1-17-2017

Investigating the Needs of Agriculture Scholars: The Purdue Report for Ithaka S+R

Jane Kinkus Yatcilla
janeyat@purdue.edu

Marianne Stowell Bracke
mbracke@purdue.edu

Investigating the Needs of Agriculture Scholars: The Purdue Report for Ithaka S+R

Jane Kinkus Yatcilla and Marianne Stowell Bracke

Introduction

Agriculture is not a single, easily defined field of study, but rather a constellation of disciplines working to study the use of natural resources to fulfill the food, energy, and material needs of a growing population; i.e. the "grand challenges" of society. The definition of agriculture may be centered on the particular disciplines in a College of Agriculture, which vary from institution to institution. Purdue University is no different. The College of Agriculture consists of eleven academic departments: Agricultural & Biological Engineering, Agricultural Economics, Agronomy, Animal Sciences, Biochemistry, Botany & Plant Pathology, Entomology, Food Science, Forestry & Natural Resources, Horticulture & Landscape Architecture, and Youth Development & Agricultural Education. It is also the home for the state's Agricultural Extension Service and Agricultural Experiment Station. These departments cover the social, life, and applied sciences, as well as engineering. In 2015, the College had 289 tenure track faculty, 1,070 staff members, 541 graduate students, 9 lecturers, 117 researchers and post-docs, and 65 adjunct faculty. Undergraduate students in 2015 totaled 2,671, a number that has risen slowly but steadily over the last ten years. To serve this growing undergraduate population, Purdue's College of Agriculture emphasizes "effective teaching"- preparing students to enter the workforce ready to make a difference.

One particular focus is the Plant Sciences Initiative, a multidisciplinary research and education effort to be a leader in discovering the new innovations, practices, and technology needed to feed the 9 billion people expected by 2050. The plan is described as: "Cutting edge advances in plant biology and epigenetics that will permit plant scientists to develop new and novel ways to deliver needed plant traits." The College is strongly interdisciplinary and has two interdisciplinary programs, Natural Resources & Environmental Sciences and the Purdue University Interdisciplinary Life Science Ph.D. Both highlight the need for many disciplines, including those outside of traditional agricultural sciences and even the College itself, to collaborate on solving the complicated problems facing the world today.

The importance of agricultural research in addressing many of mankind's current grand challenges is evidenced by the participation of Purdue agricultural researchers in key roles in several campus institutes, including the Global Sustainability Institute, the Center for Global Food Security, and the Purdue Climate Change Research Center. These centers attract researchers from disciplines across the university, and such collaboration across disciplines is a hallmark of much of the agricultural research conducted at Purdue.

Purdue University, the state of Indiana's land-grant university, has a student body of over 40,000 students, of which 23% are graduate students, 73% are undergraduates, and 2% are enrolled in professional programs. Purdue University Libraries (PUL), which belong to the Association of Research Libraries, consist of fourteen individual libraries and an archives, which are supported by centralized services such as IT, acquisitions, and technical services. The strength of PUL reflects the core strengths of the University –

agriculture, engineering, and the sciences and the professional schools of business, pharmacy, and veterinary medicine. PUL's print holdings reflect the long history of collecting, both broadly and in depth, that support these core disciplinary areas. However, in recent years, more emphasis has been placed on providing electronic access to journals and books when available and affordable. PUL collections for FY2014-15 were comprised of 3.7 million books, including 1.9 million e-books, and over 111,000 serials in print or electronic format. PUL are staffed by 89 faculty and professional staff, 77 clerical staff, and 51 student workers. In addition to providing collections, classroom instruction, and other instructional support to the campus, PUL faculty and administrative professionals also provide support services for the discovery, organization, and sharing of research data.

Methods

This study is an in-depth qualitative analyses of the research practices of academics in agriculture in order to understand the resources and services these faculty members need to be successful in their research and teaching. This information will be used to articulate the research activities and needs of agriculture scholars, including identifying potential improvements to pre-existing research support services at Purdue and opportunities for developing new research support services for agriculture more widely. This study also adds to the research in library and information studies on user needs and activities by examining the specific needs of agriculture scholars- a group that has been previously under-represented in this literature.

