Agricultural Librarians Becoming Informationists: A Paradigm Shift

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Abstract

Librarian liaisons to the agricultural sciences offer many traditional services, such as teaching classes, purchasing materials, managing collections, and providing guidance on scholarly communication issues. Data management and data literacy instruction are two emerging service opportunities for agricultural librarians to develop new roles and work with researchers to set standards and meet data management needs within the disciplinary context. Taking advantage of these opportunities will require new skills, shifts in attitudes, and increased interaction with the students and faculty to understand their needs and provide timely and appropriate services. This paper proposes creating new strategies, expectations, and opportunities for agricultural librarianship by constructing a new model based on the *informationist*. The informationist, developed in medical librarianship, offers a model for creating highly engaged liaison services. Within a medical context the informationist is an extension of the traditional model of librarian engagement in which an information professional is embedded within clinical and research settings. Librarians can have an impact outside of the traditional library contexts by developing new skills and strategies for librarians working in the agricultural sciences. The informationist model also provides the opportunity to act as a direct collaborator in the creation of new methodologies in the field, such as systematic reviews.

Introduction

There are extensive discussions of new roles and emerging models for providers of expert information services in research libraries. Changing models must anticipate short-term, rapid changes and also perceive long-

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term trends that will define libraries' and librarians' abilities to continue providing meaningful contributions into the future. Where does agricultural librarianship fall within these discussions? Agricultural librarians share many of these challenges with all academic librarians; however, there are unique aspects of the agricultural domain that offer additional opportunities to meet these challenges. These include close ties with land-grant universities and these institutions' specific mission to serve researchers and the general public, as well as a long tradition of collaboration within the national and international agricultural librarian community. New roles and emerging models may be perceived as threats or burdens, as overextending librarians' current job duties or requiring new skills to be acquired; they can also be viewed as an opportunity to remain relevant in the changing landscape and to develop dynamic new partnerships as extensions of traditional roles. The profession of agricultural librarianship can proactively redefine itself by exploiting these changes and opportunities while actively scanning the landscape to identify new chances to apply the expertise of librarians and resources of libraries.

As higher education continues to evolve and digital resources increase the perceptions of self-sufficiency in searching and locating data, librarians must recognize that traditional constituencies do not often realize that libraries and librarians are working diligently to continue to serve users' information needs. Abbott (1998) and French (1990) show that the discussion of what librarians can, should, or could be doing is not a new topic, clarifying that when it comes to knowing the future, the only constant and safely predictable aspect is change. These articles by Abbott and French both appeared before the advent of Google Scholar and the vast array of online tools, but they still describe the tension between too much information and just the right information for researchers. That tension continues today in the online deluge of information, but curiously users do not understand that librarians can still be resources of expert information services to assist in this new environment.

Agricultural disciplines include a wide range of areas of study, including those that are most traditionally associated with farming, such as crop and animal sciences, but also including the social sciences in agricultural education, economics, and agribusiness, and applied sciences like engineering. Agriculture also encompasses a number of affiliated and life science disciplines, especially those residing in a land-grant university. Garfield (1975, p. 138) captures the complicated nature as "agriculture describes only the mission rather than the approach to the problem." In this paper, *agricultural sciences* will generally refer to the array of disciplines found in land-grant universities, including those closely affiliated to the life sciences. However, many of the basic concepts outlined could be applied to liaisons to any life, basic, field, and applied sciences in any academic setting.

There are existing, successful models to help agricultural librarians define new opportunities. The health sciences library literature discusses a new role called an *informationist*. This body of research describes the possible responsibilities, challenges, and successes with implementation—how to create acceptance into libraries' administrative structure and the training needed—which could structure a conversation for agricultural librarians as they navigate the future. The title is problematic, because it is not self-evident as to what an informationist actually is or does—in fact, even a search through the literature reveals not just one definition but many similar ones and offers numerous variations on what the position could be called. The specific title, *informationist*, could be adopted or not; what is most relevant is the description of the role and how agricultural librarians are uniquely suited to adopt these characteristics. This paper will synthesize its most widely shared aspects and highlight the points useful to moving forward.

