Data feminism and agriculture

# Abstract

Agricultural systems are a function of complex institutional structures that have historically had, and continue to have, power imbalances embedded within them. The seven principles of data feminism were developed for data scientists to aid in identifying, examining, and addressing power inequities related to data generation, interpretation, and dissemination. We believe these principles provide an accessible, but under-utilized framework for helping agricultural researchers understand, acknowledge, and address power inequities prevalent in our discipline. Here we present three themes in which we interpret the tenets of data feminism specifically in the context of agricultural research: power, reciprocity, and framing. Many researchers already apply these principles in their work, but we hope that providing this explicit framework in an agricultural context will make this work more intentional, visible, and ubiquitous. We posit that applying these principles concomitantly fosters creativity, leading to better outcomes for sustainable agriculture as a whole.

# Introduction

## Issues and concerns with data and power in general

In a broad sense, the intersection of data and power has become a focal point of global discourse and concern (CITE). Issues arise along the entire data lifecycle, from data provenance to utilization, and include a suite of complex interactions that require novel ethical, technical, and regulatory considerations (CITE). The emergence of novel issues surrounding data and power has catalyzed the creation of innovative academic fields dedicated to understanding and addressing these complex dynamics. Fields such as data ethics (CITE), algorithmic accountability (CITE), and critical data studies (CITE) interrogate the ethics and power structures embedded within algorithms. Data justice (CITE) and techno-politics (CITE) explore how data and power intersect within socio-political contexts. These themes have not been isolated to academic realms; numerous books, films, series, and art pieces grapple with tensions between power distribution in data-driven societies. Many of these concerns arise from the understanding that without intentional examination of these issues, existing power differentials will likely be exacerbated, and new ones will be created (CITE). In a time when human ingenuity is arguably most needed (CITE), this could further deny vast numbers of people the ability to fully realize their potential contributions to society (CITE).

## Technical researchers’ role

Researchers and scientists in technical fields have traditionally operated under the assumption of value-neutrality, relegating ethical considerations to separate domains while technical advancement is pursued independently from such considerations. However, researchers are increasingly having to contend with the potentially profound ethical and social implications of their work as it relates to data and power (I`CITE). As such, researchers must become adept at recognizing their role in either reinforcing or challenging existing power differentials. This new awareness has been primarily discussed within the context of domains such as technology, health care, and criminal justice (CITE). We argue that despite power being a particularly salient theme within the agricultural sector, less awareness has been built within the agricultural research community concerning the intersection of agricultural research, data, and power.

## Agricultural research

Like all research, agricultural research is built upon data.

TALK MORE ABOUT HOW PEOPLE HAVE THOUGHT ABOUT DATA ISSUES IN THE PAST IN AG.

However, it is only recently, and mostly in the context of ‘big data’ have researchers begun to reflect on ethical issues regularly. Discussions about ‘big data’ and/or ‘data science’ in agriculture start to appear in the literature in the 2010s. Many of the highly cited papers mention data privacy issues, but ethical or power-related implications are not discussed in depth, if at all, and to our knowledge little guidance is given regarding *how* to consider such implications (e.g., XXXX). There is an implicit assumption that those considerations remain outside the scope of technical agricultural research.

This gap has been acknowledged within the larger food studies community, and methods for addressing concerns about power distribution and fairness are becoming codified within the field of agroecology (MacInnis et al. 2022, the European principles, is there something from that big meeting that happened in the US that I’m salty about not being accepted into?). The Agroecology Research-Action Collective has published an excellent resource with Principles and Protocols for scholar-activists but are framed in the context of social science (Wit et al. 2021). Agricultural researchers may not self-identify as scholar-activists, and scientists working in the physical science realms may have unique needs with regards to guidance on these topics.

The tenets of data feminism were developed in response to a need for tools that foster awareness about the interactions between power and data science (D’Ignazio and Klein XX). The principles provide guidance on how to approach data science with an explicit acknowledgement of the power imbalances the work is embedded within, and therefore foment reflection on the ethical implications of the work. The principles are designed to be domain-agnostic, and the book has been highly cited by a range of disciplinary contexts. However, to our knowledge, it has had limited interpretation in the context of agriculture. A recent paper evaluated the United States Department of Agriculture’s National Agricultural Statistics Service data reporting practices through the lens of data feminism, demonstrating the utility of such approaches for fostering creative problem solving in agricultural institutions (Rissing).

