

## Research Statement

Chelsea Clifford

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### Introduction

I improve our understanding of how wild nature and humans coexist and interact in human-dominated aquatic ecosystems, including urban and agricultural landscapes. I aim for strong observation and willingness to ask questions. Collaborating with students to answer their research questions helps keep my research contributions fresh. Others often know far more about the environments where they work than incoming scientists. So, I talk to people. I respect others' knowledge, even if acquired through different empirical means than my own. I believe that we will need to do a better job of acknowledging and improving interdependencies of both nature and humanity for any to persist in a recognizable form.

### Artificial Aquatic Systems

My work and I owe a great deal to naturally occurring forests, prairies, deserts, oceans, and especially creeks, rivers, wetlands, ponds, and estuaries. That said, like most people, I spend most of my time, even outdoors, in spaces less associated with the sublime wild, like backyards, cornfields, roadsides, parking lots, athletic fields, and ditches. Much as I have always loved and wanted to protect nature, writing off its less "pristine" manifestations never felt like the best way to value it or our human selves.

While beginning my PhD in the Duke University River Center in 2013-2014, regulatory happenings around the Clean Water Act suggested that human influence tends to automatically devalue ecosystems. So, I wrote a paper, published in 2018, that proposed process-based alternatives to "artificiality" as an explanation for the poor condition of some human-made and -modified aquatic systems. This paper challenged the tendency for low expectations for artificial aquatic systems to become self-fulfilling. I then began to test this framework in my empirical dissertation research. It included explorations of benthic macroinvertebrate communities in irrigation ditches as compared to creeks from whence they flowed, plant communities and other wetland characteristics of Coastal Plain roadside, forested, and agricultural ditches, and algal bloom formation in artificial versus natural lakes.

At this time, I thus found myself having to answer many basic questions of "what," and some "where" and "when," with little opportunity yet to move into the most intriguing "why" and "how." Particularly where human-made waters are concerned, we still have little idea what waters even exist where, let alone for how long, for what purpose, and under what conditions. We know less still of how we can protect and enhance positive aspects of these ecosystems and minimize the negative, which remains my ultimate research goal for them. These questions span disciplines. I enjoy dabbling widely, but recognize that no one can become deeply proficient at everything. Even in topics I know best, my research benefits from, and I enjoy, bouncing ideas off others. So, I informally gathered researchers with overlapping interests, into an interdisciplinary, international group, the Ditch-Integrating Transdisciplinary Collaboration Hub (DITCH). A colleague and I co-led a workshop in Liverpool, England, and virtually in 2023, ultimately yielding a perspectives article reviewing the above knowledge and questions in 2025. This group has also spawned smaller research collaborations. I have especially enjoyed observing student participants interact and otherwise benefit from the existence of this group, and hope to include my own student researchers in future. In the 2018 and 2025 reviews especially, we identified not just large gaps in the literature, but also some opportunities circumstances present to answer them in useful and interesting ways, and established a wonderful network of collaborators.

### Designed Experiments, Research through Education, and Community

An inaugural research fellowship in the first Earth Stewardship Initiative project at the 2014 Ecological Society of America conference in Sacramento introduced me to the concept of designed experiments, in which ecological experiments are integrated into the construction of infrastructure. In this capacity, I worked with local and regional stakeholders and landscape architects to propose experimental infrastructure in the Natomas East Main Drainage Canal intended to address concerns ranging from

salmonid migrations to homeless encampments. This experience led me to consider a research style and funding sources I had not before, of working with infrastructure builders to integrate ecological experiments into what they do, to answer questions both for them and broader ecology and conservation.

Later, by pursuing post-doctoral work in an engineering department, I sought to familiarize myself with how people who shape infrastructure operate. I brought concepts well studied in urban aquatic contexts, such as flashiness as a human signature on urban streams, to bear on agricultural drainage water management and rural streams. Next I circled insights from inland agricultural waters back around to urban and coastal ones, studying mown salt marsh lawns on vanishing Tangier Island, Virginia, for the Virginia Institute of Marine Science (VIMS). Working for VIMS also let me embed a tiny experiment into management of a local state park, conducted by a recurring graduate course in wetland eco-geomorphology.

My background prepares me to combine concepts and strategies around water issues developed from rural and urban contexts. Most major watersheds include a mixture of land uses, so it makes sense to look at human shaping of waters through both hard and soft land uses together, rather than through separate disciplines. A more permanent job would enable me to commit to a place, and develop designed experiments of my own. I have collaborated with county parks and recreation departments, state departments of transportation and of natural resources, corporate research partners, drainage associations, a watermen's association, nonprofit conservation organizations, research stations and societies, and others to address their needs. Each new place I go, I develop connections with people with interests in local land and water. Knowing where I will stay for a while would allow me to work with folks to integrate management options of interest into local ditches, retention ponds, and similar, whose performance I could compare to unchanged infrastructure and natural ecosystems on metrics of interest. Academic campuses tend to offer options for such endeavors. Campus designed experiments can in turn facilitate coursework and serve as loci for community outreach.

### **Using Existing Datasets and Broader Collaboration**

As no researcher can ever collect all desirable data alone, I have also become proficient at capitalizing on existing datasets. For example, I drew heavily on USGS and USEPA data for structural equations modeling in both my dissertation research, which included a chapter based on the National Lakes Assessment and LakeCat, and a post-doctoral side project on agricultural streams, based on the Midwest Regional Stream Quality Assessment and the USGS Stream Gaging Network. Several more such project ideas, untapped uses of a range of extant data, remain in mind. However, I also recognize that I cannot depend on US government and federally funded data collection to persist.

Perhaps this is a good time to revisit my aim to increase my use of citizen science data. In graduate school, I co-developed an elementary school educational program that generated citizen science data. For years, I have contributed extensively to iNaturalist, and use other citizen science apps. Reinstatement with the Virginia Master Naturalists in 2025 has expanded my range, and reminded me of the interests and force of citizen scientists. Next, I would like to use iNaturalist and related datasets to better characterize the variety of organisms that use artificial aquatic habitats. Through widely collaborative work, I try to simultaneously build community and good science.

### **Overarching Goals**

I seek to home myself in a community, both natural and human, which guides development of my research questions. I want to continue to examine human-impacted and -modified ecosystems, especially wet ones, while also working with the associated humans, in hopes of revealing space for improvement in condition of all. I hope to become part of local dialogue, not just an outside observer. I also plan to continue to mentor budding scholars as part of my research, and to broadly communicate what we find. My greatest impact on the future occurs through facilitating other people's environmental discoveries.