Literature Review

As mentioned above, the understanding of *agriculture* as a collected set of disciplines is defined generally for this research as those agricultural disciplines affiliated with land-grant universities. However, it should be noted that many of the tenets of this paper could apply more broadly, as agricultural disciplines in practice appear in many types of institutions and are often closely linked with many of the life sciences (French, 1990). To understand the unique aspects of agricultural librarianship it is necessary to examine the history of the land-grant university. The Morrill Acts of 1862 and 1890 facilitated each state's creating a land-grant institution to enable the teaching of the agricultural and mechanical arts. In practical terms, this fostered the ability of average citizens to gain access to a practical college education, formerly the domain of the wealthy and elite. Later, the Hatch Act of 1887 allowed for the creation of agricultural experiment stations for agricultural research, and was followed by the Smith-Lever Act of 1914 to create a system of cooperative extension service as a means to disperse the results of the experiment stations to farmers, policymakers, and others in the general public, such as 4-H (a national youth development and mentoring program) and Future Farmers of America students (Hurt, 2002, pp. 192–193, 256). Land-grant universities developed very specific ideals and goals to connect researchers and the general public. This mission is reflected by agricultural librarians and presents distinctive challenges, opportunities, and expectations that may not exist in the roles of other subject liaisons. To be able to serve all possible communities, it is necessary to understand how different users find and use a wide variety of types of information. The broad array of disciplines; academic users with teaching, research, and extension information needs; external users with

very different information-seeking behavior; and the rise of new specialties all create a unique environment for agricultural librarians, perceived as both overwhelming challenges and potential opportunities (Simonsen, 2015).

Similarly, there are numerous examples of research exploring new roles for academic librarians in the face of a changing higher education environment, especially suggesting that they become more proactive and adopt new services and service models (Auckland, 2012; Koltay, 2016). For many years the *subject librarian*, usually a reference librarian or bibliographer, was a common model of service in academic libraries (Crawford, 2012, p. 4); then the literature shows a gradual shift to using the term *liaison librarian*, indicating a more proactive role with new responsibilities (Corrall, 2015). The liaison roles usually follow a tripartite definition of collection development, reference, and library instruction, although Jaguszewski and Williams (2013) propose that this role has even more opportunities to become outwardly facing. They write that "liaisons are playing two new roles, that of advocate and of consultant, both with an emphasis on campus engagement. As advocates, they have become a research library's 'sales force,' speaking on a wide range of topics and trends in higher education, influencing and persuading campus stakeholders on important issues, and serving as ambassadors of change" (p. 16).

Changing roles in academic librarianship extend beyond the liaison librarian. Cox and Corrall (2013) survey the literature of new academic specialties using Abbott's (1988) "system of professions" as a research framework. They explore the roles of systems librarian, electronic resource librarian, digital librarian, institutional repository librarian, clinical librarian and informationist, digital curator/research data manager, teaching librarian/information literacy educator, and information and knowledge manager. This list shows both new functional specialties that require a completely different position and specialties that are extensions of current liaison roles.

Using a summary of the most common characteristics described in the literature, an *informationist* is a professional with information expertise and experience with a specific academic discipline, providing in-depth services within the work context of that discipline rather than a library. These professionals are often embedded in a lab or research group; they may have a mix of experience working with a discipline in a library setting or more academic training in a discipline, with research showing value for both and collaboration among these professionals with different characteristics as crucial. Davidoff and Florance (2000), two clinicians, first suggested the term *informationist* to describe a new profession to serve the health sciences, although as Black (2011) has shown, many of the characteristics of the informationist can be found in the first corporate librarians and documentalists at the start of the twentieth century. Cronin, Stiffler, and

Day (1993) similarly demonstrated the long existence, even by that date, of information work beyond the "heartland" of traditional library and information science. As practitioners, they recognized that despite tools like Medline, physicians were not routinely searching and applying the literature to full effect due to the fact that it was still too time-consuming to find the right material among too few or too many articles. Additionally, learning to be an effective and efficient searcher took time and was not generally taught in graduate school to the degree needed. Finally, practitioners struggled with time for the synthesis of information. They acknowledged that this was a lost opportunity to provide the best in client care and that the newest biomedical information was not necessarily being utilized, which represented an enormous waste of time, effort, and research dollars. Thus practitioners proposed a new position—the informationist—to bridge the gap. This position would have three primary attributes:

- An understanding of both information science principles and the academic discipline
- Strong searching and information synthesis skills
- Being embedded within a clinical setting or inclusion as part of research team