The goal of this paper is not to reiterate the principles laid out by D’Ignazio and Klein (XX). Nor do we intend to suggest one set of guiding principles is superior to another. Rather, our aim is to offer our interpretation of the principles of data feminism specifically in the context of agricultural research involving the physical sciences. In this paper we interpret the principles within three umbrella themes of power, reciprocity, and framing. Under each theme, we provide evidence that their consideration leads to more impactful and transformative research outcomes.

# Theme 1: Examining and challenging power disparities

## Historical perspective

Agriculture has a unique relationship to power inequities compared to other domains. At its most fundamental level it involves the cultivation of land to produce food, which is an essential resource for human survival. Therefore, its very existence invites a potential power inequity: those who control access to land hold significant power over others’ access to food. Indeed, there is a large body of scholarly work suggesting the advent of agriculture played a pivot role in the formation of social classes, and in shaping the dynamics of inequities and hierarchies in human societies (Isett and miller, diamond, against the grain, child, marx). In addition to resource requirements, other broad features of agriculture likewise invoke potential power inequities. Farming is labor-intensive, and therefore invites opportunities for labor exploitation (CITE); agriculture has large-scale environmental impacts that can disproportionately burden certain communities (CITE); agricultural interests influence public policies related to land use, taxation, trade, insurance, environmental standards, and subsidies (CITE); cultural hegemony built on agriculture legitimizes beliefs about landownership, property rights, stewardship, and dictates which voices are marginalized (CITE).

## Modern expressions

The study of how historical legacies of power imbalances manifest today falls under various academic disciplines. While it is important to recognize how modern systems legitimize or challenge historical power artifacts, it is not reasonable to expect an agricultural scientist to be an expert in these topics. However, conceptual tools such as [give more examples], and the matrix of domination (XX) have been developed to aid non-experts in dissecting where and how power inequities may manifest.

### Table x. Domains through which power is expressed and experienced (adapted from XX)

|  |  |  |
| --- | --- | --- |
| **Domains** | **Description** | **Select modern agricultural example** |
| **Structural domain** | Organizes distribution of power through laws and policies | The budgets of the black land grants? The heirship laws in the south? |
| **Disciplinary domain** | Administers and manages distributions of power by implementing and enforcing (or not enforcing) laws and policies | Pisgah suit about usda resources, the NASS survey issues? |
| **Hegemonic domain** | Circulates ideas related to power | Land Grant Universities extension systems staffed by white men to help white men  Techno-focused solutions |
| **Interpersonal domain** | Individual experiences, expression, and awareness of power | Being a woman doing ag field work paper? Andrea/Angie’s paper? |

## Challenging through research

This is not an all-inclusive list. It is meant to provide inspiration, and to demonstrate its utility.

### Technical audits

Identifying areas of inequities requires domain knowledge...Andrea Rissing’s NASS paper?The Canada soil inequity paper

### Listening to and serving the margins

Women land owners, Matt Liebman’s Marsden Farm, Tom Kaspar (maybe I’ll cite my podcast!). David might have some examples from the south.

### Legitimizing other’s knowledge (see Framing as a strength)

Disparities between university and farmer field trials (Andrea’s cc thing, Seig Snapp’s thing, Anabelle Laurent’s thing). Stefan’s field workable days, iowa nitrogen project, others…

***Random notes and thoughts, ignore***

***Future NRCS staff are not trained to think about women as land owners. Impacting their education while also understanding women’s conservation needs.***

***Shifting the power to the farmers to collect data that is meaningful to them.***

***Listening to minoritized farmers.***

***When working on an agricultural problem, it is imperative to understand the relations of power Who owns land, who manages land, who works the land***

***Identifying who is being minoritized, and amplifying their challenges, their perspectives, and their needs is a baller thing to do. For example, the national narrative in the United States is that land is owned by white men. Technical audits are useful tools for separating power narratives being . The Midwestern United States contributes XX of the world’s maize and soybean production on a yearly basis, and contains some of the most productive and expensive arable land in the US. A recent estimate showed XX% of this land is owned (and an additional xx% co-owned) by women (CITE). In XX NASS allowed for more than one person to identify as a farmer-operator, data suggested XX% of farm operators were male, Women were not permitted to own land until XX, and culturally are often not seen as capable of making farming decisions***

***Women land-owners represent a minoritized group. By using a technical audit to examine power***

For myriad reasons, researchers may not have the ability, resources, or power to do research that aligns with their desires to directly challenge power. However, the way you do research can also present an opportunity to redistribute power more equitably. The next two sections present guidance relating to the way in which research is done.

