Research Support Services for the Field of Agriculture at Texas A&M University

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Introduction

In order to study the research practices of scholars in the field of agriculture, Ithaka S+R, the non-profit research and consulting arm of ITHAKA, partnered with the National Agriculture Library and 18 university libraries across the United States. Texas A&M University Libraries was invited to be one of the participating libraries in this study, which aims to identify current research methods, characteristics of research outputs, dissemination practices, and perceptions of future opportunities and challenges within the field of agriculture. This local report seeks to report on practices, experiences, and perceptions of these scholars within the context of Texas A&M University.

Scope of Agriculture Studies at Texas A&M University

Texas A&M University is a Tier One research and land grant institution with a large College of Agriculture and Life Sciences located in College Station, TX. The College has 297 tenure-track[1] faculty with responsibilities in both instruction and research. In addition, Texas A&M University has a separate group of faculty researchers involved in agriculture through the research arm of A&M's land grant mission, AgriLife Research. AgriLife Research faculty may be located in College Station or may be located at one of 13 research centers located throughout the state. A total of 1,792 FTE employees (faculty, staff, and students)[2] work for AgriLife Research. At this university, faculty do not have split research/extension appointments. The extension arm of A&M's land grant mission is fulfilled by AgriLife Extension, a group of more than 900 extension agents and specialists that are geographically located in one of 250 county offices[3] located throughout the state. These individuals typically do not conduct primary research, but instead translate research into educational programs for the citizens of Texas.

Researchers work in one of 14 disciplines: 1) agricultural economics, 2) agricultural leadership, education, and communications, 3) animal science, 4) biochemistry and biophysics, 5) biological and agricultural engineering, 6) ecosystem science and management, 7) entomology, 8) horticultural sciences, 9) nutrition and food science, 10) plant pathology and microbiology, 11) poultry science, 12) recreation, park and tourism sciences, 13) soil and crop sciences, or 14) wildlife and fisheries sciences. Depending on the discipline (and even within disciplines), research efforts span the gamut from basic to applied (i.e., industry- or producer-driven).

Methods

Ithaka S+R developed the methodology and semi-structured interview questions (see Appendix I) employed by the participating institutions. Participants were selected through non-probability purposive maximum-variation sampling based on participants' research areas and methodologies in order to satisfy the widest range possible of agriculture scholarship at Texas A&M. Agriculture, for the purposes of this study, was defined as agriculture studies in all of its

[1] https://accountability.tamu.edu/All-Metrics/Mixed-Metrics/Faculty-Demographics, using the latest data (2015)
[2] http://www.sao.texas.gov/apps/ftesystem/(S(aacfe4m5npdqfv55lxgjdc55))/default.aspx, query of Texas AgriLife Research (A&M) FY16 4th quarter data
[3] http://agrilifeextension.tamu.edu/about/

aspects, including food, the environment, natural resources, and international issues. The study targeted tenure-track faculty or other faculty with regular research responsibilities. Graduate students, adjunct faculty, and faculty from agriculture-adjacent fields (such as veterinary medicine) were considered out-of-scope.

The sample size for each institution was capped at 15 participants. A pool of potential tenure-track faculty members from the College of Agriculture and Life Sciences were identified by the project team as potential interview subjects and sent an email invitation to participate in the study. Twelve faculty members representing 10 departments accepted the invitation and participated in the interviews.

The project team scheduled one-on-one interviews with each faculty member in their office or research laboratory. At the start of each interview, the participant was given an informed consent form (see Appendix II), the interviewer reviewed the form with the participant, and both signed and dated the consent form. Each interview took approximately 60 minutes and followed the semi-structured interview script provided by Ithaka S+R. The interviews were audio recorded and sent to Paul M. Garton, Inc. for transcription. The project team received the transcribed recordings and anonymized each transcript. After anonymization, the audio recordings were destroyed. The anonymized transcripts were loaded into atlas.ti for coding and analysis.

The project team employed a grounded theory approach, using open coding and then grouping codes according to theme. These themes were then analyzed and are presented here to create a narrative emerging from the interviews.

Limitations of the Methods

In the course of this project, limitations with the sampling method revealed themselves. One, while all potential interviewees were extended an invitation to participate based on their research focus, the majority of those who accepted and were interviewed had some sort of prior working relationship with the project team.

Additionally, for an institution as large as Texas A&M University with a distinguished and extensive College of Agriculture and Life Sciences, the sample size is extremely small (4.04% of the total tenure-track faculty within the College). Given this, the findings below represent themes that can become the basis for emerging questions for the Libraries and other research support services on campus to explore more in-depth.

Findings

Agriculture is a Vast and Varying Field

This small sample illustrated that the field of agriculture is a vast and varying field, a thematic thread that runs through all the findings to follow.

Spectrum of Relevance to Agriculture

Although it is recognized that agriculture spans a range of subfields and interests, individual researchers within departments may not feel as firmly rooted to agriculture. Five of the twelve interviewed (42%) indicated that they either did not feel like their research was very relevant to agriculture or that some of their projects may have explicit agriculture ties while others were less related.

> "I don't view myself as firmly in agriculture. And I kind of feel like by nature of [my] training…, what I'm interested in, that kind of - there's relevance in what I do in agriculture for sure, but there's also relevance to other things. And so sometimes I feel on the edge of the agricultural community, which is fine…"

> "So, it's pretty basic research. It's not very applied. So how it could be important or affect agricultural research, at that broad scale, you could maybe make some links and ties...I'm getting closer in my research in the collaborations that I'm building to have more of an applied aspect to the research, but it's just some of these things that you stumble upon, more so than a targeted, 'we're going to do this research study to see what the economical effects are'…"

> "So, both of [my research areas] definitely have large agricultural components. At the same time, they can be totally non-ag… it really depends on the applications side of things."