The local study is connected to a suite of parallel studies being developed locally at other US-based higher education institutions with agriculture departments. Ithaka S+R, a not-for-profit research and consulting service that helps academic, cultural, and publishing communities, has been hired by the researchers to provide guidance on research methodology and data analysis. The anonymized aggregated data and analysis will also be used towards a comprehensive report written and made publically available by Ithaka S+R. Ithaka S+R had no access to the research subjects or their personal information. Ithaka S+R will only have access to the transcripts, not the audio recordings. These transcripts were stripped of identifiers before they were sent to the Ithaka S+R analyst.

Subjects participated in a one-on-one semi-structured interview with an investigator. The interviews lasted no more than 60 minutes and took place in the participants' primary work spaces on the Purdue campus. As part of the interview process some photographs documenting the work were taken. In order to maintain anonymity no humans or identifying information were included in the photographs.

Eighty recruiting emails were sent to researchers across all eleven departments in the College. We interviewed seventeen researchers from seven departments (Agricultural & Biological Engineering [3], Agricultural Economics [1], Agronomy [4], Botany & Plant Pathology [1], Entomology [3], Forestry & Natural Resources [1], Youth Development & Agricultural Education [3]) and one from Agricultural Administration. Interviews were recorded using Sony ICD-SX712, Sony ICD-UX512, and Sony ICD-PX312 audio recorders, with 2 recorders used at each interview for redundancy. Audio files were converted from .wav files to .mp3 files for local transcription, which was performed by

a library staffperson using Stop Start Universal Transcription System. We reviewed and edited transcripts for accuracy and to remove identifying aspects. The transcripts were loaded into NVivo Pro for coding. We each read and coded all transcripts for the final analysis.

Findings

Multidisciplinary and Collaborative

The results of our interviews revealed that agricultural research is about much more than crops or farming. Conducting multidisciplinary or interdisciplinary research was a common theme. This collaboration is necessary in order to address large research problems.

> "I have also, I guess I would come at a fairly interdisciplinary team, I have a lot of my graduate students are not all just engineers. I have geologists and animal science on board, I have an agronomist on board, and then I have three engineers and one technician. We're investigating the specifics of the problem in order to solve the problem, so it's more an investigation than a conduction of a detailed fundamental experiment attempting to find out something very, very basic about life, it's more about finding out specifically what is the problem of the issue. Many people try to solve problems that don't really exist, or problems that aren't important."

> "If you look at the top ten problems that humanity faces, as published by the UN and several other groups out there, eight of those are essentially related in many ways to at least agriculture and natural resources. Name one that isn't – food, water, all of the basic foundational level needs of human society are tied to agriculture, so we have to produce more with less in the continual fight to improve our production and performance metrics."

> "We're going to be more collaborative and more integrative – you can only specialize in so many things before you need to team up with people to answer these big picture questions, so I don't see this problem going away."

> "If you think about something I'm doing now, I'm trying to expand into an area with hasn't traditionally been part of my background."

One surprising attitude that emerged from the interviews was that a number of researchers did not identify with being a part of agriculture; rather, it was simply the case that their appointment happened to be in a department within the College. Additionally, two social science researchers noted that their science colleagues did not always understand the value of social sciences to agriculture, or the necessary nature of using qualitative or other non-science approaches to explore the nuances of agriculture writ large- for example, studying the behavior or attitudes of farmers themselves, or of consumers of agricultural products, or of agriculture students.

> "…what I do is social science work, and I tend to be more quantitative really than qualitative, but our units of analysis are people, it's usually

> consumers or farmers, and I'm interested in their perceptions, their attitudes, and their behaviors relative to either buying food, their perceptions of safety, perceptions of risk."
>
> "Yeah, and I am not a very typical ag researcher, ok? I am kind of an engineer and sort of a renaissance man, and instead of being interested in that 12th chromosome of the mitochondrial DNA of such-and-such a species as many of my colleagues kind of are, I have a very broad interest; I like where I can have impact, and right now I have probably three or four areas that I'm working on right now, in fact I get a lot of grouching because "oh, there's no tie in between them!""

