Addressing Ecological Challenges Through Humanities-Science Collaborations

A whitepaper on the contributions, structures, and support needs of humanities-science collaboration

Introduction

Over the past decade, major organizations in the sciences and the humanities have recognized the need for deeper integration across disciplines to address complex societal challenges. The American Academy of Arts and Sciences recommended that "foundations, universities, laboratories, research centers, and government agencies bring humanists and social scientists together with physical and biological scientists and engineers to address major global challenges."[1] Similarly, the National Academies of Science, Engineering, and Medicine called for greater integration of the humanities, arts, and science fields within U.S. higher education to ensure that students are well-prepared to meet the challenges of our time.[2] And the European Commission argued, "Technical solutions are often preconditions for new policy outcomes, but in themselves insufficient to have a meaningful impact. The lasting societal impacts that policy-makers seek are often equally reliant on insights from social sciences and the humanities."[3]

Despite widespread recognition of the value of interdisciplinary research, many lack a clear vision of what this research looks like and the types of support it needs. And these broad statements of value do little to explain the dynamics that could lead to more valuable research. What does successful collaboration between humanities and science researchers look like? What distinctive contributions do humanities methods make? How are these collaborations structured? And what kinds of support do they require?

Ecological challenges provide a particularly valuable lens for examining these questions. Many environmental issues emerge from the interaction between natural systems and human systems. They are shaped by historical decisions, cultural values, public policies, economic structures, and community experiences alongside ecological processes. As a result, research into ecological challenges frequently requires expertise that spans disciplinary boundaries.

To better understand how humanities-science collaborations operate in practice, the National Humanities Alliance, in partnership with the American Council of Learned Societies and with support from the National Science Foundation, conducted a landscape survey of successful collaborations and convened researchers in Washington, D.C., to explore how humanities and scientific methods can be integrated to address ecological challenges.

Participants represented a wide range of institutions, disciplines, and ecological challenges. Projects addressed climate adaptation and agriculture in the Midwest, species restoration in California, environmental justice in Pennsylvania and Mississippi, river restoration in Michigan, cultural burning in Maine, and community redevelopment in California. Together, they illustrate the diversity of humanities-science collaborations currently addressing ecological challenges across the United States.

Across these settings, the projects reveal a common pattern. They bring scientific and humanistic knowledge into conversation with the knowledge, expertise, experiences, and priorities of the communities affected by ecological change. Rather than treating community members solely as research subjects or recipients of research findings, many of these collaborations engage them as partners in shaping research questions, interpreting evidence, and defining meaningful outcomes. The result is research that is both intellectually stronger and more responsive to community needs. For funders and administrators who hope to support more research like that presented here, we hope these researchers' insights into challenges to collaborative research and the many opportunities to better support it will prove especially useful.

Meeting Participants

Linda Shenk (Iowa State University) and **William Gutowski** (Iowa State University) spoke about ongoing partnerships with Iowa farmers and landowners through CO-Learn (Climate Opportunities and Learning). In collaboration with independent and women farmers and landowners, this work recognizes the expertise of community partners and leverages the co-production of stories to support sustainable agricultural practices.

Peter Alagona (University of California, Santa Barbara) and **Alexis Mychajliw** (Middlebury College and the Samuel Oschin Global Center for Ice Age Research, La Brea Tar Pits & Museum) spoke about combining historical and ecological research to reach a more accurate understanding of the history of bear populations in California—an effort that has produced books and articles, as well as efforts to revitalize bear populations in the state.

Bethany Wiggin (University of Pennsylvania) and **Pete DeCarlo** (Johns Hopkins University) discussed their public history and science project engaging the community around the Lower Schuylkill River in Philadelphia and an oil refinery operating in the area. The project includes creating a community archive of art and oral histories related to the area; public products, such as public tours and a digital jukebox that plays oral histories at the John Heinz National Wildlife Refuge; public testimony about the zone following a refinery explosion; and scholarly outputs such as articles.

Brittany Myburgh (Jackson State University) spoke about an interdisciplinary effort to develop an AI interface to help Jackson, Mississippi, residents better understand environmental risks posed by mosquito-borne diseases such as West Nile virus.

Caroline Gottschalk (University of Wisconsin-Madison) and **Marty Holtgren** (Encompass Consulting) spoke about a collaborative effort with local tribal groups to understand the historic flow and floodplains of the Maple River—a side-stream of the Muskegon River that was blocked in the nineteenth century—with the ultimate goal of reopening the river.