This was not a radical proposal for health sciences librarians, because Gertrude Lamb had introduced the practice of clinical librarianship in the early 1970s in which librarians worked externally with clinicians and patients (Oliver & Roderer, 2006). Health science librarians began to debate whether this was an entirely new role, an extension of current aspects of clinical librarianship, or simply a different title for what librarians were already doing. Significantly, two of the most important bodies to health sciences librarianship, the Medical Library Association (MLA) and National Library of Medicine (NLM), saw enough value to support further exploration of this proposed position. Thus began a series of task forces and conferences sponsored by both organizations to define the position and needed competencies, develop training for practicing librarians and those new to the profession, consider funding sources, and propose administrative structures to support and maintain these positions (Shipman, Cunningham, & Holst, 2002). In 2004 MLA developed an Information Specialist in Context Task Force. Although introducing yet another variation on the title of informationist, this task force issued a thorough report in 2006 on the *Information Specialist in Context* (*ISIC*) (Giuse, Sathe, & Jerome, 2006). This report highlighted the importance of disciplinary context to the position; in other words, the specific disciplinary knowledge or experience with the discipline, when added to information skills, created an area of expertise that filled a void between clinicians/practitioners and general health science librarians. Furthermore, the report emphasized the renewed and amplified focus on evidence-based medicine and

broadened the definition of *informationist* to apply the principles to any evidence-intensive domain. Federer (2014) expands her previous research on clinical applications of the informationist to be more widely applied as a *research informationist*. Her work focuses especially on opportunities in data services, and stresses the abilities of those experienced in working with disciplines as equally valuable as those with advanced degrees in disciplines. This shows the potential to extend the principles to nonmedical disciplines and the importance of liaison librarian models, as mentioned previously.

As proposed by Davidoff and Florance (2000), the balance between *information science* and *disciplinary knowledge* is left undefined and could be weighted in many ways. Oliver and Roderer (2006) proposed making a distinction between those with more emphasis on information skills and those with a stronger disciplinary background. The *informationist* would be highly skilled in searching, teaching, and supporting a research group, whereas an *informaticist* would have a stronger disciplinary background and be skilled in critically evaluating and synthesizing information, as well as providing data extraction and manipulation skills. Collaboration between these two roles would be important, because it would be unlikely that all of these skills would reside in one individual. This divergence is seen in the two most successful and mature informationist models: one is a model embedded in a clinical setting, often as a natural progression from traditional library services, where information and technical skills are a valued resource in the team setting; the second model relies more heavily upon disciplinary education, such as bioinformatics, and may be filled by a former researcher or clinician (Grefsheim et al., 2010).

The bridge position of informationist can help libraries and information skills maintain relevancy in the future. Studies of science researchers' information-seeking behavior routinely showed that they felt increasingly self-sufficient due to the wide availability of online resources; they also showed that while they felt positively toward libraries, they were unaware of many information services, thus clearly not taking advantage of them (Haines, Light, O'Malley, & Delwiche, 2010; J. D. Williams & Rambo, 2015). This does not necessarily mean that these services are not needed, but rather that they are not well-known. For example, when research by Haines et al. (2010) asked what services libraries could provide, researchers suggested services very similar to the liaison librarian approach already in existence. Williams and Rambo (2015) further described an approach to identify potential collaborators for informationists, with a particular interest in providing data services to the clientele. Identifying collaborators will be a key aspect in establishing the informationist model in agricultural or other scientific disciplines.

The literature also has case studies of successful informationists, either as individuals or small groups (Aldrich & Schulte, 2014; Cataldo, Tennant,

& Sherwill-Navarro, 2006; Zabel, Thomas, Bird, & Moniz, 2012). These case studies confirm both the challenges and rewards of the informationist position. On the one hand, this idea has only been adopted on a small scale for several reasons, including

- the novelty and ongoing development of the position for the library structure to incorporate;
- the time-intensity of the responsibilities;
- the unrecognized resource potential by researchers and the need to first identify collaborators; and
- the need for new communication, technical, and disciplinary skills for informationists.

On the other hand, the positive results show

- informationists filling unmet, critical needs;
- raising the profile of libraries and the benefits of quality information skills; and
- demonstrating a growth area for librarians to stay relevant.

