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Uncharted Territory: UVM Extension Data Visualization Needs Assessment

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UNCHARTED TERRITORY

UVM Extension

Data Visualization Needs Assessment

Sarah E Lyman

In partial fulfillment of the
requirements for the degree
of Master of Science
in Food Systems

University of Vermont Food Systems Graduate Program &

THE UNIVERSITY OF VERMONT
EXTENSION

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Abstract

Graphical displays are more effective than textual information at summarizing large volumes of data, improving retention of information, and in persuading behavior change. UVM Extension uses data visualizations every day in its mission to transform academic research into practical recommendations for Vermonters, in topics ranging from nutrition to agriculture. But how are these graphics generated across an organization with more than 100 employees? How can data visualization help advance goals which range from analyzing research to demonstrating community impact?

This paper presents the results of a Master's project study into what tools and skills are already being used at UVM Extension, and what could be done better. For this study, data were collected through an organization-wide survey, two interviews, and two case studies. Results suggest that numerous software packages are being utilized across the organization to design graphics, but they are not administered consistently or leveraged efficiently. In general, staff and faculty lack confidence in designing their own graphics, are unfamiliar with best practices, and are unsure where to go for help.

Ultimately, this study reveals that UVM Extension could: 1) save costs by consolidating software accounts, and 2) improve quality by increasing staff capacity, establishing internal workflow protocols, and centralizing high-priority projects. By incorporating graphic design staff into the first steps of project planning, UVM Extension would ultimately elevate the quality of its storytelling.

Acknowledgments

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Introduction

Why This; Why Now?

When compared with tabular or textual information, graphics more effectively summarize great sums of data (E.R. Tufte, 1990), increase retention of information (Lyra et al., 2016), more effectively communicate risk (Lipkus, 2007), and are more persuasive (Milovanovic & Ivanisevic, 2014; Pandey, Manivannan, Nov, Satterthwaite, & Bertini, 2014). It follows then that graphics are incredibly important to the work of the University of Vermont (UVM) Extension, which is charged with improving the lives of Vermonters by transforming academic research into practical recommendations that the public can utilize. The 120+ people who comprise UVM Extension faculty and staff around the state of Vermont create data-driven graphics as a critical part of their transformative outreach. I know this because I am one of them.

As a graphic designer at UVM Extension, I hear repeatedly from faculty and program staff that they need a way to more effectively communicate research graphically to academic and professional audiences, the press, the public, and other stakeholders. UVM Extension already uses a variety of assets to create or interpret data, but in my time here, I sensed that tools and skills were not always leveraged efficiently. There seemed a potential for greater cross-pollination across departments and projects, a potential for cost-savings, and I felt ultimately a potential to elevate all of UVM Extension storytelling through graphics. We needed to understand the current state of data visualization usage at UVM Extension, and best practices for data visualization more broadly, so that UVM Extension leadership could make informed decisions on how to improve.

Writer and analyst Stephen Few describes data visualization as "visual representations that support the exploration, examination, and communication of data" (Few, 2009). This data visualization project seeks to understand what tools and skills are being employed at UVM Extension to generate data visualizations, and what actual or perceived barriers faculty and staff are facing. The results could be used to inform strategy in a practical way by providing specific recommendations that could yield increased efficiency, a reorganized communications team, a redistributed data visualization workload, and ultimately, an elevation of UVM Extension's visual storytelling.
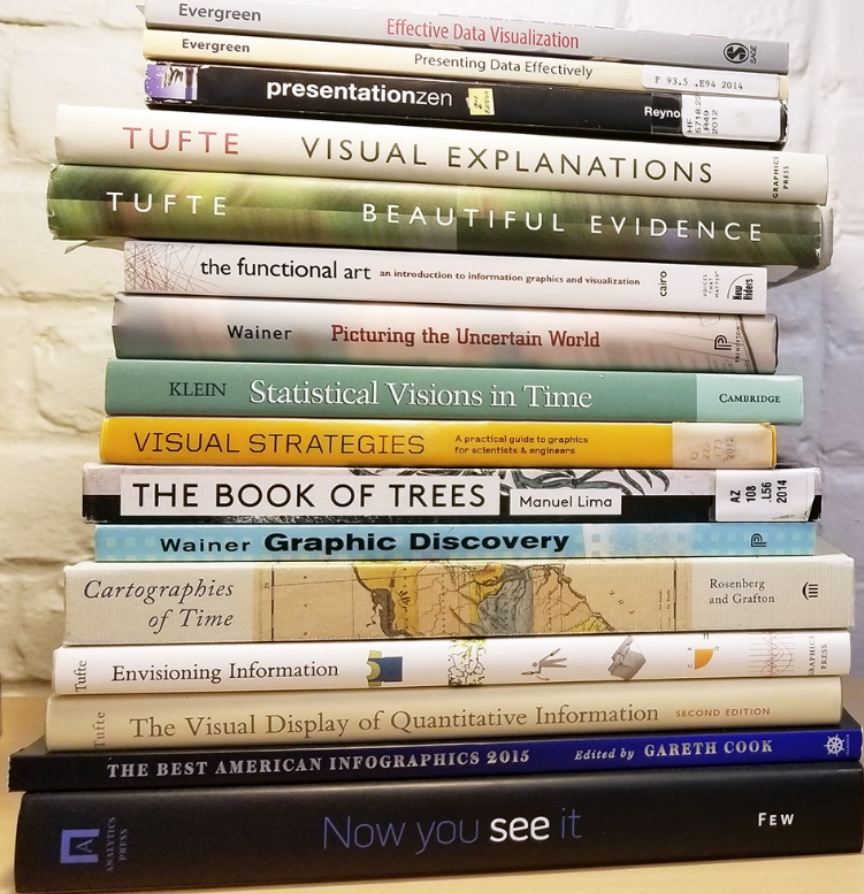
Figure 1. There are countless books on the subject of data visualization and good design. (Photo by the author.)

Literature Review

Much has been written about data visualization, from academic literature, to books, to grey literature. In reading across the tip of this vast iceberg, four themes emerge:

- Visuals are more efficient in certain settings than text.
- Visuals reflect historic changes in the way we organize data.
- Visuals are powerful storytellers.
- Visuals are occasionally measured, but more often are designed from intuition.

Visuals are more efficient in certain settings than text.

The notion that visuals are more effective than text at communicating information is not only popular in the English lexicon - *a picture is worth a thousand words* - it is well supported by the academic literature.

Molecular biologist John Medina found that when people hear information, they retain only 10% of it three days later; by simply adding a picture, they remember 65% (Medina, 2014). Part of the explanation lies in our inefficient reading skills, as our brains frantically decode letters before we can understand them (Medina, 2014). But when we glance at an image, we can interpret it much more quickly, and our working memory resources are freed up for other aspects of thinking - a concept called cognitive load theory (Hegarty, 2011; Reynolds, 2011; Sweller, 1988). The type of image matters to retention and our subsequent behavior: there is increased memorability when the image contains a human (Borkin et al., 2013; Isola, Xiao, Torralba, & Oliva, 2011), though there is evidence that when it contains more than one person, it negatively affects the likelihood of a charitable donation (Västfjäll, Slovic, Mayorga, & Peters, 2014).

These findings suggest that in order to most effectively explore, understand, and communicate our data – and engage our audiences – we should represent those data graphically. Indeed, data visualization used to be thought of as a nice but optional addition, but is now considered essential (Berinato, 2016). Visual representations of data help us recognize patterns (Hegarty, 2011), identify outliers (Cleveland & McGill, 1985; Segel & Heer, 2010), preserve topological and geometric relationships of data (Larkin & Simon, 1987), persuade us to do something (Pandey et al., 2014), retain information longer (Lyra et al., 2016), and enjoy the learning experience more (Lyra et al., 2016). Marketers frequently leverage this persuasive power of graphics (Sibley, 2017) and test in real-time which images receive more attention in digital communications (Kolowich, 2018).

> " When people hear information, they retain only 10% of it three days later; **by simply adding a picture, they remember 65%**.
>
> (Medina, 2014)

Visuals reflect historic changes in the way we organize data.

Data visualizations are not modern inventions. Florence Nightingale recognized that soldiers wounded in the Crimean War were dying from preventable malnutrition and poor sanitation, but it was not until she developed her data-driven graphics that she was able to convince Queen Victoria of the need for hospital reform (Nightingale, 1858; Rosenberg & Grafton, 2010).

The early scientific paradigm was reductive, seeking to understand nature by breaking things into the simplest possible elements and defining rules of their interaction (Manuel, 2011; Weaver, 1948). The graphics of the time helped us to understand one or two dimensions visually. Trees were a popular metaphor, as a way to express human genetic relationships ("family tree"), the natural order ("branches" of science), and even corporate top-down organization (Lima, 2014). As science progressed, researchers in the twentieth century recognized "disorganized complexity," where numerous factors vary as a whole in predictable ways (Manuel, 2011).
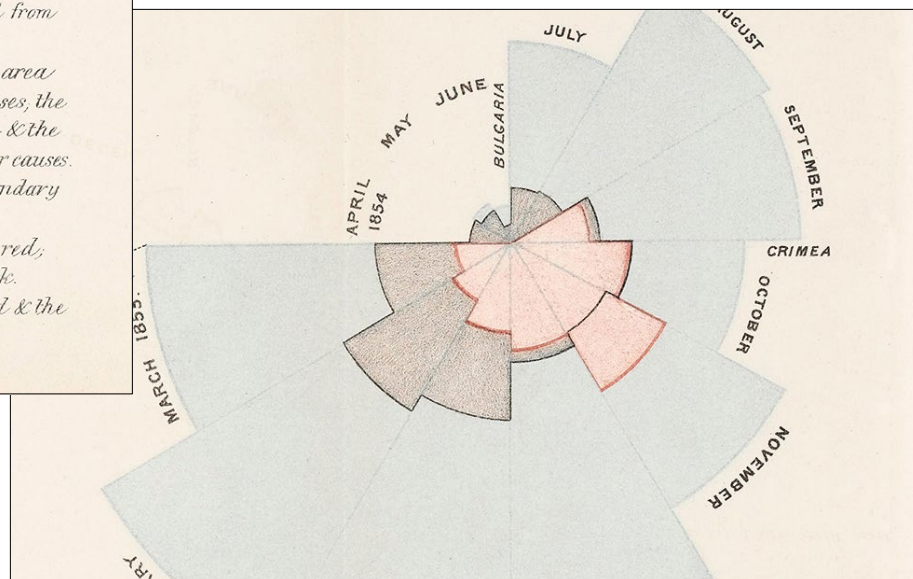

Figure 2: Diagram of the causes of mortality in the army in the east [two details].
(Florence Nightingale, 1858.)

As early as 1948, scientist and mathematician Warren Weaver predicted a challenge of his future: "organized complexity," where "a very substantial number of relevant variables … are interrelated in a complicated, but nevertheless not in helter-skelter, fashion" (Weaver, 1948). His observations were prescient, as today we attempt to understand an increasingly complex set of variables; e.g. food "chains" are now "webs" (Pomeroy, 1974). Even the way we code and search for information is different, as we turn away from the top-down organization of the Dewey decimal system and rely more heavily on bottom-up tagging and keyword searches (Manuel, 2011). The network is seen frequently as a graphical way to understand these relationships: from interpersonal connections to social media (Gladwell, 2000).

Visuals are powerful storytellers.