Jessica Barlow (San Diego State University) and **Madison Swayne** (San Diego State University) spoke about their work in the SDSU Center for Regional Sustainability's Sage Project, which supports community-driven efforts to improve local quality of life issues. They focused especially on their Brownfields project, which leveraged historical research, ethnography, and GIS engineering to identify and map local brownfield sites.

Jacquelyn Gill (University of Maine) and **Bonnie Newsom** (University of Maine) spoke about collaborating with Native people in Maine to use oral knowledge and histories, Wabanaki place names, and historical settler accounts to surface an unrecognized history of cultural burning in the state.

Characteristics and Contributions of Humanities-Science Collaborations Addressing Ecological Challenges

Although the projects differ substantially in subject matter, they share several characteristics. They are place-based, community-engaged, and oriented toward public impact. They rely on multiple forms of evidence and expertise. And they treat humanities and scientific approaches as equal partners in the research process. Together, these projects demonstrate that humanities-science collaborations can produce stronger research and more meaningful public outcomes than either domain could achieve independently. By bringing scientific methodologies into conversation with narrative studies, historical research, oral histories, cultural knowledge, and community perspectives, these collaborations have produced more accurate research, responded to community needs, strengthened ties to communities, and created tangible policy impacts. Finally, many of these projects grew out of community-identified challenges that require expertise from the humanities and sciences, as well as active research collaboration with the communities. Across these projects, humanities researchers did more than communicate scientific findings or provide historical context. Their methods shaped research questions, surfaced overlooked forms of evidence, challenged prevailing assumptions, and helped determine what successful outcomes should look like.

Producing Better Knowledge

Several projects illustrate how science and humanities methods can overturn long-held beliefs and assumptions. For example, faculty affiliated with the Climate Change Institute at the University of Maine, including ecologist Jacquelyn Gill and Penobscot archaeologist Bonnie Newsom, set out to understand the history of fire in the state in response to devastating wildfires in Canada and the Western United States. Along with other faculty, tribal historic preservation officers, and community partners, Gill and Newsom synthesized information from oral knowledge, historical settler accounts, Wabanaki place names, and paleoecological evidence, ultimately demonstrating that Indigenous people living in Maine used cultural burning to manage forests, increasing their resilience during periods of environmental upheaval. Their findings—which have implications for forest management today—corrected previous scientific studies that argued that fire had been unimportant in Maine. In this case, historical, oral, and community knowledge showed that previous assumptions about fire in Maine were misinformed, while paleobiological evidence filled gaps in the historical record.

Conversely, in the case of the California Grizzly bear project, science methods revealed that widely accepted historical records may have misrepresented the factors that led to the decline of grizzly populations. Historian Peter Alagona and conservation biologist and paleontologist Alexis Mychajliw brought historical and cultural narratives into conversation with biological evidence, investigating the role that historical narratives have played in shaping public perception of grizzly bear ecology and species interactions in California. By testing the accuracy of narratives about the history of grizzlies using paleontological methods, Alagona and Mychajliw demonstrated that while the historical record preserved one story about grizzlies—that their extirpation (geographical extinction) was solely the result of their attacks on people and livestock—isotope analysis and the study of skeletal remains established that Euro-American settlement had changed grizzly behavior by altering what resources were available on the landscape. As both the Maine and California projects show, bringing together the sciences and humanities can strengthen representations of the past, enabling us to make better-informed decisions in the present when facing challenges such as managing wildfires or reintroducing species to native habitats.

Additionally, the Lower Schuylkill River Project illustrates how humanities and scientific methods can be combined to recover overlooked environmental histories and generate a more complete understanding of present-day ecological challenges. When exploring the Lower Schuylkill River, Professor of German Bethany Wiggin was surprised to find that, when Congress designated the Schuylkill River Valley a National Heritage Area, the 150-year-old, 1,300-acre oil refinery situated on the river's banks was left out of the official history of the river. Recognizing the refinery's impact on the river and surrounding communities, she set out to reconstruct and raise the visibility of the river's history through archival research, community conversations,

and public programming. At the same time, Peter DeCarlo, a professor of environmental health and engineering specializing in air-quality measurement, was monitoring the refinery's impact on surrounding communities by conducting scientific measurements. By forming the Schuylkill River and Urban Waters Research Corps, Wiggin and DeCarlo connected environmental monitoring with historical research and community engagement to create a more comprehensive account of the refinery's impact on both ecosystems and surrounding communities. For DeCarlo, working with humanists and local community members helped place environmental measurements within a broader historical and social context. For Wiggin, meanwhile, working with DeCarlo allowed her to quantify the refinery's impact through scientific measurements.