For example, studies show that clinical groups working with informationists change their behaviors over time to include valuing informationists' disciplinary and information skills more, as well as being more likely to seek external information and viewing it positively (Grefsheim et al., 2010). Additionally, other studies suggest that informationists could focus on very specific tasks, such as graduate-student information literacy instruction in which students were exposed over several semesters to in-depth searching instruction, personal consultations, information synthesis, and the presentation of relevant literature (Tmanova, Ancker, & Johnson, 2015). Another example is working with researchers on data management plans (DMPs) and other "upstream" research needs throughout the life cycle of a research project, from seeking funding to final publication (Federer, 2013).

Although the informationist role may appear to simply be an extension of liaison librarian responsibilities, it also represents an opportunity to claim new jurisdictions for professional work for agricultural librarians by recontextualizing their expertise in deeper partnerships with agricultural disciplines. Abbott's (1988) "system of professions" systematically explores the challenges that all professions face as they develop across time, and provides structure for thinking about how professions can stay relevant in the face of change. His 1998 article "Professionalism and the Future of Librarianship" highlights concerns about librarianship specifically as a profession that must struggle with identity. Abbott points out that all professions must recognize that their work will change over time. Changes can be understood along three dimensions: larger social and cultural forces; competing expertise or turf battles; and the presence of expertise in both

things and organizations. These three dimensions can be seen in librarianship today.

Social and cultural forces include rapidly and ever-changing technology, including the internet, social media and tools like Google, and the increase in libraries' paid content being available online. These last two in particular increase users' self-sufficiency, and online content may not be adequately branded as being provided for by library budgets, thus concealing from users its importance to the scholarly process. Competing expertise may come from other campus departments or disciplines, such as information technology (IT), computer science, and disciplinary experts. This is especially true as libraries stake out roles in new areas like data services, where many competitors with different backgrounds and experience are looking to carve out areas of expertise. Finally, Abbott promotes the idea that expertise can reside in both things and organizations. This is an especially rich concept for libraries and librarians to explore. Libraries have traditionally been the holder of cultural heritage and academic knowledge—a concept easy for those outside of libraries to comprehend. Now, clearly, libraries are experiencing social and cultural changes that challenge traditional roles and consequently are losing their identity to users (Gibbons, 2013). However, this does not necessarily mean that libraries are of less value and expertise, but simply that outside forces are weakening the perception. Libraries and librarians must act in new ways to reinforce the expertise that they continue to possess. As Abbott (1998) writes:

> Rather it is to think about the likely evolution of librarian's work and to ask what the consequences of that evolution might be for the occupation. Note, too, that to ask about the future of librarianship in general is by no means to ask about one's own future in particular. The fate of occupations varies so much in social time and space that individual members can have vastly different experiences, even if separated by only a few years or a few miles or a small difference in credentials. (p. 432)

His work helps to conceptualize the challenges that all librarians are facing by identifying concrete, contextualized issues specific to a situation, and it underscores the usefulness of a model like the informationist when crafting the specifics of a new professional future. Abbott points out that there will always be new work to be done, and various professions competing to do the work. His argument shows that librarians can stake claims in the evolving landscape as information experts. This creates not just an immediate role, but a long-term strategy to utilize information skills for the future. This is relevant to agricultural librarians specifically, because as a relatively small group, it has a strong history of networking and collaborating. The expertise resident across the profession could be exploited in an informationist model in which so many skills could be utilized and thus spread across the field and shared as needed.

The Informationist as a New Paradigm for Agricultural Librarians

Table 1 shows a detailed list of characteristics that would be needed to be an informationist. This list was first proposed by Giuse, Sathe, and Jerome (2006), and then modified by Rankin, Grefsheim, and Canto (2008). This paper proposes additional characteristics that are already strengths of many agricultural librarians and the key to proposing this shift for them. The list of characteristics is long and could be discouraging; however, it should be noted that many of the qualities, particularly under the "personal" category, are those already characteristic of librarianship. Additionally, one of the core tenets of informationists is that they are highly cooperative, whether part of a local team or lab or as part of an external collaboration. These skills can be spread over a number of individuals—a situation that already exists in the field of agricultural librarianship. For example, AgNIC, a cooperative of agricultural libraries, agricultural organizations both national and international, and the National Agriculture Library (NAL), is over twenty years old. It was a grassroots effort begun by four land-grant institutions and NAL to bring together individual areas of subject expertise to create an organized portal of web resources. It has grown to almost sixty partners and continues to evolve as needs and contexts change. This would be an opportunity to utilize these diverse skills in a new way and take advantage of the knowledge resident in an organization, as described by Abbott (1998) as a way for professions to navigate change successfully.

