps, historical documents. '*Some of this data is numerical while some is verbal and qualitative. Others are imagery*.'Statistical data is also an outcome of this type of research.

For the life sciences, in microbiology for example, the types of data are measurements of microorganisms expressed in log numbers. SAS is often used to analyze such data. For thermal inactivation tests, heat resistance data may be produced. A lot of data is often generated because measurements are often done in triplicate trials or duplicate treatments. Other data are from molecular techniques such as microbiome of gut health that involve identifying organisms in the gut. Providing genetic analyses is also done. '*Also, data in form of soil isolates, metagenomics data that identifies organisms that produced antimicrobial peptides. So, in such cases, we end up with a library of bacteria.'*

For cellular biology research, examples of data generated are cell counts per millimeter or weights of muscles of different parts of livestock or poultry. '*Sometimes, we obtain qualitative data or pictorial data of cells or tissues from fluorescence microscopy. We also have protein and RNA quantifications in tables or figures.'*

4.4 Locating Information Sources

The majority of the participants were aware of important scientific databases that contain primary journal literature for their research areas. Databases used include: *AGRICOLA, CAB, Pubmed, Econlit,* and *Sociological Abstracts.* In response to the question on how the researchers locate primary and/or secondary materials, one researcher in sociological research said, '*The databases that I use online are first and foremost, Sociological Abstracts and then AGRICOLA, CAB and other agri-food related databases. I do not use the science databases much such as Web of Science although I know it is an important one to have. I always check first Sociological Abstracts and then AGRICOLA. I especially need to get the sociological content and discipline-specific studies and then get to the more general studies that also relate to the topic. What is challenging about doing research in sociology is that we have to know both the disciplinary grounding of the social sciences, the theories and methods and also we have to know the horticulture, entomology, animal sciences and other agricultural areas so we need access equally to databases and journals in all these related subject areas.'*

Another researcher also responded as follows, '*I identify articles for my research such as literature reviews to find out what other researchers are doing. I use a number of databases but as an agricultural economist I tend to use Econlit more than any other of the searches. Because*

my work is now moving into areas related to nutrition, I've started to use Academic Search Premier and I've touched on Pubmed. I also use Endnote so as to have the facility to download the citatins and physical articles.'

Some of the researchers who are at the fore-front of their fields seem to display a different approach to locating their primary and secondary literature as shown by this response, *'I would like to say that I conduct a literature search first and then stage a research study. But, a lot of times we know of the literature just from being in the field and seeing and being exposed to the literature. So, it depends on the project. We are familiar with the published literature and from that you are able to formulate the next research question… I use CRIS from the USDA that shows currently funded and previously funded projects as a resource for knowing that my research is not overlapping with existing research projects and also making sure that we are up on methods.'*

Google was mentioned as a resource for locating primary literature by three experienced researchers who are leaders in their fields. '*Mostly through my own work and with literature searches like Pubmed and Google also. Once you put keywords into google it will tell you if someone has published on a topic. You have to guess your keywords and just do a Google Scholar or in Pubmed to look for the abstracts.'* A second researcher said '*I rely heavily on the Internet to locate articles from selected journals in my field. And then, when I cannot find the articles on the Internet, I will go to the library to look at the physical copies.'*

The traditional scholarly communication cycle was cited as a source of primary literature. '*I am usually familiar with the latest research in my field through the literature, conferences, and networking with colleagues. Given a research topic, I conduct literature reviews to identify studies that need to be studied. I use Pubmed, Biological Abstracts, Web of Science and Google Scholar. I also scan food recall notices at food-recalls.gov. I read some trade magazines such as 'Food Navigator' on the Internet. I also keep up with the literature from industry by scanning products and services and news from some companies like Cargill, ConAgra Foods as well as industry associations*.'

4.5 Challenges in Research

Agriculture faculty mentioned lack of time; limited funds; limited journal collections; down-sized faculty/staff; and lack of research assistants as challenges that impede research. Structural building infrastructures and research equipment instruments were cited as problems in need of updating. Locating research methods is a special challenge that was cited by all researchers in the animal sciences fields.