One overarching theme in the writings about data visualizations is that effective design keeps the focus on the audience, and tells a story. The analyst or designer begins by making decisions about what data to include or exclude, choosing between potentially competing valid interpretations (Wolfe, 2015). Just as in storytelling, the audience needs to be guided through the process (McGhee, 2010; Segel & Heer, 2010). The audience will understand more if given structure to follow in the graphic: e.g., by creating a viewing order; by offering a clear orientation (e.g., establishing shot, checklist); by tracking progress (progress bar, timeline slider); and by highlighting important features (e.g., color, motion, framing, size) (Segel & Heer, 2010). Knowing the audience and selecting a delivery method that is appropriate to it is critical. Even the cultural heritage of the audience could affect understanding: for example, Hebrew and Arabic are read right-to-left, so the common left-to-right orientation of a timeline could be confusing (Doiron, 2018; Segel & Heer, 2010; Vedantam, 2018).

"

What's your **point**?

(Evergreen, 2016)

It is tempting to get caught up in the data or the software itself, but one needs to focus on the story (Harris, 2008). Cautions one researcher, "You can do beautiful things with computers and lots of data that look very nice, and are almost completely incomprehensible" (McGhee, 2010). Always come back to the story: what is it you need the viewer to understand? Or in the words of another expert, "What's your point?" (Evergreen, 2016).

Visuals are occasionally measured, but more often are designed from intuition.

Perhaps the largest theme in the data visualization literature is pinpointing effective design. Some academic studies explore what type of graph or chart yields the most information retention (Majooni, Masood, & Akhavan, 2018) or holds the attention longest (Borkin et al., 2013). Research has recently utilized eye tracking studies to determine the object and duration of a viewer's gaze on a page, or within a graphic (Kurzhals, Fisher, Burch, & Weiskopf, 2016; Lahrache, El Ouazzani, & El Qadi, 2018; Majooni et al., 2018; Yoon, Cohen, Cato, Liu, & Larson, 2016). But gaze heatmaps only tell part of the story; in fact, it may be that the best-designed graphic transmits information so efficiently that it does not need to be stared at for long (Courtemanche et al., 2018).

Is there a definitive set of rules for which chart to use when? Explains psychologist Douglas Gillan, "The effect of each graphical element was conditional on the type of graph and task and the presence of other graphical elements" (Gillan & Richman, 1994); or even the expertise or instruction of the viewer

(Ancker, Senathirajah, Kukafka, & Starren, 2006). Frustratingly, these academic studies are situation-specific, making it difficult to extrapolate universal guidelines.

The data need a layer of abstraction in order to be comprehended (Berinato, 2016), and this job falls most often to designers. Outside the controlled environments of the clinic and laboratory, designers have written countless books and articles in an attempt to teach data visualization with strategies and "top ten" lists drawn sometimes from research-based guidelines (Evergreen, 2016), but more often from their experience and intuition (Hegarty, 2011; Stofer, 2017; Tableau, 2017; Wong, 2010).

Indeed, one cannot discuss data visualization without mentioning Edward Tufte, sometimes referred to as the "da Vinci of design." His beautiful books (E.R. Tufte, 1990; Edward R Tufte, 1997, 2001, 2006) examine the characteristics of good and bad design and have long been considered required reading, even the graphical counterpart to writing's *The Elements of Style* (Strunk, 1979).

There is a wide-held stance among designers that aesthetics are important in visualization design, so tradeoffs are necessary to create engaging graphics (Byron & Wattenberg, 2008). Although not all of Tufte's principles have held up when measured objectively (Borkin et al., 2013; Hegarty, 2011), simplicity of design is advocated throughout the design literature, requiring discipline and courage (Berinato, 2016). Designers urge us to ask of every single element, "Do I really need this to get the point across?" Do I need the extra cross-hatching? All those colors? Three dimensions to the bar chart? If the answer is no, then it's probably "chart junk" (Edward R Tufte, 2001) and you should discard it. Indeed, sometimes the best visualization of all is not digital, but analog (Duarte, 2014; Rosling, 2010).

> I include my short list of beloved **design resources** in the Appendices as a take-away for you.
>
> -Sarah

Ultimately, knowledge visualization adoption is fostered by perceived ease of use, perceived usefulness, and perceived authority (Bresciani & Eppler, 2009). Interestingly, these are factors often associated with Extension research and outreach.

Methods

Informed and inspired by this vast body of design literature, I sought to better understand how UVM Extension utilizes data visualizations in research and outreach, and what barriers might be impeding our best possible work. Three distinct elements comprise this project's methods: survey, interview, and case study.

Online Survey

In September 2018 a ten-question non-anonymous digital survey was sent to all UVM Extension researchers and staff who are populated on the inclusive "uvmext" listserv. The goal was to assess current data visualization practices, gauge the type and scale of need at UVM Extension, and allow for user-supplied qualitative responses. The results contained quantitative and qualitative information. I enlisted the help of colleague and fellow communicator Cheryl Herrick, and we independently open-coded the qualitative results by keywords, patterns, themes, and phrases. I analyzed the results using emergent thematic analysis (Lindlof & Taylor, 2017). The survey is included in the Appendices.

Semi-Structured Interviews

I conducted interviews for this project to delve deeper into two discrete subjects: the tools and methods of expert data visualization, and the real-world application at the leadership level of an organization. I spoke with Larry Granillo, Senior Institutional Research Analyst at UVM's Office of Institutional Research; and Charles Ross, Director of UVM Extension.

Case Studies

Of the many potential UVM Extension initiatives identified during the online survey and in personal communications, two were selected to develop into data visualizations as case studies: a state summary report for the Northeast Center to Advance Food Safety; and a visualization to engage stakeholders in UVM Extension. These are highlighted below, and included in full in the Appendices.

Results and Analysis

Online Survey Results

A non-anonymous survey was sent via SurveyMonkey to approximately 117 UVM Extension colleagues: 43 responded, a 36.8% response rate. Some of the Extension colleagues known to be active or expert producers of data visualizations did not respond to the survey, so results do not reflect the full gamut of use at Extension. 90.7% of respondents indicated that they were "a user of any graphic tools." From here the survey branched to excuse those individuals who did not use graphic tools and end their survey, while the remaining participants continued. Results were cross-checked against human resources personnel job categories: respondent distribution was similar to distribution across Extension: outreach personnel (48.8%), administrative staff (34.9%), and faculty (16.7%). Respondents tended to be in mid-career (59.0%), and had been with Extension for an average of 10.3 years. Questions other than name were not mandatory.

Five themes emerged in my analysis of these survey responses. Overall, my UVM Extension colleagues:

1. Feel data visualizations are important to their work.
2. Use numerous software platforms to create graphics.
3. Generate data visualizations for a wide range of purposes.
4. Are inspired by a wide range of external sources.
5. Do not feel confident in their ability to create the type or quality of graphic they desire, and do not always know where to turn for assistance.

Data visualizations are important to UVM Extension work.

Respondents demonstrated they feel visualizations are important to their work by their detailed comments throughout the survey. They use them to show temperature rates of cooling fruit and vegetables, to understand budgets, and to understand a decision-making process. One respondent wrote, "Summarizing impact in a graphical way is meaningful and impressive." Another, "So much of our work could be enhanced by data viz!"

Numerous software platforms are used to create graphics.

Which of the following tools do you use in your Extension work?

Microsoft Excel
SurveyMonkey
Microsoft Publisher
Adobe Creative Suite
Eventbrite
Crayon & Paper
RegOnline
MailChimp
Google Earth
Google Analytics
Google Charts
Venngage
Canva
Tableau
ArcGIS
Constant Contact
Infogram
Python

0.0   0.5   1.0   1.5   2.0   2.5

Weighted Average of Frequency of Use (n=39)
0 Never - 1 Rarely (1x/year) - 2 Occasionally (1x/month) - 3 Often (1x/week)

Figure 3. Survey respondents indicated their frequency of use for each of 17 tools (n=39).

The survey queried respondents about which software tools and platforms they use to generate data visualizations, specifying 17 commonly used tools (see Figure 1); users supplied 13 more in open-ended responses. In all, UVM Extension staff and faculty are generating graphics from 30 different tools across a wide range of applications: event registration software (RegOnline), infographic generators (Venngage, Infogram, Piktochart), graphic design software (Adobe Creative Suite, Microsoft Publisher, Canva), survey tools (SurveyMonkey, Wufoo), database platforms (Google Charts, Microsoft Excel), programming languages (Python), geographic information systems (Google Earth, ArcGIS, Google Maps), web analytics (Google Analytics), email marketing (Constant Contact, MailChimp), statistical software (SAS, JMP, R, GraphPad Prism), presentation tools (PowerPoint, Mentimeter), planning/reporting/evaluating platforms (WebNEERS, Albert), and marketing tools (Salesforce, Predictive Response [inferred]). The least-used tool was Python (no one); and the most-used tool was Excel (94.7% indicating some use; 44.7% using weekly).

Largely as a joke, I included "Crayon & Paper" as one of the selections; interestingly, almost half of the respondents indicated they used it at some level of frequency. Perhaps this was a reflection of their sense of humor, but it could also have been an indicator of what is recommended broadly in the literature: brainstorming on paper, sticky notes, or a whiteboard is far more effective in generating ideas than jumping straight to a computer (Reynolds, 2011).

Some of these tools are free or are included as a standard installation on UVM Extension computers. Others, however, require a paid subscription or license: Constant Contact, MailChimp, Adobe Creative Suite, Wufoo, SurveyMonkey, SAS, JMP, R, GraphPad Prism, Salesforce, and Predictive Response [inferred].

Data visualizations are generated for a wide range of purposes.

In your Extension job, do you ever use data graphics for (check all that apply):

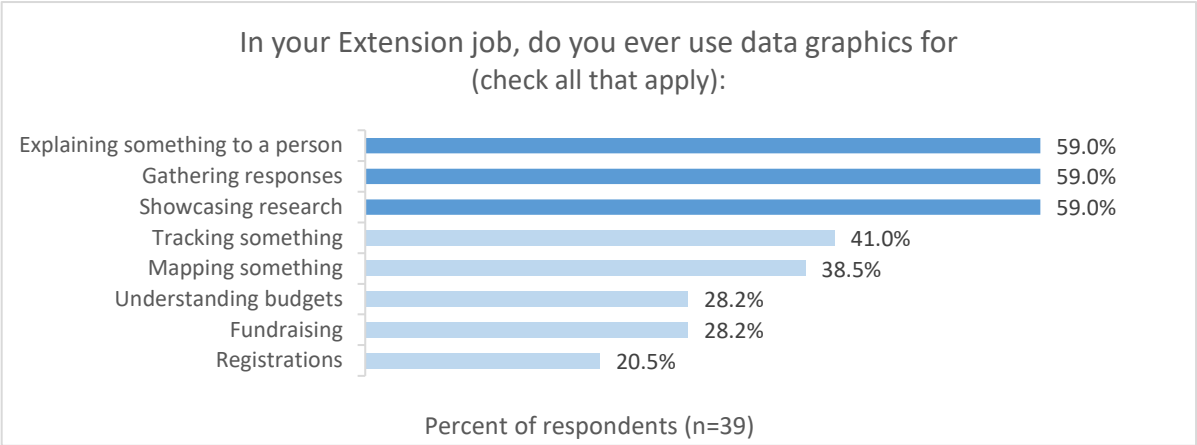| Category	Percent
Explaining something to a person	59.0%
Gathering responses	59.0%
Showcasing research	59.0%
Tracking something	41.0%
Mapping something	38.5%
Understanding budgets	28.2%
Fundraising	28.2%
Registrations	20.5%

Percent of respondents (n=39)

Figure 4. Respondents indicated use of data visualizations for a variety of purposes (n=39).

Respondents are largely generating graphics to explain something to an audience (59.0%), gather audience response via survey (59.0%), and showcase research (59.0%). Respondents are also tracking something (41.0%), mapping something (38.5%), fundraising (28.2%), understanding budgets (28.2%), or managing registrations (20.5%). Respondents were allowed to select more than one choice. Open-ended responses further fleshed out the picture: respondents are demonstrating impact to funders, describing organizational structure and process, supplementing oral presentations, managing projects, and generating promotional materials. They also reveal a strong institutional connection with federal data: UVM Extension sends data to the federal government as part of its reporting mandate, and also downloads federal data for use in Vermont-based research and outreach.