Personal

Personal characteristics include communication, professionalism, lifelong learning, quality assurance, proactivity, leadership, customer service, entrepreneurism, and the ability to function as member of a team. Many of these personal characteristics, such as communication, professionalism, and lifelong learning, are important aspects of being a successful liaison librarian (Jaguszewski & Williams, 2013). The addition of entrepreneurship is a significant step beyond just being proactive. Users have become increasingly self-sufficient (although the *effectiveness* of this self-sufficiency is in question), so they may not be using libraries' physical spaces and are thus not aware of the suite of services, even virtual ones, that libraries offer. The 2007 Kauffman Foundation report *Entrepreneurship in American Higher Education* studied the need for entrepreneurship in higher education, stating that "entrepreneurship is the transformation of an innovation into a sustainable enterprise that generates value" (p. 5). Although often associated with business, the report suggested that entrepreneurship is the introduction of any novel idea or service accepted by users, and it is a critical quality in keeping higher education relevant and effective. Entrepreneurship for informationists represents the ability to seek out and

Table 1. Characteristics of the agricultural informationist*

Personal	*Functional*	*Knowledge*
Communication, professionalism, lifelong learning, quality assurance, proactivity, leadership, customer service, entrepreneurism, and *function as member of a team*	Locating information, critical appraisal, information synthesis, information management and organization, project management, knowledge management, research, applied informatics, current awareness, *and information literacy instruction*	Domain, information environment, research design and analysis, technology, organizational, related disciplines, and *data and open access policies and government regulations*

*Modified by Bracke (*italics*) from Giuse et al. (2006) (plain text) and Rankin et al. (2008) (underlined).

creatively meet needs by using the strengths and experiences of the information professional; it is strongly rooted in an engaged liaison model and can provide more effective, efficient, and timely services to users (Chung, 2010; Smith, Brandenburg, Conte, & Song, 2014). Additionally, researchers who have worked successfully with informationists describe this type of initiative of approaching researchers as a crucial trait. The informationist must be willing, confident, and creative to bring these services to the attention of the researchers who may not be aware of services, but who can be convinced by the results (Grefsheim et al., 2010). The gradual shift to a liaison model as a more proactive role for agricultural librarians is not new, especially given the strong outreach mission affiliated with land-grant institutions (McKimmie, 2002). Entrepreneurship can take many forms of service, such as highly targeted information literacy, participation in a lab or group, or in-depth information searching and synthesis. Another area is data services, and libraries have a window of opportunity as nascent data services are defined and expanded. This requires an entrepreneurial approach to identify the appropriate services, because informationists must anticipate needs rather than simply reacting or waiting to be contacted by researchers. One way is to use classic approaches, such as bibliographic studies, to locate potential data collaborators through analyzing their current research (S. C. Williams, 2013).

In addition, agricultural informationists will need to be able to work collaboratively with other librarians at their institution and from other organizations to serve disciplinary teams, researchers, and graduate students and also external entities like the United States Department of Agriculture (USDA) and NAL. Participating as a team member blends with skills from the "functional" category in table 1. Examples include understanding the research cycle—from setting research agendas, to submitting grant proposals, to producing scholarly publications—and having education or experience with the discipline. These are all examples of the valuable assets

for an informationist to bring to the table as a team member (Garritano & Carlson, 2009).

There are two recent examples of collaborations across institutions to meet the needs of agricultural researchers. The first originates from Cornell University and includes participants from around the country. This project is creating a series of video tutorials for cooperative extension agents to address common information needs, from developing a search strategy, to effective searching, to ways to synthesize and present this research. These videos are tailored to the specific needs of extension specialists. The second example, begun at Purdue University, is working with the directors of agricultural experiment stations in the North Central Region to present a series of resources to help directors with their unique administrative lens to understand the ever-changing research data management landscape as it will impact the experiment stations and their researchers. All twelve of the North Central Region's universities have volunteered agricultural and data librarians to this effort. Both of these projects show a high degree of entrepreneurship in reaching out to provide novel resources, collaboration across institutions, and an effort to take full advantage of the expertise that exists in diverse individuals and institutions to the advantage of the greater community.