Indeed, this proximity to applied research seemed to correlate with how relevant a faculty member felt their research was to the overall field of agriculture. Conversely, some faculty acknowledged their research techniques may cross disciplines or resemble basic science but felt firmly aligned with agriculture because of their applications.

> "[My research] is pretty much firmly implanted in agriculture, although the tools that we use certainly go across anything that has DNA in it, so obviously it would go from, you know, health related, a human research to animal research. But what we're actually trying to do, I would say, is pretty agriculturally focused…"

> "…remote sensing is the big one now. And genomics, for the most part, really sort of arose in ag parallel to rising in like human health aspects and other aspects like that. But now, there are sort of people who are focused just in genomics, and so they may not be specific to a crop or even an organism, and so there is some relationship there. There's sort of a continuum between basic research and applied research and then extension, which is just, you know, translating it to the grower. And I think my program mainly focuses on applied research and then sort of moving somewhat to basic but not as basic as say somebody in biology or cell development or something like that."

Collaboration

In all but three of the interviews, the concept of collaboration arose, whether it was working with colleagues in other departments on campus, in other institutions, or in other countries. Many were motivated to collaborate because they were seeking expertise outside of their own.

> "I also do a little bit of ecological research, but that's definitely in collaboration with others. I'm not a good ecologist. I don't know all the statistics and that kind of thing. But my colleagues do."

> "So, we collaborate, because they need [my area of expertise], and they don't understand what I do, and I don't have a clue what they do."

One notable exchange incorporated this need to recruit collaborators with diverse skillsets with the recognition that funding agencies like to see interdisciplinary involvement on projects.

> Interviewer: So, do you think that focus on pulling from interdisciplinary research or across disciplinary kinds of collaborations is going to be increasingly important or -

> Respondent: Yes - increasingly important because funding agencies prefer to issue money to such a team. Therefore, universities claim that's what they want to see. And the science is just so advanced and specific. A single person won't have all the instrumentation at their immediate control and disposal, and they wouldn't have had to operate that many pieces of apparatus and interpret the data. So, we need to have teams. So, there's got to be cohesion.

This push for cross-disciplinary collaboration on the part of funding agencies was echoed by others.

> "All sorts of areas make important contributions to the success of my research program. It's very difficult these days to even get a grant funded that isn't at least in some aspect multi-disciplinary in nature because the funding agencies are not interested in more simplistic questions any longer. They want something that's more integrative and holistic in nature. So, we bring together a large collection of people to be able to do our studies."

Finding and Keeping Up with Literature

The topic of the literature of the field arose in many ways throughout the interviews. Literature plays an important role in defining questions being asked, developing methods, understanding results, and situating those results in a larger context. There is an urgency to staying current with the literature in the field and, as such, many different techniques and strategies are employed to aid in this endeavor.

Sources of Literature

When it comes to locating primary and secondary material, a wide variety of sources were cited by the participants. Specific subscription databases available through the library that were mentioned were Agricola, BIOSIS, CAB Abstracts, Food Science and Technology Abstracts, MEDLINE, Scopus, and Web of Science. WorldCat.org, a free database that allows users to search across participating libraries' catalogs all at once, was mentioned. Google Scholar was most frequently specifically mentioned by researchers as a source for primary and secondary material. Almost half responded that Google was a starting point, though some clarified that while they didn't expect to find the primary research article itself in Google, they would frequently find a press release or news item that would lead them to search for the original research article.

> "Whenever I'm searching for supporting information, going into the literature, finding out what I should be doing, how I should be doing it, for the most part, I'm going to be doing searches on the primary databases, MEDLINE, BIOSIS, things along that line. That's my primary go-to thing."

> "I'm a huge fan of Web of Science. That's my favorite. So many people that I've worked with also use Google Scholar, and this is mostly like my students and the younger generation. I'm like, well, you can use Google Scholar too. Go ahead. But I feel like Web of Science finds more relevant information than Google Scholar, and I'm just so familiar with it that that's the one I primarily use."

> "Google Scholar, I use Google Scholar quite a bit, if I'm looking for a journal article, but a lot of times I've found that Google Scholar doesn't always have the journal article. They have the citation, but they don't have the article, so usually I will go into [the library] and find the actual article, whatever that may be."

Interestingly, although several subscription databases were mentioned, only one quarter of the participants named a specific database. More frequently participants would speak in terms of the format of the material they sought. Peer-reviewed journal literature was the most mentioned format, and many spoke of looking at primary journal literature almost exclusively. Books and conference proceedings were mentioned, but not a popular response.

> "I use the journal articles. I try to attend conferences that are outside [my discipline] - to gain other knowledge of other areas […]. That was in the old days - physical days. Hard journals - you would thumb through - go to the library, where the new journals came on Thursday. They would be out on display - but don't take them away. You can thumb through them, and go to the photocopy machine for 10 cents a page and copy all the abstracts of something you like. So, that was one approach - but certainly, you can subscribe to table of content alerts from different journals that have my interest, and try to oversaturate me with knowledge."

> “I normally search online, and if I find a journal article, I use [it]. I use, I would probably say less books but more journal articles.”