More than half (52.5%) of respondents indicated they collect data that needs to remain anonymous. Some respondents indicated they work with data from minors where information is presented in aggregate to avoid personal identification, a requirement of the Family Educational Rights and Privacy Act (FERPA). Other respondents work with farmers or producers where information such as farm finances or soil and water data are collected; these also must be anonymous when shared. Similarly, respondents working with the Expanded Food and Nutrition Education Program (EFNEP) anonymize their data using ID numbers. One respondent indicated she does not promise anonymity to her clients, but does keep the information confidential and presents data only in aggregate.

Inspiration comes from all over.

Respondents were inspired by a variety of data visualization sources and experts, including statistician Hans Rosling (Rosling, Rönnlund, & Rosling, 2018; Rosling, Rosling, & Rönnlund, 2019), *Bloomberg News*,

evaluator Sara Vaca, *National Geographic*, Vermont Sustainable Jobs Fund Farm to Plate, ArcGIS Story Maps, Iowa SNAP-Ed, and *The New York Times*.

Perceived lack of skill and confidence in generating data visualizations.

When you think about data visualization for your work, what barriers come to mind?
(check all that apply)

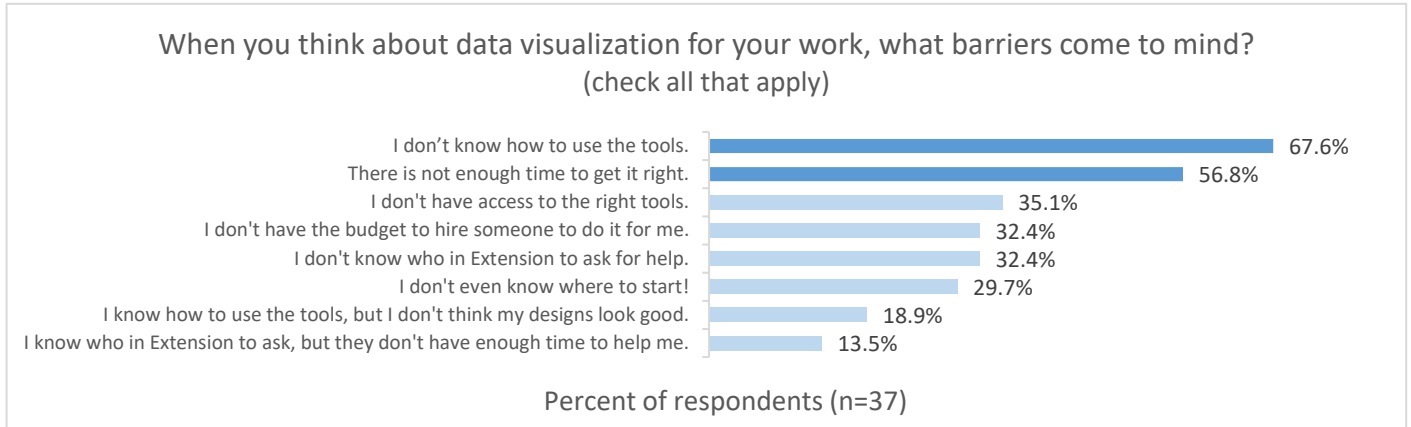|	
I don't know how to use the tools.	67.6%
There is not enough time to get it right.	56.8%
I don't have access to the right tools.	35.1%
I don't have the budget to hire someone to do it for me.	32.4%
I don't know who in Extension to ask for help.	32.4%
I don't even know where to start!	29.7%
I know how to use the tools, but I don't think my designs look good.	18.9%
I know who in Extension to ask, but they don't have enough time to help me.	13.5%

Percent of respondents (n=37)

Figure 5. Respondents indicated they faced numerous barriers in producing data visualizations (n=37).

This survey asked UVM Extension colleagues to consider what barriers they face when generating data visualization for their work. The most common barriers were not knowing how to use the tools (67.6%) and not having enough time to get it right (56.8%). Numerous open-ended responses were submitted as well. Nearly half mention insufficient time, and also go on to describe more deeply the obstacles they face.

Some respondents feel confident in the tools and skills they already have:

- "I have been able to improve my data viz [as a result of training]."
- "I did a really cool radar graph."

Others, however, lack confidence. Barriers included lack of knowledge, insufficient time, low confidence, and lack of money as seen in these representative responses:

- "I don't know what other tools are out there."
- "I'm not familiar with all the options to find the best one for my needs."
- "I don't feel like I know enough to make something great."
- "[I am] still learning."
- "I am generally very bad at graphic design in general."
- "My creations are lame."
- "[Don't have enough] time."
- "We don't have the funding to buy the right programs :("

Some are unsure where – or how – to turn for help:

- "I know the help exists in Extension but I'm reluctant to bombard my colleagues with requests."
- "I often don't have the time to do this work and am unsure of the resources available within Extension or UVM to help me."

So what to do next? Some UVM Extension colleagues expressed suggestions right in their responses:

- "Would be helpful to have more PD [professional development] on data viz and/or experts to help develop graphics."
- "I would like support creating graphics and using data visualization. I know it is needed but I don't have the skills or time to do it myself."

The survey also asked about wishes for future projects. Respondents replied that they would like:

- Annual [UVM Extension] research data summaries for the public.
- A flowchart generator.
- Summarized survey information to include in annual reporting to USDA.
- Viewership data, including platform and geographic area, about Across the Fence [UVM Extension's daily farm and home TV program].
- Concise one-page materials for volunteer recruitment, research reports, and EFNEP [Expanded Food and Nutrition Education Program] impact.
- Data about irrigation water usage on farms.
- Information about water quality and agriculture changes.
- A program-wide dashboard to use as administration and reporting tool.
- Annual data from Albert [UVM Extension's reporting tool], including snapshots of programs delivered by location, and demographics of people reached.
- More information about data collection standards and definitions.
- Secure map layers linked to student, staff and partner locations, which update to databases in real-time.
- Agricultural Labor project (with an Agriculture and Food Research Initiative grant).
- Maple data from USDA Census of Agriculture.

Interview Results

Interviewing Larry Granillo (Senior Institutional Research Analyst at UVM's Office of Institutional Research) and Charles Ross (UVM Extension Director) yielded insights into design's internal mechanics as well as real-world applications. Several themes emerged:

1. Time is the perennial barrier.
2. The question or story drives the graphic.
3. Software selection and access is critical to effective visualization and communication.

Time is the perennial barrier.

Not surprisingly, time was identified as a perpetual barrier in both interviews. Mr. Granillo observed that their office is in high demand, and wished he could more often "go out and explain" their findings, and "make connections" about how different factors impact the data. "Right now," he says, "we're just kind of doing that ad hoc, on demand."

Mr. Ross expressed that this time crunch is felt acutely on the production end of data visualization. "We need to deploy our communication rapidly and effectively, and not at the expense of having it perfect. [...] When I'm telling stories, I do not need perfection. I need symbols and representations and support for the punchline."

This is an interesting argument in light of what designer Edward Tufte has said, "Great design is not democratic; it comes from great designers. […] Marketing and the bureaucratization of design approval are the big enemies of design" (Guterman & Tufte, 2009). Tufte's sentiment of exclusivity is in some ways contrary to UVM Extension's benchmark as a learning organization, with its goals to foster collaboration, share information, and empower people toward collective vision and action (Rowe, 2010). And yet UVM Extension is also an authoritative expert for research-based knowledge. As data visualizations are created, somehow these goals – perfection and timeliness; accessibility and authority; research and education – must all work in tandem.

The question or story drives the graphic.

Both interviews echoed an integral theme revealed in the literature review: that visuals are powerful storytellers.

UVM Extension Director Mr. Ross describes communicating with state and national policymakers, funders, and constituents. He hopes to have "a succinct description that might even like be like a visual landscape and varying levels of depth. Start off a little deeper, and [go] deeper yet." He mainly uses graphics to "orient people about something they're interested in, in the broader context of who we are. […] Who is Extension?" He envisions graphics that help him do "rapid reductions to the point of the message." In fact, he indicated that a central warehouse of information – an "electronic reservoir" – would be incredibly helpful to him when doing data-driven outreach.

> " Hearing that question and **knowing** exactly **what is being asked** is the **most important thing**.
>
> Larry Granillo, 2019

Unlike Mr. Ross, who solicits graphics to illustrate his story, Mr. Granillo is the one creating them in response to someone's question. He describes his work as collecting and analyzing data "at whatever level, depending on the question that's asked of us." He goes on to say, "Hearing that question and knowing exactly what is being asked is the most important thing. Because […] you change one word, it could be a completely different answer […]. So, understanding that […] leads into the analysis that you need to do." When presenting this data to his audience (e.g. university leadership), Mr. Granillo highlights salient points of the visualization which might be missed if it stood alone. His actions mirror the practical advice advocated throughout the design literature: identify what is most significant in the data, and be sure the visualization gets that point across clearly through various ways of storytelling (Evergreen, 2016).

Mr. Ross also tailors his story to his audience: "Making those connections starts with people understanding who you are." A key driver for Mr. Ross is the question, "What's [UVM Extension's] ability to deliver [this person's] particular interest?" Indeed, one of the stories that Mr. Ross tells frequently – with and without graphics – is the impact UVM Extension makes in the state of Vermont and beyond: "We're selling our ability to make change. Because if we're not making change, what are we doing?"

Software selection and access is critical to effective visualization and communication.

Over the course of the interview, Mr. Granillo and I discussed the software options used by the Office of Institutional Research (OIR), collected in the following table. OIR uses SAS and BI Publisher for their daily

analysis. When a graphic needs to be high-quality and public-facing, OIR uses Tableau. However, they use the free version of Tableau, which exposes all of the data to an unsecured cloud; i.e., everything is public. UVM adheres to strict Family Educational Rights and Privacy Act (FERPA) restrictions, so OIR must thoroughly scrub their data of any identifiable information before uploading it to Tableau. One additional pain point emerged from the discussion: SAS, BI Publisher, and Tableau are not connected, so OIR staff must repackage data each time it is used in a different software program. This either slows them down, or results in sacrificing attractive design for expediency.

Software	How used by UVM Office of International Research	Availability
SAS	Used for daily analysis. Particularly helpful for analyzing historical data, as consistent OIR records were created in this program for decades.	Paid software.
SPSS	Used for surveys.	Provided by UVM.
BI Publisher	Used for internal visualizations. Data is stored on a UVM NetID-protected server, so identifiable information does not need to be scrubbed.	Paid software.
Tableau Public	Used for high-quality public-facing visualizations. Data must be scrubbed before uploading to Tableau's public cloud server.	Free.
Microsoft Power BI	OIR is working with ETS to turn on this component of the Microsoft Office suite. Data would be storied on a UVM NetID-protected server, but graphics are better than BI Publisher. Also has capacity to add plug-ins to expand functionality.	Soon to be provided by UVM. [maybe]
Microsoft PowerPoint	Used for presenting data to audiences.	Provided by UVM.