Students

Students, primarily graduate students, appeared often in the transcripts. Researchers mentioned students in all but four of the interviews. Students were a both a resource for research work, as well as a drain on resources because they required supervision and training.

Most researchers interviewed also had some teaching responsibilities as well. Graduating well-trained students is an important aspect of keeping the workforce supplied with the needed skills. There is a significant gap between the numbers of workers needed to fill these jobs, and the numbers that universities are training. For example, one researcher said:

> "I think that if we look at the study that Purdue does with the USDA about graduates, so demand in food and agriculture job is something like 70,000 a year, and the colleges of agriculture across the country graduates something like 40,000 or 50,000 a year, so we've got a gap of like 20,000 students that we're going to have to get from somewhere else. Those students are going to have some really great skills and are going to bring some really great perspectives, but they're not going to have sort of the baseline agriculture knowledge that employers are probably going to expect, so probably some opportunity there to think about what are the resources that set of individuals need to help our industry continue to be successful."
>
> "Wow, I think our biggest challenge right now is diversifying the pipeline. It's not real diverse; in fact, I was in D.C. the other day, and our secretary of agriculture, Tom Vilsac spoke about how, the fact that we probably have about 58,000 positions or jobs that are going to be available in the next 5 years, and we only have about 38,000 people in the pipeline, and that doesn't mean that they are qualified to fill those positions, but it means that right now we've got about 38,000 students in the pipeline that could fill those positions, but you see there's a huge gap there, of probably about almost 20,000."

This speaks to the fact that faculty must balance research with teaching responsibilities. Their students could help research by providing a body of competent workers to help in

the research process, or they could be a hindrance that distracts faculty from focusing on research. Either way, these faculty saw a responsibility to help train the next generation of the workforce.

Students could even be a barrier to research because they were not skilled enough in writing, or efficient enough in managing research, writing, and coursework, to assist the researcher in producing articles in a timely fashion. Several faculty reported difficulties in recruiting talented students, and others remarked that students' motivation for receiving a graduate education had been gradually changing over the years. Statements included:

> "[the challenge has been] definitely graduate students, finding good, competent, hardworking graduate students has been hands down the biggest challenge in doing research period."
>
> "I think what I do now is I look very carefully, I ask prospective students, but I also look very carefully at their references, and what their work ethic is, maybe more than I did 10 years ago"
>
> "I've seen a big shift in students, many of them when they come in they aren't quite sure, or mainly what I'll see is "I may want to go into academia," and then after two years they say, "Nope.""
>
> "I think, looking at the students I recruit now or talk to, the growing lack of curiosity to do more than what you expect of them. I think that's fairly common – I see it in my own children, whereas I think early in my career, there were students who had a natural curiosity, which have shown that many of them now are researchers at other institutions."

This perceived shift in work ethic and decline in skills would be a potential area for further study, to see if this is simply a perception or if it in fact signals poorer motivation or performance. In either case, this highlights a need that faculty have identified, and this could be a role for librarians to assist in providing information literacy skills to students.

Several interviewees mentioned that finding graduate students who already know how to write well is difficult, and mentoring students to write better can be a source of frustration.

> "I would ask [the magic wand] to make sure that every student that comes through the door is able to hand me a manuscript that makes sense. That is the biggest chal- I'm sitting on so many papers right now. A couple of which, I'm almost sure the group that's gonna scoop us, but I don't have time, and I do the best I can. Even the students who are good at generating data are not very good at the follow through. I guess that's what I would choose. "
>
> "Most of them don't give me a manuscript, they somehow get a thesis cobbled together, but if you look at the chapter and try to make a paper, you might as well start from a Word document. I definitely think most of the students that I've worked with don't have very good writing

> skills, because they're not trained very well to write, so this goes back to the writing lab."

Library Resources

While PUL has taken care to purchase access to many databases and electronic journals germane to diverse aspects of agricultural research, a majority of interviewees did not name a specific database for conducting their literature reviews. Several named Google or Google Scholar, and a few named Web of Science.