Functional

Functional characteristics include locating information, critical appraisal, information synthesis, information management and organization, project management, knowledge management, research, applied informatics, current awareness, and information literacy instruction. As with the "personal" category, the list of characteristics in the "functional" category is long, and again many of the qualities, such as locating and evaluating information and education, are general skills of an academic librarian. This research will focus on three of the characteristics: information literacy, an understanding of the research process, and applied informatics (having applicable domain and computation skills). Additionally, the functional characteristics overlap with those of the "discipline" category, because functional skills exist to be applied within a disciplinary context. Certain areas, such as research data management (RDM), provide an opportunity to combine all three of these characteristics. RDM is an emerging area within both general and disciplinary contexts and it provides a window of opportunity for library and information professionals to help establish best practices. For example, many fields, with the exception of a few (such as genomics), do not have standards in place for curating or sharing their data for reuse (Borgman, 2012).

Information literacy and data information literacy, whether taught as embedded in classes, one on one, or through a variety of other methods, are other areas where agricultural informationists are needed. Kuruppu

and Gruber (2006) reported conflicting attitudes and needs from faculty and graduate students in the agricultural and life sciences. Faculties reported feeling successful with their searching abilities, but admitted that these searches were often not systematic and frequently time-consuming. Graduate students remarked that they felt uncomfortable asking for help, working under the presumption that they should already possess information skills. Additionally, they turned to their peers for help, yet were frustrated by this disorganized and nonsystematic approach that led to inefficiencies in information seeking. Other faculty and graduate students were completely unaware of any related services that librarians might offer. Recognizing these barriers, informationists can step in to provide tailored instruction that overcomes discomfort in asking for help, and highlight that spending even a small amount of time learning information skills can create efficient and highly effective searching. Additionally, they must actively promote what instruction they can provide.

Finally, another area of users unique to agriculture is the cooperative extension service. Extension agents must find, evaluate, and synthesize information from a variety of sources to communicate with the general public. One can see parallels in job functions between extension agents and librarians—both are intermediaries in information exchange. Leveraging these similarities in function as well as disciplinary context, librarians could form deep and meaningful partnerships with this group to connect them with new and emerging ITs, tools, and information seeking behaviors. Research shows that agents are willing learners that recognize that they must constantly refresh their information seeking behavior (Bailey, Hill, & Arnold, 2014). Other research supports this willingness to learn, yet notes that extension agents may lack awareness of library services (Brazzeal, 2007; McKimmie, 2002; Perry, 2002). Other challenges include time, lack of resources to travel to training, and the need for specific, highly localized information for their particular geographic region (Bailey et al., 2014). This is an opportunity for informationists to make extension agents aware of services and work closely with agents on campus to utilize local expertise in teaching the appropriate information skills. Furthermore, informationists could work with local agents to create resources for agents located around the state to deliver information literacy instruction through online videos or tutorials.

The second two characteristics—understanding the research process, and having applied informatics skills applicable to the domain of agriculture—are closely related. First, it is useful to understand the research process in general from the researcher's perspective. This can include generating research questions, research design, writing grants and managing funding, literature reviews, data gathering and management, and publication. Having a working knowledge of this iterative process can help identify where information services are useful or could be suggested if

they do not already exist. This offers opportunities for information professionals to be part of the research process throughout. More specifically, understanding how this process plays out for agricultural researchers is crucial to being an agricultural informationist. For instance, it is very important to understand how USDA and other major funders of agricultural research will require researchers to share publications and data, as well as how these funders anticipate supporting these requirements through funding and infrastructure.