Table 1: Types of software used by UVM Office of International Research (OIR) and their availability to UVM employees and students.
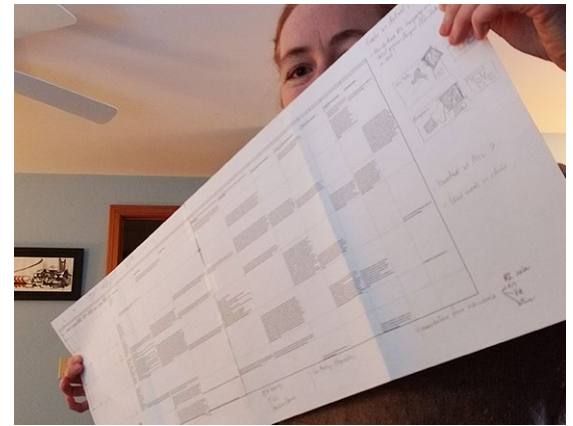
Case Studies

Of the many potential UVM Extension initiatives identified by the online survey and through personal communications, I selected two to design data visualizations as case studies for this project. This has served two research purposes. First, I was able to apply theories and best practices gleaned from the literature review to the graphic to yield a better product. Second, the design process has informed this needs assessment: I have been mindful to note successful design and planning techniques, and to identify opportunities for improvement. As such, the case studies both inform – and are informed by – this data visualization needs assessment. They are discussed in more detail below, and the full graphics are included in the Appendices.

Case Study: Annual Reporting for the Northeast Center to Advance Food Safety

The coordinators of the Northeast Center to Advance Food Safety (NECAFS) faced a unique challenge this year. They needed to showcase the hard work of the 12 states in their network in two formats: in an annual report, and in a presentation at their annual conference.

NECAFS is a collaborative effort among 12 states and the District of Columbia which aims to advance food safety in small- and medium-sized growers and processors. Since they are spread out geographically, their annual meetings are a key component to their collaboration and information sharing. Last year, each state's annual data was presented in sequence by 12 speakers. The resulting presentation was informative but lengthy and redundant. NECAFS coordinators wished for a more compelling way to present the information.

This year, NECAFS coordinator Elizabeth Newbold pulled me in at the very beginning of the process, and I helped to craft questions with a final visualization in mind. Over the following six weeks, member states submitted their information to Ms. Newbold, who compiled an expansive spreadsheet capturing a wide range of data which included number of meetings run, educational programs delivered, and anecdotes of on-farm improvements. It was important to represent each member's contributions; it needed to be accurate and interesting; and it needed to present well in a paper document and a PowerPoint deck.

Figure 6: (Top) The original spreadsheet contained 280 cells of information. This was synthesized into succinct stories and statistics in the final document (middle) and PowerPoint presentation (bottom).

In the early design process, we looked for patterns in the quantitative data and focused on how to produce a visualization that pulled together everything in aggregate. We were finding, however, that size differences between members - Rhode Island and Pennsylvania, for example - made direct state-to-state comparisons unhelpful at best, or at worst, competitive. We ruled out a single comprehensive chart.

We then turned to the anecdotes submitted by members. For example, Maryland found that "produce safety knowledge increased among 87% of participants," and a training participant in Massachusetts felt "empowered to create a food safety plan." Stories like these not only demonstrated impact, but were compelling. We also focused on photographs, encouraging states to submit their own, and supplementing with others.

Ultimately, the final format was decidedly simple, and designed entirely in Microsoft Publisher so it could be accessible to most users, even those without proprietary design software. A single large image led every state's page, each of which was designed to be extractable as a stand-alone asset for state-level use in addition to its inclusion in the full NECAFS report. The state-by-state program data needed to be included somewhere, but the interesting stories were prominently showcased in a series of call-out quotes. Succinct bulleted lists outlined the top milestones; strong headlines made the document easy to scan; and a paragraph of text brought the reader deeper into each state's story. At the end of the 28-page full-color report, aggregate information was shared in an "infographic" format with large graphic numerals. It concluded, "Together, in 2018, the NECAFS Network delivered 503 trainings, and reached 4,291 participants." The PowerPoint followed a similar style.

This new format was well-received. NECAFS Coordinator Elizabeth Newbold wrote the following after the event:

> There were a couple of comments made during the Conference that are important to capture. Angela Shaw from Iowa State University and PI of the North Central Regional Center told [NECAFS Director] Chris [Callahan] and me that she is going the "steal the state update" report for their region. She emphasized how impressive it was and something that she'd like to replicate. Also, Jodi Williams, program director for the USDA NIFA [United States Department of Agriculture National Institute of Food and Agriculture] Food Safety Outreach Program, spoke about evaluation expectations in her update on Wednesday morning. She specifically said that she'd like to see evaluation information presented in the same way we "provided the state update report."

In retrospect, my layperson's perspective on their technical data wound up to be an asset, as I was able to ask naive questions of the complex spreadsheet. This, combined with Ms. Newbold's deep knowledge of the material, kept the storytelling concise and focused on message – "what's the point?" The resulting visualization was designed with the audience first in mind, presented information graphically, and told a story, capturing themes which had emerged repeatedly during the literature review, survey results and interviews.

Ultimately, a lesson learned is that by keeping data visualization a top priority even at the nascent stages of a project (in this case by including a graphic designer on the planning team), the resulting product can be more engaging, and can better communicate the story held within the data.

Case Study: UVM Extension at a Glance

UVM Extension leadership communicates with a variety of stakeholders in Vermont and beyond, and it is critical that they have resources and statistics to help them with their goals of raising support, demonstrating impact, and advocating for change. Right from his very first months at the organization in 2018, UVM Extension Director Chuck Ross identified a specific need for visuals that would assist him in introducing the organization to the stakeholders with whom he meets. The graphic(s) needed to start broad to illustrate the scope of UVM Extension work: not only agriculture (for which UVM Extension is well known), but also nutrition, family, gardening, 4-H and youth, forestry, food safety, water quality, and more. Mr. Ross also identified another need: a series of secondary visuals which more deeply explore content areas relevant to individual stakeholders.

This challenge required a team. I pulled together a meeting with Mr. Ross and two UVM Extension colleagues Program Support Specialist Stephanie Albaugh, and Strategic Implementation Specialist Alison Nihart. Ms. Albaugh assembles UVM Extension data for federal reporting, and deeply understands the nuances of our programming. Ms. Nihart is an experienced top-level strategist, and has been instrumental in planning and executing UVM Extension's new strategic plan.

After an initial interview with Mr. Ross (see "Interview Results" earlier in this report), Ms. Albaugh, Ms. Nihart, and I coordinated the implementation of this data visualization. Several key points about UVM Extension needed to be presented visually:

- Profile: 115-160 number of employees; $21 million budget
- Programs: 50 programs in 9 program areas, delivered in all Vermont counties
- Call to Action: advocate for programmatic and/or financial support

This data visualization needed to accomplish a lot. It needed to: 1) be visually appealing; 2) demonstrate institutional breadth; 3) demonstrate deep research-based authoritative content; 4) look good in print and digital formats; and 5) be quickly editable to reflect emerging or changing needs.

[Graphic is pending final design and review.]

Discussion and Recommendations for Action

This study's survey and interview results indicate that data visualizations are recognized by faculty and staff as crucially important to the work of UVM Extension. They help us analyze our research and share it more clearly with others. They help us tell a story. Data visualizations help us turn our work into positive action in Vermont in the form of increased donations, improved food safety, safer on-farm practices, or deeper knowledge of nutrition.

This study revealed that UVM Extension has a broad spectrum of tools, utilized by people with a wide range of skills; yet, there is room for improvement. Colleagues face significant barriers to the best possible data visualization design: they don't have enough time, lack the skill and confidence, and don't know where to turn for help.

In analyzing results of the survey, interviews, and case studies, opportunities emerge that have the potential to elevate data visualization at UVM Extension. I propose the following steps for action:

Facilitate professional development opportunities in data visualization. *(immediate)*
As articulated repeatedly in the survey results, colleagues feel they need more professional development to be proficient and confident in data visualization. Time is perceived as the biggest barrier to their skills development. This could be ameliorated if UVM Extension leadership actively encourages staff and faculty to prioritize time to attend a workshop or take an online course. In some cases leadership will need to allow workload flexibility and provide resources. In fact, numerous opportunities already exist, for every skill level, and some are completely free. I have developed two deliverables directly from this project which will immediately help UVM Extension colleagues in their skills development: 1) a curated list of resources and courses; and 2) a skills workshop entitled "Uncharted Territory: Visualizing Data in Extension," presented at the annual Extension Professional Improvement Conference in May 2019. Both of these are included in the Appendices.

Explicitly prioritize high-quality data visualizations. *(mid-term)*
UVM Extension leadership has the capacity to elevate the quality and consistency of the institution's visuals by 1) helping colleagues know which projects are most important; 2) letting colleagues know when – and from whom – to seek design assistance; and 3) prioritizing them in the workflow of the communications team. Some projects can be illustrated well by the researcher or outreach professional themselves, whereas other projects are complex and important enough to require graphic design or data visualization assistance from the UVM Extension communication team (Cathy Yandow, Marcus Tracy, and Sarah Lyman). How do colleagues decide which project warrants calling a member of the communications team – and when are they "allowed" to do so? UVM Extension leadership could encourage colleagues to include a member of the communications team from the beginning of their planning process.

Centralize UVM Extension communications. *(longer-term)*
UVM Extension has just launched a strategic plan which demonstrates commitment to a new communications strategy (University of Vermont Extension, 2018). It is still in its nascent stage, but one of the possible outcomes will be pulling together the current silos of communication into a coordinated central system. This will yield visual consistency in materials, coordinated list management, and a leveraging of relationships across departments. Consolidating redundancies may also save staff time and financial resources. By coordinating materials in a central system, data visualizations would be easier and more efficient to create, deploy, and share across Extension initiatives.

Limitations

This study is limited by the fact that not all of UVM Extension's staff and faculty participated in the survey. Although we can extrapolate from its 36.8% response rate, certainly there is some data missing. Another limitation is my inherent bias: as a member of the UVM Extension communications team, and a graphic designer regularly tasked with developing data visualizations, my experiences may influence this study's analysis and final recommendations.

Works Cited

Ancker, J. S., Senathirajah, Y., Kukafka, R., & Starren, J. B. (2006). Design Features of Graphs in Health Risk Communication: A Systematic Review. *Journal of the American Medical Informatics Association, 13*(6), 608-618. doi:10.1197/jamia.M2115

Berinato, S. (2016). Visualizations that really work. *Harvard business review, 94*(6), 18.

Bird, B., & Pinkava, J. (Writers). (2007). Ratatouille. In. Burbank, CA: Walt Disney Pictures ; Pixar Animation Studios.

Borkin, M. A., Vo, A. A., Bylinskii, Z., Isola, P., Sunkavalli, S., Oliva, A., & Pfister, H. (2013). What makes a visualization memorable? *IEEE Transactions on Visualization and Computer Graphics, 19*(12), 2306-2315.

Bresciani, S., & Eppler, M. J. (2009, 15-17 July 2009). *Beyond Knowledge Visualization Usability: Toward a Better Understanding of Business Diagram Adoption.* Paper presented at the 2009 13th International Conference Information Visualisation.

Byron, L., & Wattenberg, M. (2008). Stacked graphs–geometry & aesthetics. *IEEE Transactions on Visualization and Computer Graphics, 14*(6).

Cleveland, W. S., & McGill, R. (1985). Graphical perception and graphical methods for analyzing scientific data. *Science, 229*(4716), 828-833.

Courtemanche, F., Léger, P.-M., Dufresne, A., Fredette, M., Labonté-LeMoyne, É., & Sénécal, S. (2018). Physiological heatmaps: a tool for visualizing users' emotional reactions. *Multimedia Tools and Applications, 77*(9), 11547-11574. doi:10.1007/s11042-017-5091-1

Doiron, N. (2018). Charts when you read right-to-left. Retrieved from https://medium.com/@mapmeld/charts-when-you-read-right-to-left-614f0a2cf54d

Duarte, N. (2014). The quick and dirty on data visualization. Retrieved from https://hbr.org/2014/04/the-quick-and-dirty-on-data-visualization

Evergreen, S. D. (2016). *Effective data visualization: The right chart for the right data*: Sage Publications.