> “But academic publications, which are extremely valuable for their rigor and seeing where the profession stands in certain areas, they tend to talk only to other academics, so their references tend to be other journal articles. So, and that's fine as far as it goes, 'cause as I say, that's certainly a necessary input, but - I'll come back to that in a moment - but I did need a lot of the other literature.”

Grey literature, such as government reports, were mentioned by a few people as important and sometimes overlooked sources of valuable information. However, grey literature is complicated in that it can be difficult to find or even be aware that it exists.

> “So, in terms of literature, we usually always go to primary literature, but sometimes we do use something called grey literature: there may be government reports on a project and sometimes that could be useful.”

> Interviewer: How did you discover those NGO reports or World Bank reports and that sort of thing?

> Respondent: Well, in part because for the countries that I have worked in, I was aware of them. But a lot of times, well I would simply go to Google or, you know, and then one thing would lead to another. But something that's recent and frequently cited often would appear in Google. So, that was very helpful for me.

Strategies for Keeping Up

While the sources for primary and secondary literature were concentrated in peer-reviewed journal articles, the strategies for discovering this literature and staying current in the field reflected an active and engaged agriculture faculty.

Conferences and professional society meetings were frequently referenced as a source for staying on top of trends in the field and the literature.

> “The scientific meetings are places where in theory people are sharing their brand newest material that is - should not probably be published yet. You would be surprised, unless it’s a symposium speaker. So, you can find tidbits of information there that you can’t find anywhere else and as long as the abstracts are published somewhere, then you have access to that electronically, as long as their journal or institution subscribes to it. So, there are ways to keep yourself up to date there.”

> “I get most of my recent knowledge from presentations and going to meetings. I get a lot more out of that than I usually do about reading a full article. But because we're in such a niche environment, there's not a lot of research going on at other places that's specific

> to [ours]. There are very few people who work on that. […] And so most of the new knowledge I get is from going to meetings."
>
> "Reading paper[s], talk to people. Going to conferences and listen to talks, read the paper. There are too many paper[s] to read these days. You have to learn how to deal with those."

One exchange in particular highlighted the relationship between keeping current and being an active scientist and pointed to the related tension and challenge of *needing* to stay active or risking falling behind.

> Interviewer: So we kind of hit on this a little bit, but just in case you have something else to put in it, how do you keep up with trends in your field more broadly? Like you had mentioned sort of the way you've done literature searching with colleagues.
>
> Respondent: I mean, I guess the short answer is you stay an active scientist, right? So you go to meetings for the societies and groups relevant to you. I just came back a few weeks ago from a local meeting [...] You keep in contact with your colleagues doing all the research in other institutions. I do a lot of collaborative research. That's almost necessary, and by doing that you keep track of a lot of information of what's going on in technologies, etc., new concepts. […] But I think a big part of it is if you're publishing, if you're going to research conferences, or if […] a colleague is eventually going to tell you about something you need to know and then that just, you know, as long as you're active, that kind of is a self-feeding beast. I'm sure once you stop, it's easy for someone to just fall behind.

Many respondents pointed to the sheer volume of papers being published in their area. Some pointed to setting up search alerts in library subscription databases or Google Scholar while others explained the advantages of working as an editor of a journal in the field. The nature of the search alerts varied from citation searches created for their own published papers to table of contents alerts to creating a keyword search related to their question. Scholarly social networking sites, such as ResearchGate, were mentioned as well, but not as often or as immediately as traditional avenues, which suggests that these sorts of sites are a new and emerging route for keeping current.

> "One thing that I like both Web of Science and Scopus for is to keep track of who's citing me which is often stuff that's also relevant for me to be reading, 'cause we're interested in that same kind of stuff."
>
> "In terms of the way I do it, I get content alerts from a few of the major journals."
>
> "[…] the alert systems that the journals have, the keyword searches are nice."
>
> "Well, I get a lot of the table of contents for different journals that are sort of in my field. So I get those whenever they come out, either monthly, sometimes weekly […] They're

coming out all the time. And then I get them as emails, and I just kind of scan through them, and I see if anything looks interesting. Then I also do - I'm on like a ResearchGate, so I follow a lot of people. So I get alerts when those people have published, and if it's something that I am interested in. And then sometimes we'll just do, like I said, the Google - I don't know if it's Scholar alerts, or - it's something where we can put in. Like we'll have keys words, […] different stuff like that –"

"As I say, I see on ResearchGate - it's very valuable, actually. I get a lot of reports from colleagues and not all of them are relevant to what I'm working on at the moment, but quite a few of them are. So I try to do that, follow those."

"[…] if you happen to end up in some editorial board duty, then you usually see more manuscripts than you do typically as an ad hoc reviewer. And then if you end up as an editor associate, you see a whole lot of other people's articles, good and bad - or flawed or solid - you can learn from."

"You always have your conferences, but in my case, I'm a subject editor for the major journal, so at least in my field […] I see damn near everything that's coming across."

Agriculture researchers also rely heavily on their personal contacts and networks to stay informed. The importance of talking to colleagues, collaborators, and other people in the field was highlighted in several interviews.

"Because what do we do specifically, and we sort of have a sense where our things happen, try to keep up with stuff and, of course, network is another way. Colleagues and students and you're also reading as well, and then you talk to people who are doing similar things, conferences and so forth. Of course, we miss things here and there and find them later."

"[…] it's a network, it's staying on the phone sometimes with colleagues, it's emailing."

"I mean, just communicating with colleagues […] Yeah, occasionally they'll send me a paper that they find something interesting, and I'll skim it and occasionally read it."

"I also have colleagues that know stuff that I'm interested in. You know, it goes both ways, but if we see something that's relevant to somebody else's work, we just forward it on."