> "I think the first thing that people do is they often go off and look for Google, a Google search. Usually you then start honing in on other concepts, but that's sort of high level."

> "I would start with Google Scholar, probably, and I'm looking for particular journals, and once I find hits in those journals, I capture those articles, and then I'll often just go to the most recent issue of that journal and work backwards."

Because this researcher is interested in searching specific journals, a more efficient method might be to browse or search the Libraries' online journals database, and to bookmark the sites of individual titles, professional associations, or publishers.

Several researchers described email alerts they have set up to receive notice of pertinent new articles from Google Scholar, Yahoo, or specific journals. Other described using their personal knowledge of their discipline and its key players to guide their search for primary research materials.

> "Also, often I'll know some people in the field, I'll know a bunch of people in the field, and I might go to their website, or now more often, I'll check and see if they have a Google Scholar personal profile, and I'll sort by year, and see what they've published recently and whether they've been working on that topic recently, then try to use those papers to look in the introduction or see who they've cited or see who's cited them, and branch out that way."

Here, the researcher acknowledges that not every colleague maintains a Google Scholar personal profile, so this method is clearly not comprehensive. Meanwhile, bibliographic databases routinely index systematically selected peer reviewed journals, conference proceedings, and even trade publications for easy keyword or author searching.

Some interviewees mentioned going directly to the site of specific journals to browse for new articles, without acknowledging whether their ability to access these online journals is made possible by PUL acquisitions.

A few interviewees admitted that they assign the task of finding primary research articles to their graduate students.

> "I just don't have the time sometimes, so that's why I have grad students, to help me do the lit review and those necessary set up."

> "Once I've assigned a student to the problem, I let them screen and glean for me, there's so much out there."

> "They'll send me things all the time, oh I found this. And another thing I think that my students do, some of them will share resources that they find and send it to me, and I'll use those if they're credible."

However, it is not the case that all graduate students arrive in graduate programs equipped with the skills to conduct good literature searches, as evidenced by these comments:

> "Somebody called the other day, one of my grad students, and asked for help with the lit review, and said they were really having a lot of trouble with it, they were really worried about it, and when we got through talking, they were just so grateful."

> "When I work with graduate students, I see them really struggling with even how to start a lit review, and they have a lot of anxiety about it. I know how I do it, but I also kind of know my literature, so I know where to start. They don't know, and they don't know where to start."

One researcher mentioned a database they would like to use, but did not know that PUL already subscribed to it. Another mentioned relying heavily on a free open access repository for a discipline which has not been linked in the PUL online catalog or on any LibGuides.

This topic deserves further exploration because, while striving to provide pertinent databases and journals in a fiscally responsible manner, here is evidence that some of these resources are not known by some of the prominent researchers and educators in the College of Agriculture.

Interviewees' responses about library resources and searching for primary research articles should be considered very closely by the Libraries. Many of these researchers are senior faculty who have maintained proven track records of winning grants, conducting research and producing scholarly outputs while using literature searching methods that would be considered unorthodox by librarians. Does this mean that PUL can begin diverting resources away from funding specialized databases? Or does this mean that PUL need to be more proactive in informing researchers of the breadth of databases available, as well as advertising the types of training they can offer the researchers' undergraduate and graduate students? One researcher did mention the desire to begin doing more systematic reviews and meta-analyses of literature. It would be useful to note that Google Scholar is not an appropriate resource for systematic reviews due to its personalized and undocumented search algorithms.

Scholarly Communication

The process of scholarly communication appeared frequently in the interviews. Most people are frustrated by the process: the length of time from submission to publication, the peer review process, and perceived inconsistencies. Though many problems are perceived, there do not appear to be clear solutions for improving the entrenched process.

Some felt that the peer review process was flawed in a variety of ways. Quotes included:

> "That's not to say that we don't have high standards for publications, but it's inconsistent."

