

Human Dimensions Research and Applications within WAFWA: Best Practices and Practical Recommendations

Introduction

The value of understanding the human elements of our environmental problems is well-established in wildlife management today. At the same time, there are numerous disciplines, methods, and ways of thinking about human dimensions that can be challenging for fish or wildlife managers. The Western Association of Fish and Wildlife Agencies (WAFWA) Human Dimensions (HD) Committee has developed this go-to resource for WAFWA agencies to facilitate access to and demystify the world of HD. The WAFWA HD Committee members have various roles and titles while all working to understand the human elements of fish and wildlife management. As such, throughout this guide, we refer to social scientists, HD practitioners, and HD researchers. These titles reference the individuals working within this important sector of fish and wildlife management to varying degrees.

The purpose of this resource is threefold. First, we outline at a high level the human dimensions of fish and wildlife management for natural resource professionals and decision-makers and define HD and conservation social sciences (CSS) (Part 1). Second, we describe how to prepare for HD work and work with HD specialists (Part 2). In closing, we describe HD researchers' and practitioners' varied methods and approaches. We provide examples to highlight how key issues across the North American West can be examined through a social-ecological systems lens and how HD can help answer critical conservation questions and pressing 21st-century challenges.

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Part 1: What are the human dimensions?

Human populations have long relied on and interacted with fish, wildlife, and natural resources. Over time, this reliance and interaction necessitated greater coordination, often by wildlife management agencies. This management included diverse contributions from the natural sciences (e.g., wildlife biologists) and the inclusion of **human dimensions (HD)** of fish and wildlife. In the North American West, the interaction of natural sciences and social sciences is frequently showcased in three areas: wolves, water, and conflicting ways of life (**Box 1-6**). Incorporating HD in fish and wildlife management offers innumerable benefits or value, including greater recognition of humans within management, an understanding of the complex connections between social and ecological systems, and the importance of managing natural resources within the public trust.

Box 1: HD Example

Water quality is important to shellfish and shellfish harvesters. Fish and wildlife agencies rely on conservation social scientists and/or HD researchers to gauge harvester behaviors and communicate the potential risks of shellfish consumption (Sechena et al. 2003).

HD can mean many things without a singular definition or application (Appendix A). This diversity stems from its history and wide applicability within natural resource management, ranging from:

1. **broad concepts or topics that influence behavior**- “human elements” of management or conservation, like human values, attitudes, social norms, or human-wildlife conflict
2. **Applied HD**- methods, actions, or outreach efforts used by individuals to learn from certain segments of the population
3. **HD or social science research**- individuals implementing scientific research to address agency needs, like economics

Box 2: HD Example

Wolf management is complex. Fish and wildlife agencies rely on social scientists to help gauge respondents' tolerance of wolves and human dimensions practitioners to address potential human-wolf conflicts in agricultural areas (Marino et al. 2021).

Conceptually, the term HD may be used broadly to refer to the interplay between social, cultural, economic, and psychological factors and conservation efforts. As a concept, HD emphasizes that effective conservation strategies must consider human behaviors, values, and attitudes toward nature and wildlife, recognizing that human actions significantly impact these resources and that by addressing human factors, conservation initiatives can be more effective, equitable, and sustainable.

The wide range of applications can be approached as a spectrum or typology focused on understanding and integrating the human aspects of fish, wildlife, and natural resources into management. The wide range of how HD is applied is also reflected in WAFWA agencies. For example, some states or provinces have HD specialists who focus more on things like R3 (recruit, retain, and reactivate) or other “human elements,” such as community engagement, and do not conduct social science research. In contrast, other agencies have conservation social scientists (or researchers) who use social science theory and methods to examine specific phenomena or concepts (e.g., risk perceptions associated with chronic wasting disease). Some states employ both perspectives. This way of operationalizing social science within state fish and wildlife agencies has

led to some confusion about the broad benefits of integrating social science in agency policy, practice, and management. These challenges are explored in more detail below.

Is HD new to fish and wildlife management?

No, HD is not new to fish and wildlife management. While adoption has not been widespread in North America, many fish and wildlife managers have long understood humans' role in conservation; however, over the last few decades, HD has become increasingly recognized as critical to effective and equitable management ([Bennett et al. 2017](#)). Historically, HD work emerged following World War II. North American residents began participating more in outdoor recreation activities, sparking the government's interest and desire to know more about human-environment interactions ([Brown 2009](#)). From the 1950s to the 1990s, "HD scientists" emerged to help fish and wildlife management. This HD group included (1) biologists and naturalists engaged in HD research, (2) economists examining wildlife use values, and (3) non-economic social scientists engaged in understanding users and human-wildlife relationships ([Brown 2009](#)). This diverse application of HD helped create the wide spectrum we see today.