Informatics, as a form of supporting the research process, is an especially rich area for informationist opportunities. Some areas of agriculture are focusing on data-driven agriculture, an emerging field of practice not unlike evidence-based medicine (Virgona & Daniel, 2011). In fall 2013 a meeting titled "Smarter Agriculture" brought together agricultural researchers, educators, administrators, policymakers, and librarians to discuss strategies for aligning agricultural research to be more like the medicine model. Keynote speaker Kay Dickersin of Johns Hopkins University described how the field of medicine developed the Cochrane Collaboration in the early 1990s as a way for medical researchers to do systematic reviews of controlled clinical-trial data; this allowed for relevant research to be collected and dispersed more rapidly and efficiently (Fisher, 2014). The parallels to agricultural data are striking. Research publications and datasets are being produced at an ever-increasing rate, expensively, yet medical practitioners are struggling to find and make sense of the relevant information for their patients, just as agricultural researchers are working to share findings within the research community and with agricultural practitioners. As Brouder and Gomez-Macpherson (2014) show, there are few written guidelines on conducting literature searches for systematic reviews in many areas of agriculture. They also highlight that while journals are open to publishing systematic reviews and meta-analyses, these journals do not offer specific guidance on how to structure or report this research. Finally, Brouder and Gomez-Macpherson note that there are rarely minimum requirements for data reporting, and when they do exist, publications do not systematically adhere to reporting them. This makes meta-analyses almost impossible, because even very basic scientific data, such as scientific units of measurements, are not present in publications and thus cannot be reasonably compared to others. Agricultural informationists could bridge this gap in several ways. First, there is a need for guidelines on conducting and documenting thorough literature reviews for meta-analyses and systematic reviews for specific agricultural disciplines. These should be published or made accessible in venues outside of traditional library literature so that domain researchers are more likely to discover them. Another approach would be for informationists to work with teams of researchers doing this type of research to perform the highly structured review of literature for them. Finally, for those with

more informatics expertise, there is an opportunity to assist researchers with different data applications, such as programming, visualization, and data manipulation.

Knowledge

Knowledge characteristics include the domain, information environment, research design and analysis, technology, organizational and related disciplines, and data and open access policies and government regulations. Building on the first two categories, the "knowledge" category is what would set agricultural informationists apart from other informationists. The understanding of agricultural disciplines, the practices of its researchers, and the structures of information are unique. This expertise could provide the grounding that researchers need to not only enhance their research and practices but also propel the research forward faster and more efficiently. This category is a rich source for exploring informationist opportunities; it supports domain knowledge and experience, as well as specific subfields of expertise like RDM. Domain knowledge in the agricultural and life sciences cannot be quantified in a single description but present a range of possibilities. As shown above regarding health sciences literature, there are successful examples of informationists with different backgrounds, training, and experience—all of which are also present in agricultural sciences librarians: for instance, Federer's (2014) discussion of the value of experience working with the information needs of a discipline as being of importance equal to subject expertise or education. Furthermore, research shows that subject experts value informationists more for their knowledge of information, because it provides complementary skills, which means that there is no one formula for an informationist's training or background (Grefsheim et al., 2010). This could include those with a disciplinary degree (perhaps even without any traditional training or education in the information sciences), as well as those with information sciences backgrounds and strong experience working with researchers in that discipline, or those with a mix of disciplinary and information sciences training. Disciplinary expertise is further complicated by the wide range of disciplines in agriculture and the affiliated life sciences and the increasingly interdisciplinary nature of research. For an informationist approach it is critical to possess in-depth experience with one or even a few disciplines, and to consider retiring some of the traditional, generalized approaches in order to make time and effort available for this new model.

Additionally, there are new areas of knowledge emerging for agricultural information professionals to learn. An important area of knowledge are data and open access policies initially set in motion by the Office of Science and Technology Policy's (OSTP) public access memorandum issued in February 2013 (Holdren, 2013). Researchers need help to efficiently navigate these requirements, because they represent a seismic shift

in the way that researchers are expected to share their results (Dietrich, Adamus, Miner, & Steinhart, 2012). Additionally, as these are new to the federal agencies as well, implementation and expectations are still in flux. In November 2014, USDA issued its *Implementation Plan to Increase Public Access to Results of USDA-funded Scientific Research*—the agency's response to the OSTP memo. As of January 2016, USDA was still accepting public comments on this plan, suggesting that it is diligently seeking feedback from those the plan will affect, and recognizing the need for this community dialogue to find the path best-suited for all stakeholders. A close read of this document reveals that it applies to both USDA-funded publications and data, even though most of the concern is on data sharing. Agricultural informationists can be the bridge between researchers and USDA to help understand these expectations, and to develop services and partnerships to address them. For example, informationists can promote open access through institutional repositories for traditional publications, with the added impetus of federal mandate requirements. In addition, informationists can assist researchers in writing DMPs required by funding agencies or share resources, such as the DMPTool, with them; they can also help educate researchers on the use of digital object identifiers (DOIs) for data citation and encourage citation practices for data reuse.