Few, S. (2009). *Now you see it: simple visualization techniques for quantitative analysis*: Analytics Press.

Gillan, D. J., & Richman, E. H. (1994). Minimalism and the syntax of graphs. *Human Factors, 36*(4), 619-644.

Gladwell, M. (2000). *The tipping point : how little things can make a big difference / Malcolm Gladwell* (1st ed.. ed.). Boston: Boston : Little, Brown.

Guterman, J., & Tufte, E. R. (2009). How Facts Change Everything (If You Let Them). *MIT Sloan Management Review, 50*(4), 35.

Harris, J. (2008) *Telling stories using data: An interview with Jonathan Harris/Interviewer: L. Danzico*.

Hegarty, M. (2011). The Cognitive Science of Visual-Spatial Displays: Implications for Design. *Topics in Cognitive Science, 3*(3), 446-474. doi:doi:10.1111/j.1756-8765.2011.01150.x

Isola, P., Xiao, J., Torralba, A., & Oliva, A. (2011, 20-25 June 2011). *What makes an image memorable?* Paper presented at the CVPR 2011.

Kolowich, L. (2018). How to Do A/B Testing: A Checklist You'll Want to Bookmark. Retrieved from https://blog.hubspot.com/marketing/how-to-do-a-b-testing

Kurzhals, K., Fisher, B., Burch, M., & Weiskopf, D. (2016). Eye tracking evaluation of visual analytics. *Information Visualization, 15*(4), 340-358. doi:10.1177/1473871615609787

Lahrache, S., El Ouazzani, R., & El Qadi, A. (2018). Visualizations memorability through visual attention and image features. *Procedia Computer Science, 127*, 328-335. doi:https://doi.org/10.1016/j.procs.2018.01.129

Larkin, J. H., & Simon, H. A. (1987). Why a Diagram is (Sometimes) Worth Ten Thousand Words. *Cognitive Science, 11*(1), 65-100. doi:https://doi.org/10.1016/S0364-0213(87)80026-5

Lima, M. (2014). *The book of trees : visualizing branches of knowledge* (First ed.): New York : Princeton Architectural Press.

Lindlof, T. R., & Taylor, B. C. (2017). *Qualitative communication research methods*: Sage Publications.

Lipkus, I. M. (2007). Numeric, verbal, and visual formats of conveying health risks: suggested best practices and future recommendations. *Med Decis Making, 27*(5), 696-713. doi:10.1177/0272989x07307271

Lyra, K. T., Isotani, S., Reis, R. C. D., Marques, L. B., Pedro, L. Z., Jaques, P. A., & Bitencourt, I. I. (2016, 25-28 July 2016). *Infographics or Graphics+Text: Which Material is Best for Robust Learning?* Paper presented at the 2016 IEEE 16th International Conference on Advanced Learning Technologies (ICALT).

Majooni, A., Masood, M., & Akhavan, A. (2018). An eye-tracking study on the effect of infographic structures on viewer's comprehension and cognitive load. *Information Visualization, 17*(3), 257-266.

Manuel, L. (2011). Visual Complexity. Mapping Patterns of Information. In: Princeton: Princeton Architectural Press.

McGhee, G. (Producer). (2010). Journalism in the Age of Data. [Annotated Video] Retrieved from http://datajournalism.stanford.edu

Medina, J. (2014). *Brain rules : 12 principles for surviving and thriving at work, home, and school / John Medina* (Second edition.. ed.): Seattle, WA : Pear Press.

Milovanovic, D., & Ivanisevic, L. (2014). *Infographic as a marketing communication tool.* Paper presented at the 2014 New Business Models and Sustainable Competition Symposium Proceedings.

Nightingale, F. (1858). Diagram of the causes of mortality in the army in the east. In. Public domain. .

Pandey, A. V., Manivannan, A., Nov, O., Satterthwaite, M., & Bertini, E. (2014). The Persuasive Power of Data Visualization. *IEEE Transactions on Visualization and Computer Graphics, 20*(12), 2211-2220. doi:10.1109/TVCG.2014.2346419

Pomeroy, L. R. (1974). The ocean's food web, a changing paradigm. *Bioscience, 24*(9), 499-504.

Reynolds, G. (2011). *Presentation Zen: Simple ideas on presentation design and delivery*: New Riders.

Rosenberg, D., & Grafton, A. (2010). *Cartographies of time* (1st ed.). New York: Princeton Architectural Press.

Rosling, H. (Writer). (2010). Global population growth, box by box. In. Cannes, France: TED Talks,.

Rosling, H., Rönnlund, A. R., & Rosling, O. (2018). *Factfulness: Ten Reasons We're Wrong about the World--and why Things are Better Than You Think*: Flatiron Books.

Rosling, H., Rosling, O., & Rönnlund, A. R. (2019). Gapminder. Retrieved from https://www.gapminder.org/

Rowe, E. (2010). Looking at Extension as a learning organization. *Journal of extensión, 48*(4), 110-120.

Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. *IEEE Transactions on Visualization and Computer Graphics, 16*(6), 1139-1148.

Sibley, A. (2017). 19 Reasons You Should Include Visual Content in Your Marketing. Retrieved from https://blog.hubspot.com/blog/tabid/6307/bid/33423/19-reasons-you-should-include-visual-content-in-your-marketing-data.aspx

Stofer, K. (2017). Visualizing Spatially Based Data for Various Stakeholder Audiences. *University of Florida IFAS Extension*(AEC499).

Strunk, W. (1979). *The Elements of Style* (3rd ed.): New York : Macmillan.

Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. *Cognitive Science, 12*(2), 257-285. doi:10.1207/s15516709cog1202_4

Tableau. (2017). Good enough to great: A quick guide to better data visualizations. Retrieved from https://www.tableau.com/learn/whitepapers/good-enough-great-quick-guide-better-data-visualizations

Tufte, E. R. (1990). *Envisioning Information*: Cheshire, Conn. : Graphics Press.

Tufte, E. R. (1997). *Visual explanations*: Graphics Cheshire.

Tufte, E. R. (2001). *The visual display of quantitative information* (Vol. 2): Graphics press Cheshire, CT.

Tufte, E. R. (2006). *Beautiful evidence* (Vol. 1): Graphics Press Cheshire, CT.

University of Vermont Extension. (2018). *University of Vermont Extension Strategic Plan 2018*. Retrieved from Burlington, Vermont:

Västfjäll, D., Slovic, P., Mayorga, M., & Peters, E. (2014). Compassion fade: Affect and charity are greatest for a single child in need. *PloS one, 9*(6), e100115.

R. Cohen (Producer). (2018, January 29, 2018). *Hidden Brain* [Retrieved from https://www.npr.org/2018/01/29/581657754/lost-in-translation-the-power-of-language-to-shape-how-we-view-the-world

Weaver, W. (1948). Science and complexity. *American scientist, 36*(4), 536.

Wolfe, J. (2015). Teaching students to focus on the data in data visualization. *Journal of Business and Technical Communication, 29*(3), 344-359.

Wong, D. M. (2010). *The Wall Street Journal guide to information graphics: The dos and don'ts of presenting data, facts, and figures*: WW Norton.

Yoon, S., Cohen, B., Cato, K. D., Liu, J., & Larson, E. L. (2016). Visualization of Data Regarding Infections Using Eye Tracking Techniques. *Journal of Nursing Scholarship, 48*(3), 244-253. doi:doi:10.1111/jnu.12204

Appendix A: Online Survey

Dear Extension Colleague,

What the heck is a Data Visualization Needs Assessment and why should you care?!

Data visualization is any visual representation of data - from budgets to water quality maps, from crop yield over time to stakeholder networks. As one of Extension's graphic supporters, it's my job to help you on the path to great graphics. I want to understand what tools you're already using, and where we might save a few pennies by being more efficient across Extension. Even more importantly, I want to know where your unmet needs are.

I will compile these results into a set of recommendations and eventually a presentation. The scope and format all depends on what I get from YOU! This is also a component of my Food Systems Master's project, so by completing this survey, you are helping me out both personally and professionally. So, THANKS! Comments, questions, ideas? I'm at: Sarah.Tichonuk@uvm.edu

Note: the PI's name changed during the project timeframe from Sarah Tichonuk to Sarah Lyman.

In appreciation,
Sarah L. Tichonuk
UVM Extension Assistant Webmaster

1. Are you a user of any graphic tools?

2. Has your use of graphics tools changed since you started using them? How?

3. Where would you describe yourself in your career?

◯ Early career

◯ Mid career

◯ Late career

4. Data presentation tools vary in their identity protection features. Do you ever collect data that needs to remain anonymous (such as sensitive information, or proprietary data)?

◯ Yes

◯ No

If yes, please describe the work or project:

5. In your Extension job, do you ever use data graphics for (check all that apply):

☐ Showcasing research

☐ Fundraising

☐ Understanding budgets

☐ Gathering responses (e.g. survey)

☐ Tracking something (e.g. crop growth, humidity, diet)

☐ Registrations (e.g. examining capacity)

☐ Explaining something to a person (e.g. food safety practices)

☐ Mapping something (e.g. water quality, soil conditions)

What else do you generate data graphics for? Tell me everything!

6. What has been your favorite application of data, charts, or visualization that you have created?

7. What has been your favorite application of data, charts, or visualization that you have seen somewhere else?

8. Which of the following tools do you use in your Extension work?

	Often (1xWeek)	Occasionally (1xMonth)	Rarely (1xYear)	Never
Tableau	○	○	○	○
RegOnline	○	○	○	○
Eventbrite	○	○	○	○
Venngage	○	○	○	○
Adobe Creative Suite (Photoshop, Illustrator, etc)	○	○	○	○
SurveyMonkey	○	○	○	○
Google Charts	○	○	○	○
Canva	○	○	○	○
Python	○	○	○	○
Google Earth	○	○	○	○
ArcGIS	○	○	○	○
Microsoft Publisher	○	○	○	○
Google Analytics	○	○	○	○
Constant Contact	○	○	○	○
MailChimp	○	○	○	○
Excel (to make charts)	○	○	○	○
Crayon & Paper	○	○	○	○

Tell me, what tools did I miss?

9. When you think about data visualization for your work, what barriers come to mind? (Check all that apply)

<table>
<tr><td>☐ I don't even know where to start!</td><td>☐ There is not enough time to get it right.</td></tr>
<tr><td>☐ I don't have access to the right tools.</td><td>☐ I don't know who in Extension to ask for help.</td></tr>
<tr><td>☐ I don't know how to use the tools.</td><td>☐ I know who in Extension to ask, but they don't have enough time to help me.</td></tr>
<tr><td>☐ I know how to use the tools, but I don't think my designs look good.</td><td>☐ I don't have the budget to hire someone to do it for me.</td></tr>
</table>

What other barriers do you face? It's okay, let it all out.

10. What's Your Wish?! Could you tell me about a project in the near future that you wish could be enhanced with a data visualization?

11. Your Name

Why am I asking your name? *Because we want to share these results with Extension colleagues, and I may also need to follow up with you about your responses. If you wish to share any comments anonymously you can* **submit them right here***.*

THANK YOU for your time in completing this survey, it is a huge help. I will be compiling results and recommendations, but in the meantime if you think if anything else to add, don't hesitate to contact me! --Sarah Tichonuk

Appendix B: Case Study – NECAFS State Summary

NECAFS

The Northeast Center to Advance Food Safety
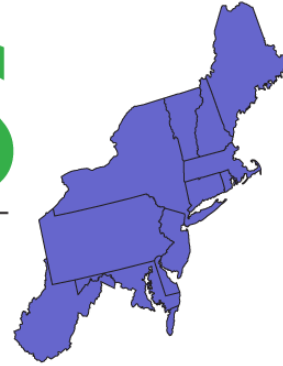
State Summary Report

February 2019

necafs@uvm.edu | 802-447-7582 x254

P.O. Box 559
Bennington, VT 05201-0559

As part of a regional effort, NECAFS works alongside the National Coordination Center (NCC), other Regional Centers (RCs) and training alliances on education and outreach efforts related to food safety and compliance with the Food Safety Moderization Act.