"We do lab meetings. So, we present papers there that are kind of, like, hey, this paper came out last week; I'm going to present it in the lab meeting next week. So, we can discuss it […] and we'll just kind of scratch our heads over it and go, hmm, I wonder what they mean by that. And so that's another way we do; it's just our own internal network."

Challenges of Staying Current

Still, even with these strategies researchers acknowledged that keeping up with literature in the field and staying on top of trends can be difficult. The easy access to information coupled with the volume of content available and the variety of communication methods is a double-edged sword.

> "This is one of the most amazing times to be alive and doing this kind of work because you do have so much available to you and it's so easy to get to, but at the same time, it's incredibly frustrating because you find yourself drowning in information all the time and I used to be really good about reading all the email, the whole thing, you know, what are they trying to tell me. Now, unfortunately, it's kind of like I read about half the way down the page and it's like, sorry - delete. That's a hundred and fifty emails a day. You got to do something to get them out of the way—"

Time was often noted as a barrier to keeping current, and even tools like search alerts have a time-cost associated with them.

> "Everybody's got to decide how they're going to spend their time, right? It's like currency - how you spend it - and then you've got less money in your bank account, so you've got less time. So, if I choose to let that computer screen show me this link, to this link, to this link, to this publication, sign this publication - there is a time-killer. So, I have to be more disciplined - to be focused, to be efficient."

> "I actually have different searches, so I have different groups of terms that I will use depending on which focus area I'm interested on pursuing right now. So, if I were to try to meld everything, like you said, you've got the laundry list of things that you would have to try to go through, whereas, no, right now I want to read on this particular area and so I have, in my own mind, the search terms that I'm going to type and I'm going to find out what's come up. […] My problem is finding the time to get in there and go through that. So, I do feel a bit of a disconnect with the literature and that has a negative impact on being most efficient at writing my own papers, having the most current literature to go in a proposal without it being a painful experience right before you're writing a proposal."

Research Outputs Are Diverse

Research conducted in agriculture runs the gamut from basic to applied, and as such the outputs are diverse. Conferences and meetings are often the first line of dissemination, presenting research projects that may not have been published as an article yet. Following this is article publications in peer-reviewed journals. Even the choice of journals varies from discipline-specific journals to cross-disciplinary journals. Likewise, the data produced from agriculture research varies.

Presentations and Publications

Journal articles are the major source for disseminating research among the participants, and most participants indicated that their publication practices were typical for their discipline. However, rich conversation developed around article publication as participants described motivations to publish and selection of journals, which will be explored more in-depth in Choice of Journals and Open Access. Some of this nuance is seen in the way participants describe article publication.

> "Peer review journals. […] That's the bread and butter of my industry."
>
> "Most of [my research], if not all of it, is peer reviewed research. And depending on what the actual project is, the journal varies."
>
> "So, I mean, I guess the easiest thing to mention would be the journal names […] they're probably applied, very technical, discipline-specific journals. I've occasionally had something in a more cross-disciplinary journal…"
>
> "I think most people do focus on journal articles, partly 'cause that's how academic incentives are set up."
>
> "Well, [I publish] mostly in general, peer-reviewed publications. We need to - we try to go, whenever possible, go to the better journals, high impact journals because that's how we're evaluated"

Conferences and society meetings are often the first stop for disseminating research findings. Though most respondents seemed to follow the pattern of presenting things in progress, some said they presented at conferences after an article was published.

> "Most all of our work - the output initially is abstracts for presentation - scientific conferences […]"
>
> "But big dissemination for me is publications and talks at conferences. So we go - and other invited talks for colleagues. So grad students and I go - we're all giving presentations and then we publish a few times a year,"
>
> "So, give talks. Students as well will give talks and posters, presentations, stuff like that, in order to share the current stuff we have out there."
>
> Respondent: But most times, you've got a paper published or about to be published when that happens, before you're going to present it to a national audience.
>
> Interviewer: So, for you guys, it's paper first; then presentation.

> Respondent: It just depends. It can be either way. You can do a presentation on something, and you've got the manuscript that just hasn't quite made it through the journal yet. So, all that stuff will eventually get published.

Technical reports and white papers and presentations to commodity groups and producers are also other means of disseminating research.

> "And we will go out and present one or two times of each one of those projects where we're dealing with the stakeholders during that process, and there'll be a final written report that we contribute to that goes to them. So, it'll be a technical report, basically, but it won't be an extension type publication."

> "Yeah, everything's a journal article - very little popular press type stuff, if really any - because, I mean, we may write a white paper or stuff like that for somebody. Where they go with that - it may get out there into the popular press. We know they're probably going to use it. They'll put it on their website. They'll send it to growers, if it's a commodity group, or they'll send it to, you know, importers, if they're trying to bring products into the country or something like that, to go, look, we're doing things to help sell your product."

> "Because of the nature of my work […], there are groups, or commodity groups that would be interested in learning about the outcomes because they are out there busy producing the stuff. And, so, learning the potential for their commodity to have a benefit is kind of interesting for them. So, hey, you know it's a different kind of presentation that you give to them. You still tell them about your current research outcomes, but you're talking to not necessarily a lay audience, but not a scientific audience."

> "I prefer that it be a journal article first. The abstract presentation in the annual conference and be in the book citation, volume, whatever - the graduate student begins to build their resume. But then when they get enough abstracts together to make a body of knowledge to be a publication, then I feel like it's been through peer review, other than me and [another faculty member] down the hallway saying, hey, this looks really nice. Then it's been through a test. Then I would prefer to take it into the lay language. I don't want to prematurely take information to a producer group and then say, oops, we did a second experiment, and the opposite - or that effect was not observed. You don't want that. So, I like to go a little slower with bringing it to the public in that standpoint."