> "Oh, and the publications wouldn't take months and months to get feedback on, so ideally you could be paid to review articles, and so it would be prioritized in the whole scheme of things, and the articles would come out in real time. I know that some of them are publishing on Research Gate, and some of the alternative online options, PLOSone. That's where, as a field, coming to terms with it's seen as credible as a peer review process, as the old process, certainly if you're doing real time science, it's much more valuable to have…"

> "I've always faced this before, but anyone who's ever written a paper thinks that all reviewers are idiots, and somehow you have to screen the fools from the reviewers, that would be a good start. People that ask you a whole bunch of questions that are right there if they'd actually read the paper. "See paragraph dadadada…" I find many responses like that that go back. I don't know, I think quite frankly, it's a good process overall, the peer review process produces a better product. It could be somewhat frustrating, some of the reviewers need to learn a little more professionalism, I think. Sometimes you get stuff back, and it's like, just poorly worded, insulting, the anonymity of the web kind of snarkiness somehow seems to have worked its way in."

> "To me, one of the biggest challenges that I am doing with my research is, because it's a qualitative type of research, are lots of reviewers coming back and one of the standard answers is saying this cannot be generalized. I want to think of a way to, when I'm doing the small scale type of research - I always call it small scale type – how could we spin that up without putting too many people. The coding systems, that was just tedious, and that's why qualitative types of research could only be done in a very field participating in any way. If that could be solved, I think that's one of the biggest challenges right now for the research. How could we show that the research result could be generalized to the different place or different setting."

These quotes illustrate a variety of concerns. One example included inconsistency in the peer review process. Despite generally valuing high standards for publication, the researcher was concerned that, due to time constraints, these standards were not applied evenly by publishers, editors, and over-burdened reviewers. Others were concerned about the length of time it took from submission…through review…to final publication. This time frame seemed inconsistent with the reality of how quickly advances in science happen, and was impeding the advancement of new ideas. Still others felt that peer reviewers did not understand and could not properly address their research. This could be due to the highly specialized nature of research, the growing multidisciplinary nature of research, or even a disconnect between appreciation for quantitative and qualitative research. All

researchers shared frustration with these flaws, but no one was exactly sure how to address these problems.

Keeping Current

Conference attendance was the most common way the researchers keep abreast of new trends in their fields. Several respondents named participation in a professional organization or on a journal editorial board as their major method for keeping current. Fewer named the use of technologies such as Twitter, other social media, RSS feeds or other types of automated content delivery to stay informed. Similar to the answers for literature searching, several researchers stated they also rely on their graduate students to alert them of new developments or the scuttlebutt from listservs or blogs. Several interviewees admitted they are not certain they do keep up.

Challenges and Opportunities

Many of the researchers' stated challenges were already mentioned, but a number of general themes emerged. Researchers referenced the need for more time and money as a given challenge, commenting:

> "I would stop time with it [in regard to the magic wand question], so that I could get more done, so that I could get more of my own stuff done, rather than spending a bunch of time working on projects that I'm more tangentially involved with."

> "And time is a factor, because you're balancing your teaching load and your research load, but they're mutually reinforcing, so I don't want to give up either one of those. I think I would be a happy camper if I could have unlimited support, and financing to design the project that I wanted to, and do it real time and have enough graduate students to do it."

Time is obviously a finite resource, yet researchers are continuously being asked to do more with less. Many of these additional activities may be related to research, but still detract from time spent in the lab or field. These activities include applying for highly competitive grants and knowing that only a fraction of the applications will be successful; teaching and mentoring students; getting papers published through the current peer-review system; learning new software skills; and finding and developing new collaborations as research becomes multidisciplinary. Technology support was also seen as lacking. This included the lack of desktop support, training in statistical or analyzing software, and the uncertainty of what shared general resources were on campus. This could impact the Libraries, as they could be a source of training for faculty and students on some software such as EndNote or NVivo, a clearinghouse of shared resources on campus, or a researcher to investigate specific software for best purposes (e.g., types of data mining software).

Money was also a common concern, as grant funding continues to grow increasingly competitive.

> "I would say the biggest issue is always money. It's always funding to support the work that you do, and in that regard there's no difference between my life as a business man and entrepreneur, and my life as a faculty member. It's always about the funds to support your work."