Under-Funding of Agriculture Research

All participants were in agreement that the field of agriculture is grossly under-funded especially when compared to other fields such as the basic sciences or medicine. Because of this, faculty spend considerable amounts of time writing research grants to help fund graduate students as research assistants. Most faculty are conducting research without the help of lab assistants or assistants to help with any of the data gathering in field experiments. The success rates of the grant writing is low because of the great competition that exists so that even grant proposals with otherwise excellent ideas are turned down. This was cited as a cause for low morale for most researchers. As an example, in response to the question on challenges that impede research, one respondent said:

'*The oldest challenge is funding. For agriculture, this situation is quite unique. Some countries still value agricultural research. I'll give you some examples: China, India, and Israel, they value agricultural research. In the U.S. we have such a small agricultural population with only a small number of people who are engaged in agriculture as food producers and so politicians discount this group. We spend about 9 to 11 % on food in this country and that is minimal considering that we spend about 20% on healthcare and about 24% on the military. Medical research gets a lot of money. The USDA is funded at about $330 million while NSF has an 8 billion dollar budget which is about 20 times more than the USDA. So, I think all sectors of agriculture are grossly under-funded and so is agricultural research. In this country, we are broken when it comes to agricultural research. We take agriculture for granted. It is time that we really fixed this. The U.S. is falling behind other countries. Many think we are the first world and everyone else is third. When you visit India or China and look at the progress they are making, their situation is way better than the agricultural research situation here. Our buildings and our agriculture equipment is not state of the art like that in the medical field.' Our leadership and standing in the world will be lost if we do not strengthen agricultural research.'*

Lack of Time for Research

All respondents were again in agreement that they do not have adequate time to devote to doing research. Most have teaching duties alongside research or extension with research. Because of decreased university funding, most departments have been down-sized resulting in higher teaching loads. This response expressed the lack of time for research best:

'*Probably the biggest stumbling block is the need for time for research. I am always multi-tasking. This is a huge problem that limits my ability to conduct research. As a faculty member in a department and college of a shrinking staff, the remaining faculty are serviced to death: from counseling and advising students to serving on departmental, college and university committees. All these tasks are important but are all service functions. They take time away from my ability to focus on research. This is a huge problem. It is the number one issue that gets in the way of my research*.'

Limited Journal Collections

In agreement, one respondent also said, 'Faculty are also always chasing grant money. Applying for grants takes up an enormous amount of time. Everything must come to a complete stop when you have to apply for a grant and adhere to the grant's timeline. All your research work is placed on hold as you work to meet the time deadlines of a grant that you are seeking. If you do not apply for grants, then you cannot have the money to hire graduate students. The one connection with the library is that when I need resources, such as journal articles, I need access to them pretty quickly to meet strict deadlines. Then, in the grant I can demonstrate that I am aware of what has been published on a given research topic and that I am using the current resources to establish the state of the art that is available in the latest publications and latest methods and theories.

Access to Research Methods

Identifying research methods to use in a given research project is a problem that was cited in the biological sciences and animal sciences research, *'It is important that I be up on methods. It is one thing to formulate a research study but just as important to have proper methods. In this research, we use the AOAC Manual for analytical, tissue and histological studies. We are looking for methods all the time. If the library can provide paid access to cell biology methods journals that all chemists, microbiologists use, that would be helpful. For methods, even the literature from 1800 or earlier needs to be accessible because it provides a foundation for understanding how methods have evolved over time. Some of the most important documentation, for example of chicken anatomy, that contain drawings of chicken muscles was done around this early period and now it is taken for granted as common knowledge. It is important that this literature be digitized and be made accessible electronically. And, students need to be trained to research original citations instead of getting in a bad habit of perpetuating wrong citations. And then, people make mistakes in their analytical methodology that leads to erroneous results and conclusions that affect decisions or policy.'*

State of the Art Scientific Equipment

The need for up-to-date scientific equipment was cited as extremely critical in areas such as genomics, bioinformatics, molecular biology, biochemistry, and biosystems engineering where lab equipment can cost over $500,000 and require periodic maintenance.