Books are not a popular source of publication among the participants, though this sort of publication is not unheard of in agriculture. Some participants had published books or book chapters while others pushed against the idea of books as a valuable source of publication. The range of reactions illustrates the importance of context and discipline norms in regard to

drawing conclusions about typical publication practices, and points once again to the diversity of agriculture research and its outputs.

> “Yeah, so, books are not something that you, unless you're writing a text book, not something that you're necessarily going to be putting a lot of things into. I don’t know but only a handful of people who have written a book on their discipline. Especially, when it comes to original research. Now, writing a textbook, putting, say a review paper in annual reviews or something like that, winds up being a chapter, really. Things along that line that, I think, is a little bit different. Like I said, I've known a couple of colleagues here who have written discipline-related books, but it’s not many.”

> “Journal articles, primary; and then I've coauthored a textbook. So, those are the two main avenues.”

> “I don't know why people even still write books. Sorry. That information is already out there. […] Go to the original research, and read all the details, instead of reading someone's summary of a summary. […] I mean, even when I write book chapters, it's a year [to publication], right? And so it stinks, too, when you're trying to put a chapter together, because every month, the journals come out, and there's something coming out. And it's like you never catch up. And so that's how it actually gets published and shows up in print. It's easily a year.”

> “I could devote myself to publishing articles, but I guess I'm long-winded and it's easier for me to write books.”

Choice of Journals and Open Access

When discussing dissemination practices, inevitably the conversation turns to the types and quality of journals available. Journal impact factors, open access, and predatory publishing practices are all sources of concern for faculty. Indeed, as some participants noted, the career stage of the faculty member can influence how concerned they must be about the quality of the journal.

> “At my stage of career, I can afford to care a little bit less. I have more flexibility if you think there is some impact, I want some other journal even if it’s a lower impact factor, I can just go, I don’t care.”

> “And depending on what the actual project is, the journal varies. And it could be from low-impact factor and like the low one up to higher impact factor. So a manuscript we're working on right now is for [a journal with] a pretty high-impact factor. I forget what it is, but it's high. And at the same time, I'm also working on the manuscript that's going to go to a [journal with a] relatively low impact factor. So all - I'm really all over the map, which journals I submit to. It's highly variable. […] And other ones that we're working on bigger question types of things will go to bigger journals with a bigger readership and a higher impact factor.”

> “Well, you know, I am seeking tenure, and so [where] you publish that is the place most accepted by your tenure committee. So, some of the places that we publish are not necessarily tier one journals. […] And so I'm looking now at starting to get into that cycle a little bit more, because I've felt like I have quite a few articles underneath my belt in the journals that they want me to get them in that I can start to branch out a little bit and they'll see that as productive and not hurtful to me, you know.”

Open access journals seem a viable route for publication within agriculture. Some faculty members are seeking to increasingly publish in open access and they see the benefit in terms of impact and citation rates. However, as some researchers note, open access is limited by the costs associated with publication fees, which can be prohibitive.

> “So, you know, two-thirds, maybe a third [of our publications], would go to [journal A], a third would go to [journal B], and we're starting to use some of the new […] open access, as long as they're peer reviewed, we're doing more open access. Sometimes we'll start here and end up in open access, because we weren't successful someplace else. And you're not guaranteed a successful publication in open access either, but that's how I would split it up in my field.”

> “So, I think the one phrase is, ‘it's the money is what limits it.’ So, we got some money to publish one of ours in open access a couple years ago. And I think it's wonderful. I think we get a lot higher citation rate; we get a lot higher dissemination results. And I think it's really good. It's just the high cost of publishing is what deters us from doing it more commonly.”

> “All of our journal articles if I have the money or feel like it's warranted, I'll submit them open access, and then they're open access [...]”

> “We have used [the university repository] a number of times over when we publish in open access journals […]”

Data

It makes sense that the data outputs across agriculture are just as diverse as the projects that produced them. Researchers’ projects elicit data from DNA sequencing, remote sensing, field research with live animals, microscopy work, and more. These data come in a variety of forms from images to Excel files with hundreds of lines of data to paper files that have to be transcribed to electronic to text files with millions of lines of sequencing. Data management is a real concern across the agriculture disciplines, with questions arising about data integrity and storage.

> “So, the more difficult ones are giant text files with millions and millions and millions of lines of sequence, of gene sequence information, and so these can be very big megabyte, sometimes even terabyte size files […]”

> “Your biomathematics people will kill you, right? I kid you not. I mean, terabytes upon terabytes of data. I don't know what the one above tera is, you know, but, I mean, the gene sequencing and stuff - the files - I mean, they would overload a standard computer.”

> “We also have a lot of imaging files. So, we do a lot of microscopy work, like I said. So, we get thousands of images that will be captured from the microscopes to be able to analyze those bits of information. […] But, a lot of what we’ve been getting lately, that’s kind of a hog on the memory or storage capacity, you might say.”

> “We're setting up all these specific conditions to a field-type condition so the data sets we generate are data for every [animal]. So maybe 1,000 data points in one set, or 288 potentially in that set. They're not that big, but they're not that small either.”

> “Okay, for the morphological stuff, it's totally an Excel sheet, where you do things like principle component analyses and discriminant function analyses and some basic stats, you know, how does each measurement - what's the mean and variation around the mean for each of these measurements? And maybe a couple of other things, depending on what questions we have.”