Despite that, many were satisfied, or even optimistic about money:

> "I've raised $17 million dollars to do what I do."

> "If I had more money, I'm not sure I could do it any better, because there's a lot of these projects that are conceptual in nature in that you have to try different things, and if you've got too many resources at one time, you may not do as well as if you go a little bit slower. "

> "I have never felt that money was a barrier. We've always had a good flow of money from outside sources to do what we were doing, which I think – I've been encouraged by that. I've found that internally, the issues of how we spend money and so forth, sometimes becomes a barrier. "

> "Fortunately, we've gotten a few – we just recently got a big grant from the National Science Foundation to improve the entomological collection here, and that has a lot of money for personnel and travel to conferences for the next three years, so we'll be good."

The interviewees were similarly optimistic when describing other challenges, which they concurrently viewed as opportunities. Some talked about the enormous opportunities related to the amount of data being generated by agricultural research.

> "It's so easy to generate this digital data, but if you're not careful how you name things and how you document stuff and making sense of it later, particularly for someone else, is going to be a real challenge. On the other hand, the opportunities are there to do some really interesting and neat and novel things with all this data, and we're going to have to figure out how to do it."

> "Certainly the amount of data is going to be a challenge, no matter whether you're an animal scientist or an agronomist, or an ag economist. There's about to be volumes of data that can help us improve decision making, improve crop production practices, improve animal production practices, and it's going to take somebody or some people with a sophisticated skill set to really analyze that data. I see mounds of – and it already exists, right?"

> "As it relates to big data, the opportunities are unlimited, and somebody someday is going to get very rich creating a very simple user interface that uses all that data for farming. It's not there yet, I think some people think to have it, but clearly it hasn't had the uptake they

> thought it would, but someday somebody is going to figure it out, and then they're going to make a lot of money."

However, the lack of interoperability of disparate computer models and their respective data sets, and the lack of understanding of the expertise and amount of work required to easily share data sets, is a source of frustration.

> "I think one of the real challenges we've had, and this is seeking research support, so it's in the research domain, but it's in the past year or so, we've been working with modelers – big modeling groups, who have finally realized that to model their…what this group is doing it taking a suite of models for various crops, like for corn or soybeans or wheat, there's multiple models, but they don't get the same output. So there's both the FAO, the UN, Gates Foundation, want these things reconciled, they want these models…you know, if it's a wheat model, you give it the data, it should give you the yields or whatever. And so we're, so this group, for a long time has not valued the data much. They come at it from a modeling perspective, and they think data is free and data ought to be freely available, but without realizing to achieve this goal of reconciling all these models, that they need access to data, and I think that one of the more difficult things we've had in the last year or two is conversations around data, and how valuable data is as an asset, an institutional asset, and to try to convey to them the cost of doing these studies, for even getting the data we have organized and provided to them. Again, they continue to want to strive to, well, from their perspective, they were talking to a fairly significant group of us, and they thought a half-time post doc, from their perspective, would be enough to get all of this data combined, reconciled, set up into sheets, that they then could feed into their models, and they clearly – there's a huge disconnect between the challenges associated with data, reconciling data, organizing data, annotating it, adding the metadata, so it can all be repurposed, and from the data generator side versus the data users, and I suspect this is extends to economists, extends to the modeling community, that they're very difficult conversations, because I think that they're realizing to really achieve their goal they need to invest more resources into data related issues, so that's been – part of it's the personalities involved, part of it is that there's money on the line, and to do what we think is necessary, they've got to release far more money than they're willing to release at the moment. Instead they just want everybody to go through their data archives free of charge, and re-annotate everything to their standards, their data standards.

Other common challenges/opportunities were specific to agriculture, such as the need to feed 9 billion people by 2050 and to provide clean and water to a growing population. These are the grand challenges they face, along with their colleagues at other land grant universities and affiliated organizations.