There are governmental resources to assist in some of aspects of RDM. For example, NAL has created the Ag Data Commons (ADC), a data repository for USDA-funded research that must be freely available and reusable by others (USDA, NAL, 2016). The website describes ADC as follows:

> [It] provides access to a wide variety of open data relevant to agricultural research. We are a centralized repository for data already on the web, as well as for new data being published for the first time. While compliance with the U.S. Federal public access and open data directives is important, we aim to surpass them. Our goal is that ADC will foster innovative data re-use, integration, and visualization to support bigger, better science and policy. (USDA, NAL, 2016)

This statement shows a commitment to data services. The user manual outlines how users can upload datasets, but it is a very self-serve process. Here again is another opportunity for agricultural informationists to work with their users throughout the entire research lifecycle: advising on selecting a repository when writing data management plans for federal grants, structuring data collection prior to the start of a project with sharing in mind, and helping describe the dataset once it is ready to upload.

It is also important to note that the data services are not a single monolithic concept, but a complex series of services and needs that will require a wide array of different expertise to address. This includes everything from highly specific needs, such as data visualization, data mining, and synthesis, to basic needs like data organization, storage, preservation, description, discoverability, and reuse. While advanced data manipulation

services may seem to be the highest status, this might not be the area of focus for librarians shifting to becoming informationists. The very basic skills of data organization—file-naming conventions, backups, description (metadata)—are the natural successors to traditional librarian skills of organization and preservation and must be in place for researchers to take advantage of data mining, visualization, modeling, systematic reviews, meta-analyses, and other advanced data uses (Diekmann, 2012). Researchers are aware that basic skills are needed to preserve their data, but they do not believe they have the time nor knowledge to implement best practices in their lab or to teach them to their undergraduate and graduate students (Carlson & Bracke, 2013).

There are no set standards for data information literacy, but there are at least two useful examples. One example translates the ACRL Information Literacy standards specifically for data: understanding the nature of data; finding data; reading, interpreting, and evaluating data; managing data; data handling; and the ethical use of data (Calzada Prado & Marzal, 2013). Sapp Nelson (2014, p. 232) takes a wider view of data information literacy to include all skills that a researcher needs to be able to work with their own or other's data, even those skills such as data processing and analysis that will likely fall outside of librarians' or even informationists' purview to teach. However, informationists could teach many of these skills to undergraduate and graduate students through online resources and seminars or embed them into disciplinary courses (Johnston, Lafferty, & Petsan, 2012). Another approach, although a time-intensive one, can be to offer a semester-long class in which students use their own research data to work through creating best practices and a working DMP (Carlson & Bracke, 2015). This approach allows students time to digest and apply the skills, learn from other peers, and customize data solutions for their unique situation.

Conclusion

In conclusion, there are many reasons why agricultural librarians should shift to an informationist model to remain relevant and effective in the future. Although this is still an emerging model that requires time and a new mindset for librarians, agricultural librarians should consider adoption, or at least partial adoption, of the principles. Although challenging, this should be considered as a long-term strategic ideal for librarians to fill unmet information expertise needs, and to stake a claim to new knowledge work as it emerges. There are numerous configurations of this position, and it may contain a range of domain and information science knowledge. Many of these skills already reside in librarians or may be simply an extension of current practices, including information skills, such as the searching, synthesis, and teaching of these skills. Collaboration with a variety of peers and researchers is key, both to achieve a range of skills and

to be an embedded part of a lab or group. Furthermore, as liaison librarians to agricultural and related disciplines, many librarians are poised to make this shift to the new role. Research like that by Jaguszewski and Williams (2013) demonstrates that many libraries are already switching to an enhanced liaison model to remain relevant and successful. The informationist is the next step on the continuum of new liaison models; users are coming to the library less often, and there is a repeated theme of a lack of awareness of all types of library-service users. Time and energy that used to be expended in working with users in these older models, such as serving users in the library, can be shifted to working with users outside of the library, in the users' own spaces. Thus it is vital that librarians be entrepreneurial in the development and delivery of services to meet informational needs where users learn and work. RDM provides both rich opportunities to support evidence-based practice and federal mandates. The new model of informationist, although it may require additional training or the creation and provision of new services, is a worthwhile endeavor to invigorate services and provide users with the information services that benefit them most, as well as to keep librarians relevant into the future.

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