> “Okay, we use very - we tend to use big data. […] So, spatial data, in general; GIS data, remote sensing based data is the kind of data we use.”

> “I've talked to you guys about this before. So there's this huge issue with genomics now of data management. I get giant files, I want to make sure my giant files don't disappear before I analyze them, and then they end up on a repository before we publish. 'Cause you hate to put all this time and research into it, and like the file be corrupted or something. So we end up squirreling away, you know, versions of files all over the place. For the most part, that gets handled by just submitting things to the short read archive at NCBI.”

Most participants indicated using quantitative data and a few expressed misgivings with qualitative data. On the other hand, some disciplines rely on qualitative data to help complete the picture of the condition of the animal, plant, or other organism.

> “No, I mean, I don't - for the most part, I don't really trust very much qualitative data. […] if we can't measure it, then we can't, you know, especially with the type of prediction we want to do. If you don't have quantitative data, it's not really going to be very predictive. The few examples where it would be qualitative is where I go out and just take ratings in the field, but we rarely use that in any type of publication or any type of formal thing. That's more to inform whether or not we're going to advance some specific line or throw it away.”

"So, in the case of, let's say, a company that we're working with is trying to determine what their shelf life is, okay? So, we assume the product is safe. It's not a microbiological issue, so their qualitative data would be, I think your shelf life here, based on color, or flavor, or appearance, is three weeks, you know. The chemistry's all still there. The quantitative data says these compounds are there, but maybe a secondary action's occurring; the product's turning brown - or the product was a nice, pretty red, and then that red color fades, and it turns kind of a brownish color. And people go, you know, I don't want to sell that product after that. It's a subjective call. So, it is very much qualitative at that point, but most of our stuff is quantitative."

"I use mostly qualitative research methods. I do use some quantitative. […] Most everything I do is some type of qualitative work. So understanding the experience basically from the participants, not so much quantifying them into numbers."

Open Data and Emerging Data Mandates

The advent of data mandates that require researchers to make their data publicly available and accessible is generating awareness of the need for good data management practices and raising questions about the process, time commitment, and ease of depositing data. A few participants expressed concerns with how data would be used and even questioned the usefulness of their data to other researchers.

"[I have seen mandates] only in connection with the federal projects. So, kind of familiar with some of that through the RFPs that have been put out. But I haven't been involved in a project that's mandated that, that has happened yet."

"NSF requires that you do that. NSF requires that you make everything freely available. It's expected. It's pretty much expected these days."

"If I have to make [my data] publicly available, they're not going to just take any format. It's not like you can just dump the data. You're going to have to provide metadata, and do I have all that metadata? Do I have it in the right format? Am I going to fill out 50 forms? It's going to really limit the amount of data I want to report on any project, because I don't want to fill out all this and submit all this metadata. So having a curator for that, I think, is absolutely critical…"

"You know, I think for any of the researchers, oftentimes, [depositing data] is just required or is in the larger picture, always a good thing to do. To our own research, definitely, there's not much direct benefit. Unless, collectively you do a certain kind of study then others, the archived data by others, could be useful to you. But, still, I think we still have a more traditional culture. If you want to use somebody's data, we probably would talk to that group first. I'm not sure there's - I don't know how much use and what kind of culture that gets to use data from these repositories. But, certainly, in the large picture, that would be a good thing to do."

> “I'm probably still hesitant, being an old codger, to think about, well, why should I make all this data available for a whippersnapper to do nothing except reanalyze all the old people's data, and get a publication, and say the same thing? But meta-analysis is supposed to be pulling all these different things together. […] Yes, I see the point of that.”

Some researchers, especially those working with genomic data, were very familiar with depositing data and/or had deposited data already. There is acknowledgement that with that sort of work, making data available allows everyone to move forward faster. This is contrasted with the perception that colleagues working in areas that had outputs with patent or market potential were understandably more guarded with their data.

> “I was always kind of trained that you should have your data available, because someone may want to go back and reanalyze it and that sort of thing. […] I'm not curing cancers, so there's not as much hoarding of information to make sure that, like, you know, nobody else can get the patent. […] By and large now when you publish, you're expected to have data available so people can actually look and see if what you published makes sense or not. And in the old days, I guess you could justify the, you know, how am I going to make all this information available, and now that's just kind of solved by computers and servers.”

> “Patents and intellectual property kind of get in the way of sharing information. And that's - I mean, that just is what it is. But this is kind of the antithesis to that, right? The more you share, the faster you can move as a community.”

> “It’s becoming more and more expected that those data are available. Otherwise it's - and maybe the journals are just trying to protect themselves this way and not publish too many articles that are super wrong and bad, because they're basically putting the trust in you and the reviewers to make sure everything is solid. So that means the data that's behind the questions that you're asking needs to be good, clean, solid data, and by them being able to access that data if they wanted to is a way for them to protect themselves and to make sure that you're not completely fabricating something.”

Certainly there are barriers to depositing data that exist. The time commitment to prepare data for depositing is a big concern, along with a concern with having to fill out forms and provide accompanying metadata. Participants also raised the issue of costs associated with some repositories, such as Dryad.

> “So, same thing with your data repository. Who's the gatekeeper to that? How do you get it in? What's the protocol? So, you know, it's another headache to deal with in a given day. I'll have to reformat all my data. Well, I published the paper last year, and we're busy with the next project. I don't have time to do that. So, it's going to be maybe a challenge.”