Co-Producing Knowledge With Communities

While the interplay between humanities and science methodologies strengthened research outcomes, many of these collaborations also depended on the co-production of knowledge with community partners. For example, Linda Shenk, professor of English, and William Gutowski, professor of geological and atmospheric sciences, both at Iowa State, work with Iowa farmers and landowners using Shakespeare as a model to move "from individual knowledge to coproduced knowledge to community action."[4] Explaining that Shakespeare left gaps in his plays for actors and audiences to fill, Shenk and Gutowski supply groups of people engaged with farmland with tools that simulate science-based ecological relationships, but that also leave gaps that these partners must complete with their experiences and knowledge. The process puts researchers and community members on a more equal footing in creating a participatory, shared, interpretative space to engage complex agricultural and environmental challenges. This approach allows participants to enter the story from different perspectives, acknowledging disagreement, partial knowledge, and evolving conditions. At the same time, climate data, soil analysis, and environmental measurements provide essential data to help farmers understand shifting conditions, such as temperature extremes. This co-creation process allows farmers and landowners to imagine initiatives that align with their priorities and pursue them individually and together. The project demonstrates how humanities methodologies can help transform scientific information into a collaborative process of interpretation and decision-making, allowing communities to participate actively in shaping responses to ecological challenges.

By working directly with communities, many of these projects also received real-time feedback on their efforts and goals, ensuring that academic work doesn't bypass community needs. For example, a collaboration between the Muskegon River Watershed Assembly, the Little River Band of Ottawa Indians, and community residents, the Maple River Project aims to restore water flow in the Maple River, a branch of the Muskegon River that was dammed in the nineteenth century to facilitate the transportation of lumber along the main Muskegon River route. Blocking the Maple River caused flooding of farmland and roadways and the loss of habitat for spawning Lake Sturgeon and native rice stands. The project, represented by English professor Caroline Gottschalk and fisheries biologist and social scientist Marty Holtgren, brings together different knowledge types, including Indigenous knowledge, archival research, oral histories, community storytelling, fish ecology, hydrology, and geomorphology, to understand the past and present of the Maple River and restore its flow, surrounding habitats, and traditional uses. Collaborators from the Little River Band of Ottawa Indians helped researchers understand the locations of dams and the historical flow of the river. They have also reframed some of the project's goals. While the researchers initially focused on making the island and river more welcoming for traditional uses through signage and interpretation, collaborators from the Little River Band emphasized that safe access to the land was a more fundamental concern. In this case, collaboration with tribal partners not only contributed new information but also changed the project's understanding of what restoration should achieve, illustrating how community knowledge can reshape research priorities.

Many of the projects discussed here originated in community-defined problems rather than academic research agendas. Jackson State University's Environmental Justice and Vector-Borne Disease Education project emerged from a local community resident's desire to make information about West Nile virus more accurate and accessible. Jackson State responded comprehensively, engaging faculty from fields such as computer science, civil and environmental engineering, public health, science communication,

digital humanities, and Africana studies. The project is developing an AI chatbot and offering community workshops and digital literacy training in partnership with local nonprofits. By bringing scientific data on weather patterns, disease outbreaks, and insect populations together with oral histories, archival records, and local narratives, the project is developing new and more accurate pictures of vector-borne diseases in Jackson that support community needs.

The Center for Regional Sustainability at San Diego State University has maintained relationships in San Diego County's National City for over a decade through its Sage program, which fosters community relationships and connects students and faculty to community-driven research projects. The Center's Brownfields Project, built on relationships with the National City government and local nonprofits, leveraged federal grants to help National City better understand its contaminated sites, enabling remediation and redevelopment. Directed by Jessica Barlow, a linguist and professor of sustainability, and Madison Swayne, a professor of city planning, the project relies heavily on community involvement and local knowledge to identify and trace the history of contaminated and abandoned sites. Starting with existing databases of environmental contamination and GIS mapping software (GIS), the project relies on community input through surveys, ethnographic research, oral histories, and focus groups to identify potential sites and help set priorities for remediation. In addition to documenting the sites, the local community is also envisioning a new future for them through the project.

From Research to Public Action

Taken together, these projects reveal that humanities-science collaborations do more than combine disciplinary expertise. They create new forms of evidence, bring communities into the research process, and connect scientific findings to the historical, cultural, and social contexts in which ecological challenges unfold. These characteristics make such collaborations particularly well-suited to informing public policy.