> "Or as someone said yesterday, the 'Ag enterprise,' because it's more than just industry. So that's one of the challenges, because we have this

> huge challenge ahead of us that we need to be able to feed at least 9 thousand billion people by 2050, and we don't have – land use is not as prevalent as it used to be, and so how are we going to grow more food, or is it necessary to grow more food? The forecast is that, at looking at where we were yesterday, we're going to have to have more land to grow more food in order to feed a population of over 9 billion people."
>
> "I don't know that we're that different from other land grant disciplines or other groups that are working on some of these grand challenges."
>
> "If you look at the top ten problems that humanity faces, as published by the UN and several other groups out there, eight of those are essentially related in many ways to at least agriculture and natural resources. Name one that isn't – food, water, all of the basic foundational level needs of human society are tied to agriculture, so we have to produce more with less in the continual fight to improve our production and performance metrics. Agriculture has a golden future, and one of the things – the other exciting things now, certainly for the cadre of students that are coming through academically right now – is if you historically look, technologies are typically, at least throughout the 20th Century introduced into the aerospace industry, moved into the automotive and truck industry, and then show up in agriculture, and so right now, we are on the cusp of the biggest change in agriculture in history as electronics and sensors and control applications and techniques come in and create precision and software controls so many of our processes. This is an exciting time to be in agriculture."

The close ties between society's grand challenges and agricultural disciplines highlights opportunities and challenges for Libraries. On one hand, there will be the need for more education and increased awareness of information resources to support these disciplines. On the other, the global nature of the challenges highlights hurdles the Libraries will face, such as providing more open access to scholarly materials for researchers at this university and also to non-affiliated partners around the globe.

Conclusions

These interviews capture a snapshot of some of the practices of researchers within a highly diverse College of Agriculture. Researchers described an environment that was growing ever more complex and inter- or multi-disciplinary. This put a strain on researchers to learn new skills or build collaborative networks, both within the university and more broadly nationally or internationally. Most researchers implicitly or explicitly acknowledged that there was great pressure on agriculture and the related disciplines to actively find solutions to feeding 9 billing people by 2050. This idea echoed through their work as researchers and for many, also as teachers.

Many concerns were not unexpected. These included the frustration with the lengthy and imperfect peer review process for article publication, and the need for more time, money, and human resources. Students, particularly graduate students, are an integral part of the researchers' landscape. This can be positive, as they assist in conducting research, but it

can also be a drain on time and energy as students may require significant amounts of supervision, mentoring and training on basic skills such as writing literature reviews. Some of the researchers enjoy teaching and see it as a positive compliment to their research.

More research is needed to refine these concerns to be better able to address them appropriately. For more generalizable, and actionable findings, this survey could be re-used to focus on one department (e.g., Agricultural Economics) or one specific area of study (e.g., plant genomics and phenotyping).

Appendices

1. Recruiting Email
2. Interview Script
3. Relevant Demographic Information

Appendix 1

Email Recruitment Text

Subject: Invitation to Participate in Study on Research Support for Agriculture Scholars

Dear [First Name]:

Purdue University Libraries are conducting a study on the research support services needs of agriculture scholars at Purdue. As a member of the agriculture community at Purdue your participation is essential for developing insight into and improving the research support services we provide for you and your peers.

Your participation would entail a 60 minute interview that explores your research process and identifies your ongoing research support service needs. Your responses will be anonymized. We also would like to take photos to document your research space, however, you would not be included in the photos to ensure your anonymity.

This project is part of a larger suite of similar studies being concurrently conducted at fifteen agriculture libraries in US higher education institutions in conjunction with Ithaka S+R, a not-for-profit research and consulting service that helps academic, cultural, and publishing communities. The information gathered in this study will not only be used to improve the research support services at [name of our institution] but also towards writing a larger report from the aggregated results that will be written and publically disseminated by Ithaka S+R. This report will provide invaluable insight into the research support services needs of the agriculture community more broadly.

If you have any questions about the study, please don't hesitate to contact Marianne Stowell Bracke at mbracke@purdue.edu or Jane Yatcilla at janeyat@purdue.edu.

Sincerely,

Marianne Stowell Bracke, Associate Professor of Library Science and Agricultural Sciences Information Specialist

Jane Yatcilla, Associate Professor of Library Science and Health and Life Sciences Information Specialist

Appendix 2

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?