> “The journal makes you do it. 'Cause I wouldn't do it if the journal didn't make me do it. It's very tedious and time-consuming.”
>
> “No, no, it's just that [the data] are very voluminous, and again, very time-consuming to organize them.”
>
> “You know, I just don't think it's going to be practical for us to make some of the data available, not 'cause we don't want to or not 'cause we're afraid to, but there's just so much hassle to get it in a state that other people would use it. And who knows if anybody's ever going to use it?”
>
> “And again, with the journals that are contemplating doing - you know, providing all raw data - they're going to have to provide some sort of template for how this goes in - or otherwise, it's just, people are going to use it as their trashcan. Oh, I have a place where I can back up all of my information. If I ever need it, it's on your server - and just scary, because all this stuff's cloud-based, right? When the cloud goes away –”
>
> “So, that was a learning curve is figuring out how to arrange, annotate, put together all the metadata for the experiment and stuff like that so that it could be up there and could be used by other people. I’m here to tell you it took me probably - me, us, the whole group, probably five or six times before we got it in a format and uploaded in a way that they were happy with it. So, it was definitely a learning curve and obviously we are going to have to do more of that in the future.”
>
> “And the reason I mention that is, you know, if you publish in [a certain journal], and you have to submit something to Dryad for them, whatever your data is, so there's usually a subscription to that and you have to buy that space on Dryad basically, which is kind of a back door increase to the publication cost. It's not an increase to [the journal]; it's an increase to us.”

Additionally, a few participants mentioned making their data available through the supplemental materials in the journal where their article is published. This avenue for making data available needs to be investigated more thoroughly because it is unclear whether the individual journals or publishers are committed to the discoverability and preservation of the data.

> “You know, it's just - a lot of journals, I do like the fact that they have supplemental data available through the journal, and we definitely use that. It's almost necessary now for what we do. You cannot fit all the figures and tables, so you need to explain what you're doing in the, you know, 10 pages they give you or whatever it is, but you can give supplemental files that help people understand what's going on.”
>
> “So I'm actually leaning towards, with this one that we have in revision right now, is just online supplementary material. So it's there forever, and it's part of the submission, and

> it doesn't cost us anything extra. So that's what I'm leaning towards, I think, with some of my future work is to have it as online supplementary information. So anyone could get it, it's freely available, and they could do with it what they want, even if it's a response paper on there."

Several respondents, when asked the future challenges in the field, pointed toward the need to understand and manage the data mandates that would be coming from funding agencies.

Research is Entwined with the Development of Graduate Students

Although the focus of this study is the research practices of tenure-track faculty, when discussing their research, it became clear that role of graduate students in their research and their labs was intimately linked to their own research productivity. Many expressed the challenges of mentoring graduate students, which entails offering support and guidance in terms of developing their research abilities and pointing them in the direction of other campus support services when needed.

> "I don't know because a lot of students, even though they may be working in this multidisciplinary environment of our research projects, they still, for the most part, are thinking vertically. […] The place that I like to make sure that my students are always at to try to learn about different things is making sure that they go to our seminars."

> "I don't know how much this directly related to the library work and their mandate, but […] I think that's where a whole lot of my graduate students go. They can go over there, because some of the writing they give to me in terms of publications or anything else I refuse to accept. So there's the writing institute over there. I know there's some places you can go that have the actual help proofreading and those types of things."

> "A former lab tech says that I said at one time - that I don't recall - but every good project begins with a sharpie and labeling tubes. […] And we have - each student, when they enter the lab, they receive a notebook, a log book where they are asked - reminded and taught they should be writing down what they do, like a diary. So, they have that kind of information - and to back things up in the computer, and back things up, and back things up - and don't let the cattle or the sheep eat the data sheets."

> "I suppose some of the most recent issues that I've had has to do with student quality control. […] I've had lots of talks in my lab meetings, and I need to remember to keep doing that every year, every six months, make sure your data are clean, make sure everything is organized in a way and clean enough in a way that somebody can replicate the work that you did with the data that you have."

> "And I think a lot of it […] is have a formal process to where they get exposed to how to search for literature and find the primary literature - where to get it. So, I think that'd be very beneficial. With our undergrads, we have gateway courses. With the grads, there

isn't that corresponding thing. And so it would be hard to catch them all - at least in terms of an official course."

The discussions about graduate students reflected a tension between wanting to develop good researchers for the future and the time commitment involved in trying to mentor students who may not have fully developed skills in writing or data management. Interestingly when participants were asked what they would have a magic wand do, often they pointed to helping out their graduate students develop skill sets they didn't already possess.

Conclusion

While the usual issues that plague researcher these days – funding, bureaucratic red tape, increasing numbers of students without an increased budget – were certainly discussed, the themes that emerged supported the idea of agriculture as a many-faceted field. Whether it is the research questions generated, the types of data collected and produced, the sources for literature, or the chosen places of research dissemination, the emerging narrative is one of a field that cannot be pigeonholed. Certainly, whether the questions asked were basic science or applied, they seemed to exemplify what one participant astutely observed: "always remember that agriculture serves society."

With this in mind, it is important for any support services, including the Libraries, to consider the disciplinary context of the researcher they are serving, rather than treating agriculture as a monolith. While interesting anecdotes arise from the interviews, readers are warned against drawing firm conclusions based on this small sample. Rather, these anecdotes should serve as a jumping off point for developing a deeper, more targeted, and more expansive research and analysis of the needs of faculty in these agriculture disciplines.