# Theme 2: Reciprocity in farmer relations

*RA Fischer’s launch of statistics in agricultural research plots…issues with his context could be discussed.*

For over a century, plots managed by researchers have been utilized for controlled experiments, allowing researchers to isolate variables and study specific phenomena while controlling for other factors. However, as agricultural research has evolved, there has been a growing recognition of the importance of conducting trials at the farm scale to better understand how research findings translate into real-world agricultural systems (CITE). Furthermore, advances in the ability to organize and streamline data collection from farm environments has opened the door for more nuance in blending research plots with farm fields to answer novel research questions. There are significant opportunities for performing better, more statistically powerful, and more relevant public research in collaboration with farmers (igancio’s paper, laila’s, mother daughter stuff, participatory breeding thing). However, these arrangements require careful consideration to support equitable and fair power relations.There are numerous guides for farmers on conducting on-farm research (Stefan’s list). However, to our knowledge, there are fewer resources suggesting best practices for the scientists, researchers, and organizations the farmers may be collaborating with in their research efforts. The Agroecology Research-Action Collective’s Principles and Protocols provide useful guidance on working with communities and organizations in general (de Wit et al. 2022), however we feel the researcher-farmer collaboration merits explicit attention.

## Compensation

The context for farmer involvement in research can vary widely. For example, a project may be initiated by a university researcher and the farmer is only expected to contribute land and management of the crop, wherein the research is ‘owned’ by the university (cite some of Francis’s work, need to read that book again). In another arrangement, farmers may simply give researchers access to data previously collected on their farms. Alternatively, farmers may initiate a research project, with the researcher contributing coordination or data analysis. Regardless of the degree of involvement, farmers should be compensated. The form this compensation takes is particularly germane to this paper’s topic of power.

In many on-farm research arrangements, farmers are compensated by ‘the experience and knowledge gained from the activities,’ ‘access to research findings,’ or a similarly non-tangible exchange (CITE something, I know this is UC Davis’ mode of action). This practice is elitist, extractive, disrespectful, and in the authors’ opinions, unacceptable. Participating in research projects requires farmers to allocate significant time, resources, and land for experimentation and coordination of data collection. Projects should provide tangible compensation that acknowledges the farmer’s investments and sacrifices, ensuring fair remuneration for their professional contributions to the research process. Fair compensation also fosters mutual respect and builds more equitable partnerships that are more likely to be sustained in the long-term. Furthermore, failing to provide compensation further exacerbates historical biases, favoring well-resourced farmers in access to on-farm research activities.

Monetary compensation is the most direct, and often preferable, form of compensation. Paying farmers for their participation in research has been shown to promote a climate of mutual respect between farmers and researchers (Thornley 1990). Since its inception in 1985, the farmer-led, non-profit group (STEFAN, what is the official category of PFI?) Practical Farmers of Iowa has incorporated farmer payments in grant proposals, wherein a farmer received a set dollar amount for conducting an on-farm trial, and 1.5 times that amount if the trial included a farm tour open to the public (Liebig paper). The farmer cooperator program is still in operation after 37 years, a fact attributed in part to the policy of monetarily compensating farmers for their participation in on-farm research.

There are fair criticisms of using monetary compensation for farmer’s collaboration, include warping of incentives, and creating selection biases towards those who are not truly interested in the research. While these unintended artifacts are indeed possible, we feel XXX.

Monetary remuneration may often be preferable, but we recognize it may not always be possible. The reality of funding limitations and grant restrictions on how monies are spent necessitates exploration of other methods of compensation. ‘Work a day’ compensation, wherein researchers offered to work on the farm for some period of time in exchange for research collaboration, showed benefits to both participating farmers and university researchers (Liebig et al. 1999). In this same vein, the Agroecology Research-Action Collective identifies two practices within the principle of fair resourcing that directly mirror these views – that researchers should provide remuneration of partners for time and expertise, and that researchers should provide valuable work that could include digging fence holes (de Wit 2022). However, the high degree of mechanization on many farms and liability issues may restrict this to unique situations. A recent on-farm study comparing precision nitrogen management approaches found most farmers would not have participated without payment, but they also appreciated the technical training and assistance that accompanied the project (Laila’s paper). Alternatives such as training opportunities, technical assistance, provision of inputs, or in-kind support may be acceptable alternatives to monetary compensation, but should be considered carefully, and exact dollar values on the compensation should be calculated and communicated. Arrangements wherein a donation is made on behalf of the farmer as compensation also merit careful deliberation (I remember some program that did that…PFI may have thought about this). Without deep considerations of the context, issues concerning choice and control, transparency, cultural sensitivity, perceived influence, and perceptions of tokenism of this practice may undermine good intentions.