Out-dated laboratory buildings and equipment were also cited by another researcher in the biological sciences. '*This building is antiquated and has faulty wiring that results in power surges and black-outs. Power loss affects ultralow freezers and damages biological samples*.'

4.6 Research Trends

On research trends, respondents cited that journals will become electronic and accessible globally; and faculty are spending more time chasing funding which in turn determines the types of research programs that are developed; evaluation of company products are a research trend. '*I think more journals will become global. Faculty at universities are spending more time chasing funding and unfortunately, funding determines the type of research that is developed especially when industry is the source of funding. So, faculty are funded to do evaluations of company products. As a result product comparisons become a research trend. This is a different type of science because the researcher is not 100% objective in such situations. Then, when you go to scientific meetings, the meeting is much like watching a commercial of industry product evaluations and comparisons. To overcome this, universities need to be adequately funded so that the land grant universities can go back to what their true mission is. Universities should be the center of knowledge with adequate federal and state funding to promote the basic scientific discovery and research. Now, scientists are frantically working to seek funding so that they can have income for three months.'*

Big data; data mining and visualization were also cited among research trends.

4.7. Disseminating Research Results

Because of university tenure and promotion requirements, all agricultural faculty reported that they publish results of their research in peer-review journal articles. Faculty with extension responsibilities also disseminate their results at grower meetings, in extension publications, at county city events as well as regional and national meetings.

Research faculty also cited grants and graduate student research and instruction as avenues that are used for disseminating research results.

Two researchers mentioned the need for university scholarly research to go beyond the peer-reviewed journal. For greater impact, they argued that research should also be published in media outlets that include trade publications, blogs, facebook, videos, and tweeter. To the question on how you normally report and publicize your research findings, one researcher said:

'*That's been evolving. I would say up until the last 5 years, the typical way for me was to just get the work into a journal article format and be happy. I have done some work for an international organization also for a period of time and the mechanism there involved publishing the work as online sources and physical books. And then, I spent some time as a visiting professor at another university. I worked in a lab involved in food research where you not only produced a research publication but they also developed a whole media strategy for disseminating the findings. As the paper was undergoing a review, you were expected to prepare a press release, there would also be a video made of it. When the article got published, the press release went out and then the video and the website associated with the research all became live. It's been interesting. For some of my research, I have just finished an interview for a live TV program and a piece for Huffington post. Traditionally, as researchers we have said our work*

needs to be published among ourselves. But, I am discovering that other researchers have been outward focused for more years than I. That we need our work to be out there in the public space so that it can be part of policy or shape people's behavior.'

4.8 Institutional & Data Repositories

All respondents were not aware of the local institutional repository that the library offers for depositing scholarly works and data. In some fields such as agricultural economics, some of the journals allow publishing of data with a published article. Other research fields such as genomics have well established subject-oriented data repositories such as NCBI. Similarly, the Social Sciences Research Network (SSRN) and AgEcon Search data repository networks for agricultural economics.

All respondents did not have the correct understanding of open access, in its true meaning of publishing of research articles that is free of monetary and time barriers. One researcher argued that to have scientific works published in open access channels will require government legislation. And that scientists are under so much pressure to publish that they are not in a position to argue with publishers and seek alternative copyright to the traditional exclusive copyright agreements. In that situation, scientist are most eager to have their works published in order to beat the competition.

4.9 Opportunities and Trends in Agriculture

'*Industry plays a large role in the field of food microbiology and food safety especially when looking at intervention methods. The research helps industry. Research from universities is integrated into the larger pool of knowledge that informs industrial practice. It is common to see researchers from universities contributing to trade magazines and other technical literature.'*

'Consumer preference is also important as they increasingly demand chicken and poultry, for example, that is natural, antibiotic free, hormone free, cage free and free range. While that is important, scientifically, some of these demands are not possible. Antibiotic free may mean that the poultry will experience more stress.'

'*I expect there to be increased use of big data and increased visualization of data in graphics that help us to understand inter-relationships of factors that interact in the situation being studied.'*

'There are areas in agri-food and social scientific research in general, where we find it difficult to find data because it is proprietary. Data on agri-food systems is being concentrated in proprietary sources as companies enter agri-food and become more powerful and monopolize the generation of data. This observation was also made in Biosystems engineering where manufacturers of agricultural equipment may install data collecting devices on farm equipment. However, for the farmer or academic researcher to have access to that data, cost may be a factor.