Implications for the University Libraries

1. Support for data management

With the advent of open data mandates from funding agencies, in addition to the researchers' own concerns with maintaining their data, the time is ripe for developing deeper library services around data management. Some of the participants raised questions that indicated their own misgivings or confusion around making data available. The Libraries can help bridge these conversations with our expertise and experience with the organization of information and good data management practices.

Additionally, concerns were raised around data archiving, including costs, spaces issues, and access. The Libraries has had an open access publications repository, OAKTrust, for over 7 years, and will soon support depositing data via the Texas Data Repository (available through the Texas Digital Library). Based on these few interviews, the College of Agriculture and Life Sciences will potentially be a big user of this data repository, so a concerted effort to market and educate about the repository coupled with a more extensive investigation into the data repository needs of agriculture scholars is recommended.

2. Support for graduate students in research labs

Many of those interviewed referenced their graduate students when referring to their research, and it became apparent that faculty have real concern about and investment in developing graduate students to be good researchers. At the same time, several faculty members acknowledged the help the Libraries, and other support services such as the Writing Center, have given to their students. A few noted that there was no systematic way that students learned how to conduct literature reviews either within their lab or within the degree program. Subject librarians can step into this gap by building upon workshops and sporadic instruction sessions to develop a robust plan in collaboration with faculty for teaching these research skills.

3. Support for scholarly metrics

Discussions around publication practices bring to light issues of evaluating journals for impact, relevance to the research, and credibility. These are pertinent points because promotion and tenure committees look at the publication record of faculty going up for tenure. Some faculty explicitly noted the need to look at these factors when choosing a place to submit their manuscripts. Hand in hand with developing a publication record is the need to develop a narrative around that activity for the promotion and tenure packet. This is an area where the Libraries can offer support using the tools available through various databases and tools. The Libraries has been steadily building its support services in scholarly communications, hiring librarians for the Office of Scholarly Communication who in turn have been working with subject librarians to develop skills in helping faculty develop their scholarly identity. The words of the participants serve to justify the work already done in this area and are an encouragement to continue growing this skill set and service among the librarians.

Appendix I

Semi-Structured Interview Guide

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?

Appendix II

Texas A&M University Human Subjects Protection Program
Consent Form

Project Title: Research Support Services Study for the Field of Agriculture

You are invited to take part in a research study being conducted by Jenni Simonsen, Sarah Bankston, and Ithaka S+R and funded by the Medical Sciences Library at Texas A&M University. The information in this form is provided to help you decide whether or not to take part. If you decide to take part in the study, you will be asked to sign this consent form. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?
The purpose of this study is to examine the research practices of academics in agriculture in order to understand the resources and services these faculty members need to be successful in their teaching and research.

Why Am I Being Asked To Be In This Study?
You are being asked to be in this study because you are engaged in research in the College of Agriculture and Life Sciences or Texas A&M AgriLife Research.

How Many People Will Be Asked To Be In This Study?
15 people (participants) will be invited to participate in this study locally. Overall, a total of 225 people will be invited at 15 study centers.

What Are The Alternatives To Being In This Study?
The alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?
Your participation in the study involves a 60 minute audio-recorded interview about your research practices and support needs as an agriculture scholar. We also may take photographs to document your work space, however, you will not appear in the photographs. Your participation is completely voluntary. You are free to withdraw consent and discontinue participation in the interview at any time for any reason.

Will Photos, Video Or Audio Recordings Be Made Of Me During The Study?
The researchers will make an audio recording during the study so that we can accurately collect your responses to the survey questions. A third party transcriptionist will be used to transcribe your audio recording. Identifying information will be redacted during transcription. Audio recordings will be destroyed immediately following transcription. If you do not give permission for the audio recording to be obtained, you cannot participate in this study.

_____ I give my permission for audio recordings to be made of me during my participation in this research study.

_____ I do not give my permission for audio recordings to be made of me during my participation in this research study.

The researchers will take photographs during the study so that they can better understand your physical work environment only if you give your permission to do so. Photos may be shared with Ithaka S+R and the 15 study centers and/or used for publication purposes. Indicate your decision below by initialing in the space provided.

_____ I give my permission for photographs to be made of me during my participation in this research study.

_____ I do not give my permission for photographs to be made of me during my participation in this research study.

Are There Any Risks To Me?
The things that you will be doing are no more risks than you would come across in everyday life. Although the researchers have tried to avoid risks, you may feel that some questions that are asked of you will be stressful or upsetting. You do not have to answer anything you do not want to.

Will There Be Any Costs To Me?
Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?
You will not be paid for being in this study.

Will Information From This Study Be Kept Private?
The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only the principal investigator and co-investigators will have access to the records.

Information about you will be stored in locked file cabinet; computer files will be protected with a password. This consent form will be filed securely in an official area.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

Who May I Contact For More Information?
You may contact the Principal Investigator, Jenni Simonsen, M.B.A., M.S.L.S., to tell her about

a concern or complaint about this research at 979-862-1050 or simonsen@tamu.edu. You may also contact the co-principal investigator, Sarah Bankston at 979-458-0575 or sbankston@library.tamu.edu.

For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu.

What If I Change My Mind About Participating?
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your employment or relationship with Texas A&M University or the University Libraries.

STATEMENT OF CONSENT
I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. I can ask more questions if I want, and I can still receive Library services if I stop participating in this study. A copy of this entire consent form will be given to me.

_____ _____
Participant's Signature Date

_____ _____
Printed Name Date

INVESTIGATOR'S AFFIDAVIT:
Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

_____ _____
Signature of Presenter Date

_____ _____
Printed Name Date

Version Date:

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