Across these projects, scientific methods provided the measurable evidence that agencies and policymakers often require, while humanities approaches helped build trust, foster public participation, and create a shared sense of ownership of the research. In the Lower Schuylkill River project, in the wake of the refinery explosion, Peter DeCarlo was appointed by the Mayor of Philadelphia to the Philadelphia Refinery Advisory Group, where he contributed insights gained from the project. Similarly, community members and groups who had participated in the project were well-positioned to testify about the impact of the refinery on the community, as was Bethany Wiggin. In the California grizzly project, ecological analysis, paleontological evidence, and species assessment allowed researchers to evaluate what conditions might make grizzly reintroduction feasible, while partnerships with California tribes and other communities have helped build consensus around why reintroduction might be desirable. In Iowa, researchers, farmers, and landowners developed and promoted agricultural interventions that address challenging weather conditions within the context of scientific data and the desires, needs, and lived experiences of farmers. Likewise, work on the Maple River project is bringing together partners and approaches, including scientific and historical research and community engagement, to work toward public commitments to fund the reopening of the river.

Collaborative projects like these can also be mechanisms for government funding to support communities grappling with ecological challenges, promoting strong public policy without imposing one-size-fits-all solutions. The climate and agriculture work at Iowa State is supported by the National Oceanic and Atmospheric Administration (NOAA) through its Climate Adaptation Partnerships program. The project brings resources to its partners in Iowa, Kansas, Missouri, and Nebraska that make iterative and collaborative co-creation of best practices possible, while also bringing that knowledge back to policymakers. Likewise, the brownfields project at San Diego State University has received substantial funding from both the Environmental Protection Agency (EPA) and the California Department of Toxic Substances Control. By identifying environmentally compromised locations in National City and creating opportunities for remediation and growth, the project supports the goals of these national and state agencies while doing so in a way that is responsive to the direct needs of the community in question.

Barriers to Effective Collaboration

As the work featured here demonstrates, equal humanities-science collaborations can lead to strong, impactful research that can be of immediate use to communities and policymakers alike. Perhaps because they are different from other types of research projects more commonly found at higher education institutions, efforts like these can meet significant obstacles that make it difficult to undertake interdisciplinary research. Drawing from their experiences, meeting attendees identified challenges they have faced, including difficulties with funding, institutional structures, community relationships, and cultural differences.

Funding Structures

Interdisciplinary projects like these are complex, bringing together different types of partners and requiring time to establish work patterns, build trust, and identify research questions. Funders do not commonly provide the sustained investment necessary to cultivate partnerships, build trust, and surface the problems and questions that underpin impactful research. Typical short grant cycles don't support long-term relationship building between humanities and science research or with community partners. While many of the projects profiled here emerged from open-ended research without an initially clear research question, funding sources typically ask for research questions to be fully formed before applying. Even when funding is available, funders limit spending on the kinds of activities and participants that are useful for building trust and connection: food, staff, and community members. Universities frequently offer small pots of money to incentivize interdisciplinary collaboration on particular topics with the message: here is some money, go find a collaborator. But the researchers we convened explained that collaborations arise out of longer relationship building. Researchers also expressed frustration over the changing priorities of funders when projects need longer-term commitments. Many science funders are also looking for scalable solutions, where many impactful humanities-science collaborations are impactful because they are particular to their communities.

Institutional Barriers

Institutional barriers can also create structural challenges for researchers, even when institutional rules were initially well-intentioned. This is especially true as many interdisciplinary researchers are experimenting with new modalities and encountering new research partners. Long-held institutional rules, perhaps created for good reason, were not created with interdisciplinary, community-oriented work in mind. Researchers cited issues such as rules against paying or diverting money to community partners as a major barrier to success. There is also seldom training support to build faculty capacity to manage collaborations, community partnerships, and complex project budgets and logistics. Last, in the humanities, tenure and promotion incentives are seldom aligned with collaborative and community-based work. Unfortunately, while specialized research centers may help overcome these barriers and foster interdisciplinary research and community partnerships, they can also be subject to funding cuts and shifting priorities that undermine long-term relationship building.

Community Partnerships

Building equitable relationships with community members—as many impactful humanities-science collaborations require—can create additional challenges. Long periods of relationship building are essential to ensure that research questions come from community needs rather than being imposed on the community. And yet, as one meeting participant noted, building trust can take "longer than it takes to get a Ph.D." This challenge is exacerbated by funding and institutional structures that do not reward or account for trust-building as a research activity. It can also be exacerbated by the inability to get money to communities, especially when researchers are seen to be bringing in large grants. Finally, even the most enthusiastic community partners can have capacity constraints, and it's important not to overburden already under-resourced communities. Beyond financial support, researchers also expressed that they could use help ensuring that their partners are championed and managing projects in such a way that collaborative research does not become a burden for community partners.