*Public funding sources, and private sources committed to fair and equitable research activities, should explicitly provide funding for monetary compensation of farmers and require remuneration of farmers for their participation in research projects, xxxx*

## Metrics for success

In addition to fair, preferably monetary, compensation, both researchers and farmers should aim for relationships beyond simple transactions (**Figure X**). We believe many researchers strive to build rich relationships with their farmer collaborators, however they often lack metrics that help them articulate and measure that success. Building on recommendations made from data feminism (D’Ignazio and Klein XX), we suggest the following four metrics be incorporated into project evaluations:

1. Was trust built?
2. Were power and resources shared?
3. Did learning happen in both directions?
4. Were both entities transformed as a result of the collaboration?

Incorporating these metrics *a priori* can help guide activity planning and help ensure anticipated outcomes are aligned within a relationship of reciprocity.

A collage of images of a farm and a building

Description automatically generated

***Figure X.*** *Expanding the metrics used to evaluate project success can aid in enriching the collaborative process for both farmers and researchers. (A) A simple, transactional, and un-equitable exchange of resources wherein the metrics of project success may be measured in ‘increase in knowledge’ by the collaborating farmers. (B) A richer relationship built on exchanges and associated metrics that, although more difficult to measure, promote fair, effective, and sustainable collaboration relationships.*

The success of this type of model can again be demonstrated by the longevity of the Practical Farmers of Iowa (hereafter shortened to Practical Farmers) on-farm research program, which has been in place since 1987. Practical Farmers *…. Stefan can help here. As the program has grown, I think the evaluations have likewise grown to include information about the learning, trust, and transformation that was exchanged, and that feedback has been taken very seriously and allowed the program to continually adjust to meet its goals.* Other researchers and entities likely utilize some form of these metrics, but to our knowledge they are not widely employed by granting agencies or at an individual researcher level.

In this section on reciprocity, we have concentrated on designing equitable farmer-researcher relationships. However, many of the ideas presented are not exclusive to this type of relationships. All relationships contain the potential for power inequities, and intentional examination can lead to better collaborations, regardless of the form. Researcher-researcher collaborations, for example, may contain power inequities based on seniority, discipline, perceived prestige, etc. BLAH BLAH.

# Theme 3: Framing as a strength

Objectivism in science has always been surrounded by rigorous philosophical debates (CITE). However, more recently those debates have expanded outside of the field of philosophy as scholars and activists draw attention to the historical roots of scientific objectivity and its entanglement with colonialism, racism, and other forms of oppression.

As a corollary, the acknowledgement of how value systems impact approaches to problems, and perceived solutions has grown. In ‘The Wizard and the Prophet’, a white man explains how two other white men

STOP

## XX is the new objectivism

What is a ‘workable field day’? Let them decide for themselves.

In , we draw a distinction between ‘biases’ and ‘framings’. The life experiences an individual researcher carries with them into their work

Your background frames your work, it does not bias it.

By seeking to eliminate bias, we are insinuating it is possible, and are concomitantly quelling what our own experiences can proffer to our work.

We argue that adding a more diverse set of framings creates a more complete picture of the ‘truth’. Uhh this needs help.

Ironically, although the worldviews of the two example figures are divergent, they represent those of two American males of European descent as written by an American male of European descent. This demonstrates how even classical delineations such as race and gender portend very little in regards to value systems, and lends us to imagine the insight that would be gained from adding more framings.

"The Wizard and the Prophet" delves into the divergent worldviews of two influential figures in environmental thought, Norman Borlaug and William Vogt, to illustrate how underlying value systems shape individuals' perspectives on solutions to global challenges. Borlaug, the "Wizard," embodies a technocentric worldview that prioritizes technological innovation and human ingenuity as the means to address environmental issues, advocating for intensive agricultural practices and increased food production to sustain a growing population. In contrast, Vogt, the "Prophet," espouses a more ecocentric philosophy, emphasizing the need for conservation, population control, and sustainable living to mitigate environmental degradation and ensure the long-term health of the planet. Through the exploration of these contrasting visions, the book illuminates how personal values and beliefs influence one's approach to problem-solving and underscore the complexities inherent in addressing pressing global issues.