CONNECTICUT
- Buyer outreach through educational programs
- PSA trainings attended by most exempt growers

OUTREACH & EDUCATION

IMPACTS & STORIES

Conformance with Produce Safety Rule

CT has developed a state program "Connecticut GAP or CGAP". It is a regulatory, public health inspection program that verifies conformance to federal and state Produce Safety Laws and includes a market access piece. We are currently meeting with industry stakeholders to roll out our plans as we firm up the details.

Buyer Education

UConn Extension took the lead to organize and present a half-day informational program for retail, foodservice and restaurant produce buyers regarding implementation of the PSR. Massachusetts and Rhode Island collaborated in this effort that involved both regulatory and extension personnel.

Additional Outreach

CT Small Fruit and Vegetable Meeting, CT Water Well Association

> "*Your PSA course format was especially useful as it was over a* **two day period, allowing for feedback activities and more grower participation.** "
>
> - NY regulator

The majority of farms attending our PSA courses are **exempt** from training requirements.

UConn, URI and UMass **collaborate** to offer PSA and PCQI Trainings.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
4	94	1	13	11	2	368
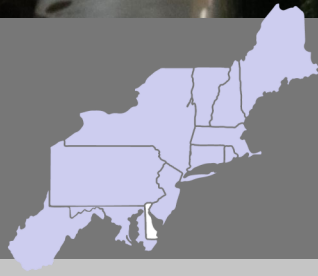
DELAWARE
- Working with growers to convert poultry houses
- FDA Commissioned study of BSAAOs

OUTREACH & EDUCATION

IMPACTS & STORIES

Grant Offsets Cost for Growers

University of Deleware has a USDA Specialty Crop Block Grant that reimburses 80% up to $1,000 of the associated costs of a successful third-party food safety audit (both USDA harmonized and commercial) as well as 80% up to $500 of the associated water testing fees. Water testing reimbursement is contingent upon successful completion of a third-party food safety audit and must include receipts.

PSA Grower Trainings Remain Popular

Deleware continues to have new attendees at PSA trainings. This is in part due to turnover, but more often due to the growing numbers of new producers entering the produce production field and interested in produce safety. Another targeted audience has been remaining large growers (mostly watermelon) that have not attended PSA training. Once watermelon growers attend, a majority of these producers make valuable changes to their packing houses, including removal of carpeted areas.

"
I need advice on buying new packing equipment to best address produce food safety.
"
- DE grower

Modifications have been made to existing packing equipment to be better able to clean and sanitize.

OFRRs have included great discussions on farm during the process.

PSA Trainings	PSA Training Participants	On Farm Readiness Review	TOTAL PARTICIPANTS REACHED
4	84	3	88

MAINE
- Creating new collaborative network
- 60% PCQI participants start plan within 6 months

OUTREACH & EDUCATION

Educational Material Developed

Educational partners created and updated more than 25 templates for farmers brand new to record keeping. These, along with other resources, are distributed on a thumb drive to all PSA training participants. For preventive controls, Maine developed in-depth overview of process validation.

Technical Assistance Follow-up to Trainings

When needed, University of Maine works with companies after a PCQI trainings on PC process validation and plan completion. Therefore, addressing their confusion and helping with implementation of supply-chain controls. OFRR follow-up technical assistance resulted in very small farmer installing new roof over washing station, another adopting a new practices around cleaning, sanitizing, and transporting knives to the field, and another improving how he cleans harvesting bins.

Additional Outreach

FSMA introduction for farmers and producers, FSMA Update at state Ag Trade Show, FSMA Update at Organic Producers Conference (MOFGA), and FSMA Overview ME Dept of Ag, Conservation and Forestry annual workshop.

IMPACTS & STORIES

*"You present ... in such a way that it is not only **interesting** but just naturally **brings up all kinds of questions**. ... People are actually thinking about what you're saying ... And that combination makes for a successful presentation.*
- Farmer participant

Produce Safety knowledge **increased** 16% (from 72% to 88%) in pre– and post-tests.

OFRRs are overwhelmingly **positive** and farmers are highly **satisfied** with their farm review.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	**TOTAL PARTICIPANTS REACHED**
7	150	3	70	29	4	**413**
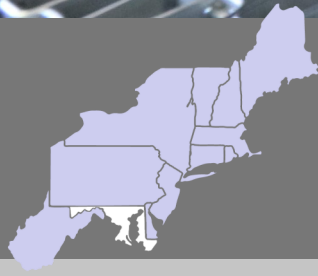
OUTREACH & EDUCATION

IMPACTS & STORIES

Grants Further FSMA Research & Education

A Specialty Crop Block Grant funded the Maryland Department of Agrigulcture's GAP food safety plan and audit to be aligned with the Produce Safety Rule. Research assesses the impact of water sample source (tidal, reclaimed, pond, non-tidal fresh) and holding time on generic *e. coli* numbers. Through another Specialty Crop Block Grant, UMD completed 3 years of on-farm environmental sampling, "Sampling on Maryland's Eastern Shore Farms: Keeping an Eye Out for Pathogens and Providing a Service to Produce Growers". A SARE Grant funded UMD Extension to work with UMD Agriculture Law Education Initiative to provide targeted GAP and recall readiness workshops and webinars to pick-your-own farms, CSA's, and farmer's market growers. Draft recall plan templates were created as part of this grant. Food Safety Outreach Program Grant "Develop & Implement A Hybrid Workshop In FSMA Produce Safety & Preventive Controls Rules For Stakeholders Growing & Processing High-Risk Produce " was completed this year.

Additional Outreach

Central Maryland Veg meeting, Southern Maryland Veg Meeting, Western Maryland Fruit and Veg meeting.

Produce Safety knowledge **increased** among 87% of participants in pre– and post-tests.

After completing the reviews, MDA inspectors noticed areas of the Rule where almost every grower was **struggling**, including: how to conduct water system inspections, covered and non-covered items/supplies need to be kept separate, how to properly train workers for specific tasks. They are now working on training docs/videos/in person in Spanish and English to **address** these issues.

PSA Trainings	PSA Training Participants	PCQI Trainings	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
3	60	3	11	11	194

MASSACHUSETTS
- Unique approach to farm registration
- Extensive collaborative efforts in MA

OUTREACH & EDUCATION

IMPACTS & STORIES

Grants Further FSMA Education in MA

The University of Massachusetts has two Food Safety Outreach Program Grants. The first, "Food Safety Management Training for Small and Emerging Food Businesses: Integrating a Food Safety Culture from Concept to Commercialization" has developed a database of 94 shared-use facilities and was used to distribute needs assessment to stakeholders, currently in the response period. Existing product development and food safety curriculum was analyzed with the advisory board to determine strengths, weaknesses, and areas for improvement. The second, "Expanding Food Safety Education in Massachusetts and Shifting from Voluntary to Regulatory Compliance" has a goal to expand the audience for farm food safety information and training, in part by collaborating with community organizations to reach new growers. Most (68%) in attendance at the PSA trainings in 2018 had never received any food safety training previously.

Lastly, UMass has a MA DoA Grant "Establish FDA approved scheduled processes for acidified shelf stable foods to increase usage of specialty crops" with the goal of increasing the production of specialty crops

This was a great course and I feel ready to dive into working on a food safety plan for my organization
- PCQI Training Participant

The majority of farms attending our PSA courses are **exempt** from training requirements.

UConn, URI and UMass **collaborate** to offer PSA and PCQI Trainings.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	Other Educational Programs	TOTAL PARTICIPANTS REACHED
5	164	3	57	6	227

OUTREACH & EDUCATION

through value-added processing. This project provides the necessary product development processes required to manufacturer acidified shelf-stable foods that will help to increase the value and help to extend the season of specialty crops including the recipe development, standard operating procedures and the required regulatory scheduled processes for 12 products.

Educational Materials Developed

Seven food safety related publications in UMass Vegetable Notes Newsletter. Food Safety for Farmers Web Tool- Sections on each of the major food safety risk areas, and resources and information to help growers comply with the FSMA Produce Rule and good agricultural practices. Do I Need to Comply with the FSMA Produce Rule?- Interactive PSR compliance tool for growers.

MDAR Projects

State Program CQP:
Checklist includes requirement of the PSR. CQP served as OFRR in 2018. Total CQP audits conducted in 2018: 85

Collaboration with buyers:
Meeting with regional buyers (annually) for an overview of MA Produce Safety Program. Buyers accepting CQP for market access. On-going direct relationship with all major retailers, wholesalers-distributors and Cooperatives in the Commonwealth and greater region procuring product from produce farms in Massachusetts.

Collaboration with buy-locals:
Collaboration with buy-locals for education, outreach and support and delivery of technical assistance and grower/buyer inquiries
Conducting joint workshops in 2018. Regionally based meetings with buy locals in 2018 + quarterly calls scheduled for 2019 for updates and collaboration.

Participation in FDA Workgroups:
Farm Inventory Aggregate Data
Inspection Prioritization

Inspection Prioritization Tool: MA participated in the Beta testing of the platform.

IMPACTS & STORIES

*"Overall, completely painless, concise, and clear instruction. Very supportive and understanding environment. I left feeling **empowered to create a food safety plan** instead of anxious, stressed, and discouraged. Thanks!"*
                    - PSA Training Participant

Instances of behavior change or adoption of practices:
- Training farm workers on food safety
- Help grower identify if sanitizer addition is necessary during post-harvest
- Development and support of grower Food Safety Plan
- Cleaning and Sanitization of harvest bins, helping grower choose a sanitizer, test sanitizer concentration, and keep logs.
- Helping grower determine work flow, proper storage of personal belongings, and proper storage of packaging material.
- Elimination of debris that harbor pests surrounding buildings
- Replacement of rusted and hard to clean packing equipment
- Keeping domestic animals out of fields and packing areas
- Addition of handwashing stations next to porta-potties in production acreage

NEW HAMPSHIRE
- Behavior change seen from many types of programmi
- NHDAMF expanding outreach efforts quickly

OUTREACH & EDUCATION

IMPACTS & STORIES

Grants Further FSMA Education in NH

The University of New Hampshire was awarded two Food Safety Outreach Program (FSOP) grants to provide additional FSMA education and assistance throughout the state. Titled: "Assisting Maple Syrup Producers to Comply with the Preventive Controls for Human Food Rule of FSMA" and "Expanding the reach of New Hampshire's food safety education and FSMA programs to include value added processors."

OFRRs Identify Educational Needs

Areas of farming practices needing improvement are identified during farm visits resulting in planning around additional educational programming to assist with: employee training records, health & hygiene education, water source management and future testing requirements.

Additional Outreach

NH Maple producers, Maple Producer Events, Small and Beginning Farmers/Processors, USDA FSA, and Farm & Forest Expo NH Veg and Berry Growers.

"*The personal interest [and] offer to work with each of us independently to help us get it right, is both generous and gracious.*"
— FSOP Workshop Participants

___

65% of participants rated FSOP grant workshop as "very useful" or "I'll put this to use immediately." **Collaborated** with URI on PCQI training and VT Ag/UVM and NE Farmer's Union on PSA trainings.