Disciplinary Differences

Finally, there are also disciplinary and cultural differences between researchers that must be bridged. Specialized language and different methodologies take time to explain and be understood by partners. Research products and practices of assigning authorship and credit for collaborative projects also differ. These issues take time and practice to overcome, and researchers could use support in undertaking this work.

Recommendations

The participants had recommendations for overcoming these challenges:

1. **Create Long-Term Funding Mechanisms**. The long timeline for interdisciplinary work that addresses ecological challenges was a constant refrain among researchers. Building relationships across humanities and science disciplines takes time, as does building bridges and trust with the community members who are an essential part of these efforts. Funders interested in supporting projects that address these challenges need to take into account the time required to do so and offer long-term support.

2. **Invest in Partnership Development.** Building community partnerships and exploring opportunities to address ecological challenges takes time and is less outcome-oriented than a typical research project. Funders and higher education institutions interested in this work might consider directly supporting community engagement efforts through grants, course releases, and other mechanisms that promote exploration. They might also consider relaxing restrictions around catering and staffing that make it difficult for researchers to contribute to community events and similar activities.

3. **Support Open-Ended Interdisciplinary Exchange.** Meaningful opportunities to engage with people from other disciplines in open-ended ways over time are needed to build strong partnerships based on common interests. Opportunities that are not overly oriented toward research projects and the pursuit of research grants allow researchers to build relationships that can evolve into research projects as compelling questions arise.

4. **Invest in Interdisciplinary Research Centers and Staff.** Many logistical hurdles cited by researchers can be addressed by support for university centers and adequate staffing. Broad-based centers that have sustained university support can bring together interdisciplinary researchers to explore areas of common interest. They can build, maintain, and structure relationships with community partners over the long term and serve as a point of stability when researchers' affiliations may change. Moreover, university staff can support grant proposals and offer professional development opportunities, helping faculty build new skillsets.

5. **Create Flexible Funding Pathways for Community Partners.** Because university restrictions and overhead costs make it difficult to redirect grant money to community partners, funders in particular might consider grant programs that provide different pots of money for university and community collaborators.

6. **Reform Tenure and Promotion Systems.** As with other burgeoning fields of work, including public humanities, higher education systems are not set up to account for the complexities of interdisciplinary work in the tenure and promotion process. Designing means for recognizing interdisciplinary work, including the effort of grant writing, in the tenure and promotion process will make it possible for researchers to engage in interdisciplinary work earlier in their careers, and without having to weigh the cost of this research to their own careers.

Conclusion

The projects featured in this report demonstrate that ecological challenges provide a particularly valuable lens through which to understand the contributions of humanities-science collaboration. Across diverse contexts, humanities scholars contributed more than contextual knowledge or public communication. Historical interpretation, oral history, cultural analysis, community storytelling, and related methodologies repeatedly influenced the questions researchers asked, the evidence they considered, and the solutions they pursued.

At the same time, the projects show that scientific and humanities methodologies are most powerful when they are brought into sustained conversation with one another and with the communities most affected by ecological change. Whether uncovering histories of cultural burning in Maine, reexamining the history of California grizzlies, restoring the Maple River, supporting climate adaptation among farmers, addressing environmental health challenges in Jackson, documenting the Lower Schuylkill River, or remediating brownfield sites in National City, researchers repeatedly

found that meaningful solutions emerged through collaboration rather than through the application of disciplinary expertise alone.

Together, these projects suggest that effective responses to ecological challenges require approaches that integrate scientific evidence, historical understanding, cultural knowledge, and community experience. The collaborations highlighted here reveal both the promise of such work and the institutional changes needed to support it. As funders, universities, and policymakers seek new ways to address complex environmental challenges, these examples offer valuable lessons on how humanities–science collaboration can strengthen research, public engagement, and policy alike.

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[1] *The Heart of the Matter: The Humanities and Social Sciences for a vibrant, competitive, and secure nation* American Academy of Arts and Sciences. 2013.

[2] National Academies of Sciences, Engineering, and Medicine. 2018. The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education: Branches from the Same Tree. Washington, DC: The National Academies Press. https://doi.org/10.17226/24988.

[3] Krzysztof Kania and Rickard Bucksch, *Integration of social sciences and humanities in Horizon 2020 : participants, budgets and disciplines,* European Commission, Directorate-General for Research and Innovation, 2020. https://data.europa.eu/doi/10.2777/141795

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