Charles C. Mann, the author, is a white man, and that both Norman Borlaug and William Vogt, the central figures of the book, are also white men. This lack of diversity in authorship and subject matter has been seen as limiting the range of perspectives presented in the book

*Scholars and activists have drawn attention to the historical roots of scientific objectivity and its entanglement with colonialism, racism, and other forms of oppression. Reexamining the history of science reveals how certain knowledge systems and perspectives have been marginalized or excluded, prompting a critical reassessment of scientific practices and norms.*

Researchers are encouraged to critically examine their assumptions and biases, engage with diverse perspectives, and communicate their findings transparently. By acknowledging the limitations of scientific objectivity and striving for a more inclusive and reflective approach to knowledge production, scientists can work towards a more robust and socially relevant scientific enterprise.

* + 1. **Wizard and the Prophet, they are both demographically very similar, but have very different values and histories that are expressed in their world framing**
       1. **No such thing as an objective scientist**
    2. **Embrace your framing, it is there whether you acknowledge it or not**
       1. **Example? Need to think of a good one.** 
          1. **Do cover crops reduce weeds?**
          2. **Are cover crops as effective at reducing weeds as herbicides?**
          3. **Different framing, could have same figure, your figure should say why you are including it, what your take-away is. Maybe use PFI?**

## Contextualize (don’t be a big dick data ninja)

On the flip side of this coin, researchers should respect the framings that create data.

There are numerous initiatives that advocate for free and open sharing of data generated by governments, industries, and research institutions ((CITE). The open science movement champions the ethos of transparency, collaboration, and accessibility in scientific research; as a corollary the movement promotes the unrestricted sharing of data (CITE). Additionally, there are similar efforts surrounding open government data . Indeed, the sharing of data has facilitated more efficient use of resources for research through data re-use (Piwowar), and in some countries freely available governmental data XXX both public and private entities leverage governmental data that is freely available (Piwowar). However, the open sharing of data also introduces risks regarding data misinterpretation or misuse. Data shared openly may be used out of context.

FAIR data principles (findable, accessible, Interoperable, Reusable)

Narratives should be included in the meta data.

Data should be treated within the gift culture of scholarship, in which goods are bartered between trusted colleagues rather than treated as commodities (Wallis).

Practices of releasing, sharing, and reusing of data in CENS reaffirm the gift culture of scholarship, in which goods are bartered between trusted colleagues rather than treated as commodities.

The open science movement champions the ethos of transparency, collaboration, and accessibility in scientific research, advocating for the unrestricted sharing of research findings, methodologies, and data. Embracing principles of open access and open data, this movement seeks to democratize knowledge production, accelerate scientific progress, and foster innovation by removing barriers to information. Indeed, the sharing of data has facilitated unprecedented opportunities for collaboration, reproducibility, and interdisciplinary research, enabling scientists worldwide to build upon each other's work and address complex global challenges more effectively. However, while the open sharing of data holds immense promise, it also introduces risks, particularly concerning the potential for data misuse or misinterpretation. Data shared openly may be used out of context, leading to misrepresentations, erroneous conclusions, or even harm if not properly understood or interpreted. Therefore, while promoting data sharing, it is crucial for researchers to uphold ethical standards, provide context and metadata for shared data, and actively engage in transparent and responsible data stewardship practices to mitigate the risks associated with data misuse in the open science ecosystem.

Top of Form

* + 1. **Why is this helpful?**
       1. **Cropscape data article (double cropping)**
       2. **NASS data increase in women producers**
       3. **Andrea R’s work**
    2. **Fill out the ‘what is this data’ card**
    3. **Present your results to people connected with the data before publishing them**

# Conclusions

In this paper we ….

We demonstrate how (1) examining and challenging power led to novel teaching, training, and research questions, (2) building farmer collaborations with reciprocity metrics codified in the project leads to better outcomes for the farmers and researchers, and has resulted in long-term viability of an on-farm research program and (3) embracing framing as a positive attribute leads to more transparent, effective, and .