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PSA Trainings	PSA Training Participants	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
1	25	13	10	298

NEW JERSEY
- OFRRs heavily emphasized in NJ
- Lookback evaluation work began in Dec. 2018

OUTREACH & EDUCATION

IMPACTS & STORIES

New Website Developed

A new website was created, www.onfarmfoodsafety.rutgers.edu to house educational materials for producers, information on upcoming training sessions as well as the latest updates on the Produce Safety Rule. In addition, regular posts to the Rutgers on Farm Food Safety Facebook page and regular food safety blog posts on the Rutgers Plant and Pest Advisory.

Instructional Materials Created

FSMA Produce Safety modifications were reviewed and program content was finalized ensuring existing educational materials cover rule. Informational packets with new fact sheets and handouts were created for training sessions and meetings with producers. Presentations are being videotaped to be used in conjunction with voice over Power Point for use as a refresher for growers.

Additional Outreach

Eastern Produce Council Meeting to educate buyers on FSMA

The OFRRs provided feedback and helpful tips to almost every grower covering health and hygiene, pre and post-harvest procedures and worker training.

These reviews have been **great experience** for **both parties** involved.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	TOTAL PARTICIPANTS REACHED
6	179	12	211	78	468

NEW YORK
- 1,104 manufactures received resources on FSMA
- Updating inspection program to include PC & PS

Grants Further FSMA Education

Food Safety Outreach Project Grants, include "Fruits, Vegetables and FSMA Compliance: Multilingual Audiovisual Food Safety Training fro Farms and Packinghouses," " Expanding Food Safety Outreach And Education To Small And Mid-Sized Farms In New York And Vermont," and "Artisan Food Safety Coaching Workshops."

Educational Material Developed

Cornell Vegetable Program completed a research project to determine the best ways to clean some common produce washing equipment and developed factsheets on "Cleaning Produce Washing Equipment: Conveyor Washing System" and a "Root Barrel Washer Checklist."

Additional Outreach

NYSDAM is conducting educational phone calls and visits with growers in their farm inventory. Empire State Producer's Expo, Empire Farm Days, Long Island Ag Forum and the NYS Agricultural Society's Forum.

" I thought because I had a Harmonized GAP Audit done I wouldn't need an inspection. "

- NY Grower

NYSDAM and Cornell are **collaborating** to create a mentorship program to ensure team comfort and knowledge when conducting OFRRs.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
15	357	5	93	1	7	505

PENNSYLVANIA

- "Tool Box" created to distribute at OFRRs
- $45,000 saved by growers with reduced training cos

OUTREACH & EDUCATION

IMPACTS & STORIES

Grants Further FSMA Education in PA

Penn State has received two Food Safety Outreach Program Grants, including "Development of an alternative FSMA compliant produce safety curriculum for plain sect and other smaller fresh produce growers" and "Bilingual Produce Safety Educational Programming for Hispanic/Latino Fresh Produce Growers and Farmworkers in Pennsylvania."

Materials Developed through Grants

Completed Amish slide set book. Developed and translated existing fact sheets ("Reducing Risk Ag Fact Sheets series": -Safe Uses of Agricultural Water, -Worker Health and Hygiene, -Reducing Risks from Animals and Manure , -Reducing Food Safety Risks during Harvest, -Reducing Food Safety Risks in the Packhouse). Power Points on: A) Basics of GAP; B) Workers Health and Personal Hygiene; C) Introduction to Pathogens in the Environment - Pre and Post Sources of Contamination. Creation of Spiral book and factsheets and translation to Spanish on: A) Basics of GAP; B) Workers Health and Personal Hygiene; C) Introduction to Pathogens in the Environment - Pre and Post Sources of Contamination.

" Our OFRR program has helped us to debunk all their fears and we now see the "sigh of relief" from our farmers after our OFRRs. "

- PA regulator

Working together with Penn State, FDA and selected Pennsylvania farmers, an article highlighting the OFRR program will be published in the winter addition of the Penn State "AgScience" magazine.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	**TOTAL PARTICIPANTS REACHED**
17	529	8	190	151	7	**1048**
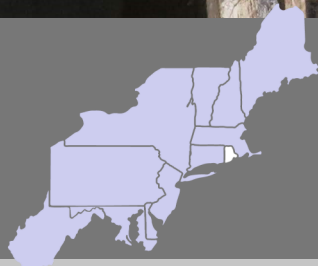
RHODE ISLAND

- Several unique grants serve RI producers and processors
- Development of educational materials underway

OUTREACH & EDUCATION

IMPACTS & STORIES

Grants Further FSMA Education in RI

URI has several grants supporting the produce and processing industry in the state, including an FSOP Grant "Food safety management training for small and emerging food businesses: Integrating a food safety culture from concept to commercialization," an AFRI Grant "Defining and overcoming economic factors hindering adoption of food safety practices by small and medium sized farms in the New England region," a Specialty Crop Grant "Rhode Island Good Agricultural Practices: Produce Safety Alliance," and a USDA Regional Project "Enhancing microbial food safety by risk analysis."

Educational Material Developed

Produce Safety Program is currently in the process of developing rack cards (designed for farm staff), a qualified exemption calculator™, on-farm food safety signage, and multi-lingual resources.

Additional Outreach

PSR for Buyers, PSR Update with RIDOH for public health work group at RIDOH, Yankee Conference for Environmental Health Produce Safety Rule and PCHF review, Post-Harvest Handling and Storage.

> " *I plan to install one water pump instead of two to simplify my water testing regime.* "
>
> - RI Produce Grower

RI GAP audits and OFRR reviews show an **increase** in practices to improve food safety, such as adding a division between the designated employee break and packing area and multiple

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PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
3	53	3	76	8	5	**343**

VERMONT
- Awarded $74k in produce safety improvement grants
- Tested surface & ground water on produce farms

OUTREACH & EDUCATION

IMPACTS & STORIES

Produce Safety Improvement Grant Program Addresses Risks

VT produce growers have addressed numerous produce safety risks and adopted practices that has improved food safety on the farm including, but not limited to: enclosed wash/pack facilities to reduce the risk of pest intrusion; upgraded to stainless-steel and easy-to-clean surfaces to improve cleaning and sanitization of equipment; add floor drains to reduce standing water; increase produce safety hygiene signage around the farm to inform employees and visitors on where to access hand-washing stations.

Educational Material Developed

Post Harvest Case Studies at Mighty Food and Footprint, Factsheet/Blog posts on equipment including: Hoses, Bins, Floors, Spinners, Rats and Rodents, and Surfaces.

"This grant was an incredible boon for us. We had been really hoping to do this project and looking for the money to make it happen, so more grants of this type would be great. The feedback that we have gotten from our customers has been so positive."
- Sweetland Farm, VT

Following **direct technical assistance on-farm**, 31 producers have clarified plans for upgrades to their packshed.

The VT-CAPS program provides an **early entry point produce safety** program that benefits from **voluntary, peer review and support**.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	TOTAL PARTICIPANTS REACHED
2	46	6	130	18	144
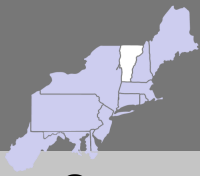
Direct Technical Assistance Results in On-Farm Changes

Multiple farmers, following direct technical assistance, have implemented many upgrades to their packshed in the realm of produce safety including: concrete floors, floor drains, durable/cleanable walls, rinse conveyors, and increased pest control plans. A few examples include:

During a wash-pack shed planning consult we outlined a rough plan for a wash pack shed on their home farm. At that time, they were washing and packing out in the open with mud and poor drainage. This visit prompted them to apply for and receive a $10k VAAFM PSIG grant. A follow-up call helped them refine plan and they are currently under construction. Based on this visit, they also intend to complete VT-CAPS Plus, and schedule an OFRR in the summer or fall.

Direct technical assistance with one producer enabled conversations between them and their builder / concrete contractor regarding trench drain design in their new facility. This specific application required some nuanced consideration for flow and elevation as well as attention to details regarding planning for cleaning.

Direct technical assistance another during farm visit helped alleviate concerns of the producer about the need for a total tear-down and rebuild of their cooler. The existing conditions were reviewed with the producer and relatively minor recommendations were made to improve.

Finally, technical assistance helped the farmer design and plan for a new, covered loading dock on the west side of current barn that was installed this fall.

## Grants Further FSMA Education in VT

USDA FSOP "Expanding Food Safety Outreach And Education To Small And Mid-Sized Farms In New York And Vermont." USDA SCRI Eastern Broccoli Project in collaboration with Cornell and others. As part of the Eastern Broccoli Project, extension educators attended hygienic design of equipment training, which will used to develop future factsheets tailored to the produce industry.

I'll say that [the grant] was the impetus for finally tackling issues that we wanted to address but kept putting off. Increasing our awareness of food safety issues has made us a better farm, and now we have the tools to do the job right.

- Cate Farm, VT

The new structure eliminates the risk of contamination from overhead and the stainless-steel sink and counters can be thoroughly cleaned and sanitized.

- New Leaf CSA, VT
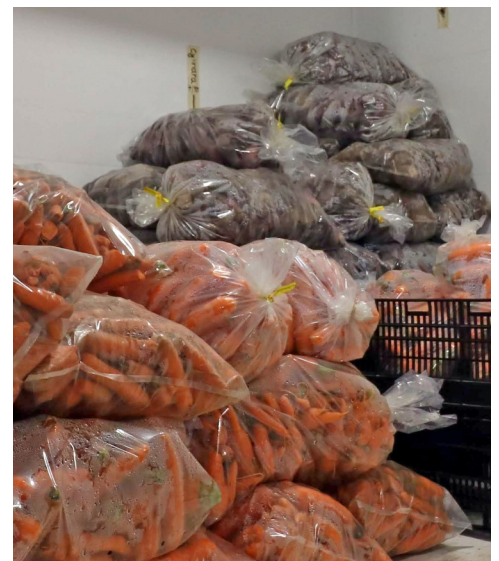
WEST VIRGINIA

- SPGP funding leveraged into additional work
- Seeing increase in new farmers passing audits

OUTREACH & EDUCATION

IMPACTS & STORIES

FSMA Educational Efforts Merge with other Programs

West Virginia Department of Agriculture offers Writing Your Farm Food Safety Plan trainings with the goal to provide an efficient and regulatory-accepted record keeping system to follow up PSA Grower Training and dual usage—FSMA/GAP while providing framework for additional audits/ inspections including Organic certification & GAP-Harmonized Plus. WV Dept of Ag is also providing a training called "Responding to Food Emergencies" (ICS Course) with the goal to interface with the state emergency response system and local EMS coordinators to incorporate produce/ food safety resources by the Department and the WV Farm Food Safety Training Team in the event of a food/water-based outbreak scenario.

Additional Outreach

Sprouter Training, Emergency service providers (100) at ICS training, Farm Bureau, State Fair, Pumpkin Festival, County meetings, Small Farm Conference, and Mountain State Art and Craft Fair

"There are areas within West Virginia where nutritious snacks may be hard to find, so by helping a local farmer consistently and safely produce a desirable product that they can sell within the community helps everyone take the right step forward.

- Litha Sivanandan, WVU

A student who attended WVU fruits and vegetables drying workshop has **successfully established** his own business in dried foods for pets.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	Other Educational Programs	TOTAL PARTICIPANTS REACHED
8	87	3	50	8	255

OUTREACH & EDUCATION

IMPACTS & STORIES
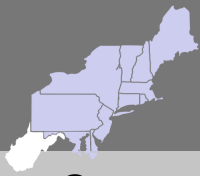
Publications

The WV Dept of Ag has dedicated six columns in the *Market Bulletin*, a newsletter for farmers and those interested in farming, to food safety. They have also published a catalog of decision trees.