In agri-food, sellers and retailers are labelling food as 'local' to make their food attractive to the consumer when it is not and so they add to the confusion on the use of this term. '*So, we will*

likely see more definitions of what local food means as well as more rules and regulations establishing legislation on what local food or what natural food is.'

'In agri-food, there will be more linking of agriculture to theoretical, social and behavioral sciences. A linking of agriculture studies to research on values, beliefs and attitudes drawn from social psychology.'

Sustainable agriculture; climate change; molecular biology; genomics; biofuels; privacy; water quality; food insecurity; biosecurity; and big data were examples given of expanding areas of research.

5.0 Major Themes

This section will attempt to list issues that have implications for libraries or agricultural information systems locally or nationally and internationally.

Competitiveness of research, for fast moving research fronts, necessitates quick access to scientific literature. And yet, declining library budget mean that most libraries may not subscribe to all the journals that researchers need.

Researchers expressed a need for easier access to scientific research methods and protocols.

A need exists to support researchers store, analyze and preserve data generated by research.

Keeping up with research trends can be facilitated with some mediated current awareness services.

A need exist for storage of big data from life sciences genomics and bioinformatics research, for example, for plant and animal genome. Researchers need access to supercomputers, one for storage and another one for back-up. Such computers typically become obsolete in 5-8 years before they need to upgrade their capacity.

Big data storage is needed with mirror sites for back-up storage.

A need exists to publicize some library services such as the institutional repository that the library offers for depositing scholarly works and data.

Agriculture faculty are not familiar with the concept of open access in it's true sense, without monetary or time barriers. They associate open access with for paying publication fees and articles having embargoes.

Paying for journal article publication costs that publishers require can go as high as $5000 per article. For prolific authors, this model is not sustainable.

Libraries could play a role in helping researchers publish their works in publications and other media for wider dissemination of scientific research results to the general public.

6.0 References

Cooper, Danielle. (April 2016). Agriculture Project: Interview Sampling Webinar and Workshop. New York, N.Y. Ithaka S+R.

Appendix I: Participating Institutions

1. Auburn University
2. Clemson University
3. Cornell University
4. Kansas State University
5. National Agricultural Library
6. Oklahoma State University (Main campus)
7. Oregon State University
8. Purdue University - West Lafayette
9. Texas A&M
10. The Ohio State University
11. University of Arkansas
12. University of California – Davis
13. University of Connecticut
14. University of Florida
15. University of Georgia
16. University of Illinois - Urbana Champaign
17. University of Minnesota
18. University of Nebraska - Lincoln
19. Virginia Tech

Appendix II: Semi-Structured Interview Guide and Questions

Research focus

1. Describe your current research focus and how this focus is situated within the broader agriculture discipline and the academy more broadly. [Probe for whether/not they see themselves as located firmly within agriculture as a discipline or located across/between disciplines]

Research methods

2. What research methods do you currently use to conduct your research?
3. What kinds of data does your research typically elicit?
4. How do you locate the primary and/or secondary source materials you use in your research?
5. Think back to a past or ongoing research project where you faced challenges in the process of conducting the research.
    a. Describe these challenges.
    b. What could have been done to mitigate these challenges?
6. How do you keep up with trends in your field more broadly?

Dissemination Practices

7. Where do you typically publish your research in terms of the kinds of publications and disciplines? How do your publishing practices relate to those typical to your discipline?
8. Have you ever deposited your data or final research products in a repository?
    a. If so, which repositories and what has been your motivations for depositing? (i.e. required, for sharing, investment in open access principles)
    b. If no, why not?

Future and State of the Field

9. What future challenges and opportunities do you see for the broader field of agriculture?
10. If I gave you a magic wand that could help you with your research and publication process – what would you ask it to do?

Follow-up

11. Is there anything else about your experiences as a scholar of agriculture and/or the agriculture discipline that you think it is important for me to know that was not covered in the previous questions?