Resulting from Special Project Grant Program funding, WVU published two peer-reviewed research papers, 1.)"Effects of liquid smoke infusion on osmotic dehydration kinetic sand microstructural characteristics of apple cubes" – published in the journal of Food engineering, and 2.) "Microbial shelf stability assessment of osmotically dehydrated smoky apples" – published in Food Science and Technology.

Grants Further FSMA Education in WV

WVU was recently awarded an AFRI Grant ""Improving Manufacturing Method for Production of a New Smoky Dried Apple Snack and Promoting Small-Scale Fruit Drying Businesses to Process Unsold Apples in West Virginia."

Formal subawards to WVU from WV Dept of Ag for programming and OFRRs are expected in 2019.

" At first I did not want to do a virtual class, but I actually really enjoyed it and felt like it was a real classroom experience where I was able to interact with other participants and the instructors on lots of examples. "

— PCQI Course Participant

The state has seen an increase in **new and beginning farmers** successfully **passing a GAP audit**.

Visit from **Produce Safety Network** staff resulted in the development of programming unique to WV, including working relationship with other agencies and the building of program technical capacity.

**TOGETHER, in 2018
the NECAFS Network...**

DELIVERED **503**
TRAININGS

REACHED **4,291**
PARTICIPANTS

NECAFS
The Northeast Center to
Advance Food Safety

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs
75	1,828	45	840	323	60

NECAFS
The Northeast Center to Advance Food Safety

The Northeast Center to Advance Food Safety is a collaboration among 12 states and the District of Columbia which aims to jointly advance understanding and practice of improved food safety among the region's small and medium sized produce growers and processors.

go.uvm.edu/necafs

Appendix C: Case Study – UVM Extension at a Glance

[Graphic is pending final design and review.]

Appendix D: Project Poster

Presented at UVM Student Research Conference, April 17, 2019, Burlington, VT

UNCHARTED TERRITORY

UVM Extension
Data Visualization Needs Assessment
Graduate Project, Food Systems
Sarah E. Lyman

GOAL: ELEVATE DATA VISUALIZATION AT UVM EXTENSION

Which data visualization tools and skills are used at UVM Extension?

What barriers are impeding our best possible work?

LITERATURE REVIEW

Visuals
- Are more efficient than text.
- Reflect historic changes in the way we organize data.
- Are powerful storytellers.
- Are occasionally measured, but more often are designed from intuition.

> When people hear information, they retain only 10% of it three days later; **by simply adding a picture, they remember 65%.**
>
> - J. Medina, 2014

METHODS

Data Viz at UVM Extension
A non-anonymous ONLINE SURVEY was sent to all UVM Extension researchers and staff to query their current usage and perceived barriers. I conducted an INTERVIEW with a data visualization expert, and with a UVM Extension leader. Two CASE STUDIES provided real-world application of design best practices.

RESULTS

My UVM Extension colleagues
- Feel data visualizations are important to their work.
- Use numerous software platforms to create graphics.
- Generate data visualizations for a wide range of purposes.
- Are inspired by a wide range of external sources.
- Do not feel confident in their ability to create the type or quality of graphic they desire, and do not always know where to turn for assistance.
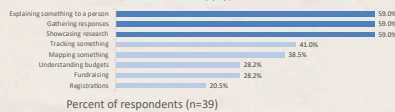
In Designing Data Visualizations
- Time is the perennial barrier.
- The question or story drives the graphic.
- Software selection and access are critical to effective visualization and communication.
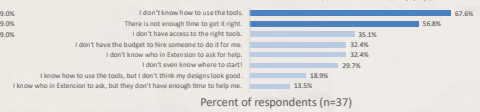
> **I would like support** creating graphics and using data visualization ... **but I don't have the skills or time to do it myself.**
>
> - UVM Extension colleague

**In your Extension job, do you ever use data graphics for** (check all that apply):

Explaining something to a person	59.0%
Gathering responses	59.0%
Showcasing research	59.0%
Tracking something	41.0%
Mapping something	38.5%
Understanding budgets	28.2%
Fundraising	28.2%
Registrations	20.5%

Percent of respondents (n=39)

When you think about data visualization for your work, what barriers come to mind? (check all that apply)

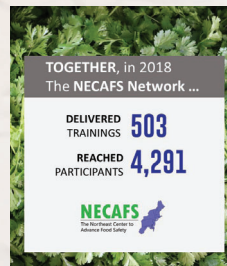|	
I don't know how to use the tools.	67.6%
There is not enough time to get it right.	56.8%
I don't have access to the right tools.	35.1%
I don't have the budget to hire someone to do it for me.	32.4%
I don't know who in Extension to ask for help.	32.4%
I don't even know where to start!	29.7%
I know how to use the tools, but I don't think my designs look good.	18.9%
I know who in Extension to ask, but they don't have enough time to help me.	13.5%

Percent of respondents (n=37)

Case Study
The challenge: display 12 states' annual food safety program data in a concise report, and PowerPoint presentation.
- Use big images.
- Highlight anecdotes.
- Aggregate numbers into "infographic" format.
- Prioritize data visualization from the start.
- **Include a designer in the project planning.**
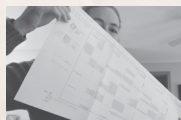
Case Study. *Raw annual data from the Northeast Center to Advance Food Safety (above) was condensed into final aggregate statistics (right), and a newly designed report (far right).*

TOGETHER, in 2018
The NECAFS Network ...

DELIVERED TRAININGS **503**

REACHED PARTICIPANTS **4,291**

NECAFS
The Northeast Center to Advance Food Safety

RHODE ISLAND
- Unique grants serve R.I. producers and processors
- Development of educational materials underway

OUTREACH & EDUCATION

Grants Further FSMA Education in R.I.
URI has several grants supporting the produce and processing industries in the state, including an FSOP grant, "Food safety management training for small and emerging food businesses: Integrating a food safety culture from concept to commercialization"; an AFRI grant, "Defining and overcoming economic factors hindering adoption of food safety practices by small and medium sized farms in the New England region"; a Specialty Crop grant, "Rhode Island Good Agricultural Practices: Produce Safety Alliance"; and a USDA Regional Project, "Enhancing microbial food safety by risk analysis."

Educational Material Developed
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Additional Outreach
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IMPACTS & STORIES

> *I plan to install one water pump instead of two to simplify my water testing regime.*
>
> - R.I. Produce Grower

R.I. GAP audits and OFRR reviews show an increase in practices to improve food safety, such as adding a division between the designated employee break and packing area, and multiple handwashing stations for U-pick.

PSA Trainings	PSA Training Participants	PCQI Trainings	PCQI Training Participants	On Farm Readiness Review	Other Educational Programs	TOTAL PARTICIPANTS REACHED
3	53	3	76	8	5	343

RECOMMENDATIONS

IMMEDIATE
Facilitate professional development in data visualization for UVM Extension staff and faculty.

MID-TERM
Explicitly prioritize high-quality data visualizations in UVM Extension work.

LONGER-TERM
Centralize UVM Extension communications.

RESOURCES TO TAKE AWAY
I compiled a data visualization resource guide for you. Download the PDF:
go.uvm.edu/dataviz

WORKS CITED
Just a few favorites: Stephanie Evergreen, Stephen Few, Manuel Lima, Florence Nightingale, Garr Reynolds, Hans Rosling, Edward Tufte

Appendix E: Workshop "Uncharted Territory: Visualizing Data at UVM Extension"

Delivered at the Extension Professional Improvement Conference (EPIC), May 7, 2019, Woodstock, VT

View presentation at Prezi:

prezi.com/gwkbvx_jd87x/uncharted-territory-visualizing-data-at-uvm-extension/

Approximately 34 attendees

Appendix F: Resources to Take Away

UNCHARTED TERRITORY
UVM Extension
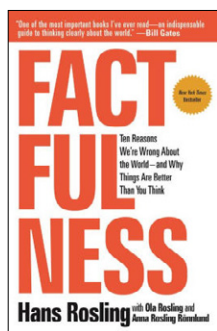## data visualization
## resources
to Take Away

Sarah E. Lyman

Get Inspired (Dreamy Data Viz)

TALK www.ted.com/speakers/hans_rosling
The late global health researcher Hans Rosling was a master with data and storytelling. He combined the simplest visuals (cardboard boxes!) with his robust software to create some of the most engaging TED presentations available.


BOOK *Factfulness; Ten Reasons We're Wrong About the World and Why Things are Better Than You Think*, Hans Rosling, Anna Rosling Rönnlund, Ola Rosling (2018)
Rosling was adamant that today's hyperbolic news not be our only source of information: we should use data to form our view of the world. *Factfulness* helps us understand our proclivity toward certain biases, and how to avoid them.
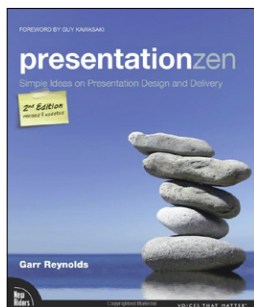
BOOK *Presentation Zen: Simple Ideas on Presentation Design and Delivery,* Garr Reynolds (2nd Ed, 2011)
Reynolds demonstrates how the correct visuals make your presentations far more engaging and memorable. Don't just throw together a slide deck; tell a great story.
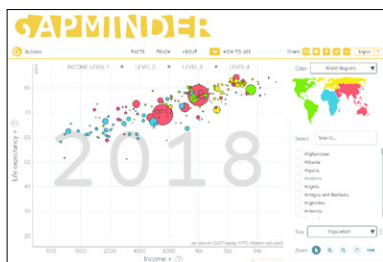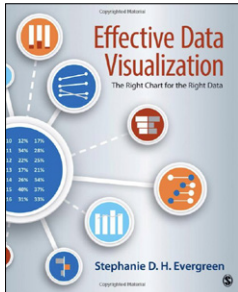

WEBSITE Gapminder.org
This extraordinary open-source database contains too many global development data metrics to list. Includes employment, education, economy, public health, agriculture, nutrition, sanitation, traffic, and CO_2 emissions.
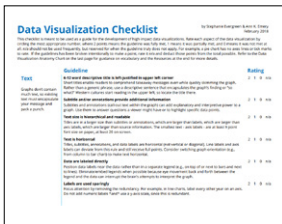
Get Down to Work (How to Do Stuff)

BOOK *Effective Data Visualization: The Right Chart for the Right Data,* Stephanie Evergreen (2017)
If you can only get one book on data viz, get this one. Evergreen applies her research background to this step-by-step guide for building great charts using Excel. Available at UVM Howe Library. 2019 edition forthcoming.

WEBSITE & PDF datavizchecklist.stephanieevergreen.com
Stephanie Evergreen's interactive data visualization checklist is great. Upload your graphic and have her tool grade it, or keep her downloadable checklist PDF handy when designing.
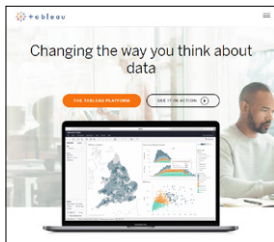
LEARN TABLEAU PUBLIC www.tableau.com/learn/starter-kits
Your data must be suitable for public access (you upload it to the cloud and your vis is public). If you have the time to learn this powerful tool, you will be able to produce complex beautiful digital graphics which can be embedded on your website.

WHICH CHART?
linkedin.com/pulse/60-charts-visualize-yourdata-wenjun-wu
There are lots of these chart selectors out there, but Wenjun Wu has compiled it all into one attractive format.

CHART DESIGN TOOLS
There are so many out there - some free, some paid - what's the best one? *I have no idea!* But I have had luck with these few:
Datawrapper: datawrapper.de
Free until you exceed 10,000 chart views.
Venngage: venngage.com
Free option; paid account removes Venn logo, allows exports.
Visually: visual.ly
I go here to ~~drool over~~ find inspiration from their portfolio.

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Drop me a note with any questions, and be sure to share your designs with me!