Box 3: HD Example

Outdoor recreation is a way of life for many people. Fish and wildlife agencies have long relied on human dimensions scientists to measure hunting, fishing, and outdoor recreational behaviors to enhance outdoor opportunities ([Brown 2009](#)).

What are the conservation social sciences?

HD research is connected to and/or benefits from a newer framework called the conservation social sciences (CSS). The CSS represents a diverse range of scientific disciplines that examine HD (as a CSS sub-field) of fish, wildlife, and natural resource management ([Bennett et al. 2017](#)).

Box 4: HD Example

Examining human values can help better understand the public and potential public responses to management decisions. Fish and wildlife agencies have relied on social scientists to gauge wildlife value orientations to gauge public perspectives on wildlife and wildlife management decisions ([Dietsch et al. 2018](#)).

The CSS includes a variety of social scientific fields and subfields ranging from classical fields such as environmental sociology and environmental psychology to applied and interdisciplinary fields, including HD ([Bennett et al. 2017](#); **Table 1**). While each scientific field within the broader CSS is distinct with its own history, key terms, scholars, theories, professional associations, journals, and conferences, most conservation social scientists (or HD researchers) working within fish and wildlife management agencies are trained as interdisciplinary scientists and draw upon various CSS fields to create hypotheses, research questions, or scientific projects. HD researchers use diverse tools or methods to conduct their scientific studies (see **Part 2**).

Broadly, the CSS study human-nature relationships and interactions.

This often spans research examining people's values toward wildlife to perceptions about specific ecosystems and species. Common topics often studied within the CSS include historical contexts, governance structures or processes, human demographics, human population growth, land use and development, social contexts, recreation activity, stewardship behaviors, public opinion, landowner characteristics, human-wildlife conflict, human-wildlife interactions, and human values ([Bennett et al. 2017](#); [NABCI 2023](#)).

Type of Social Science	Conservation Social Scientific Field	Brief Description	Possible Research Questions Addressed by Discipline
Classical	Environmental Anthropology	Studies human-environment relationships through a cultural lens	How does culture influence people's relationships with fish and wildlife?
	Environmental or Natural Resource Economics	Studies the economic value of nature, use-protection tradeoffs, and role of regulations and markets in natural resource management	What is the demand for recreational opportunities on different access areas?
	Human-Environment Geography	Studies human-environment relationships and interactions with an emphasis on place, space, and scale	How can fish and wildlife be more inclusive of diverse communities?
Interdisciplinary	Political ecology	Studies how "processes of power" impact human-environment relationships	Are inequitable power dynamics evident in the application of law enforcement?
	Science and Technology Studies (also known as STS)	Studies on the intersections of science-policy-practice within conservation through an interdisciplinary lens	What types of knowledge are prioritized when making decisions at agencies?
	Ecological economics	Studies the value of nature to society	What is the non-market value of local spaces to a community?
Applied	Human Dimensions of Conservation	Applies the social sciences (interdisciplinary fields, often relying on psychology and sociology) to address management needs	How effective are our conservation strategies?
	Conservation marketing	Applies marketing research studies to determine the influential nature of differing strategies to encourage behavior change	How effective are our social marketing campaigns in relation to behavior change?
	Environmental and Conservation Education	Studies the effectiveness of educational campaigns by way of researching target audiences for learning adoption	How familiar is the public with the natural world to inform an education curriculum?

Table 1. Selected Conservation Social Science Fields (note: this is a generalization used for illustrative purposes and not a comprehensive list of conservation social science fields and human dimensions questions ([Bennett et al. 2017](#)))

While one CSS field may be more well-suited to address a particular topic or research question than another, rarely, *one* topic is solely linked to *one* specific field. Each CSS field can address various topics or research questions, adding its distinct value, lens, and perspective.

Box 5: HD Example

For many hunting is a way of life and form of heritage. Fish and wildlife agencies rely on social scientists to examine hunters. A natural resource economist may examine hunter behaviors, and species or location preferences (Kerr and Abell 2016).

Box 6: HD Example

Wolf management decisions may impact public trust (Sponarski et al. 2014). Fish and wildlife agencies may use conservation social scientists to help better integrate good governance principles to enhance transparency and ultimately public trust (Pomeranz et al. 2020).

What are the benefits of incorporating human dimensions and/or conservation social sciences into agency decisions and processes?

Human dimensions (HD) and the conservation social sciences (CSS) offer innumerable benefits to the field of fish and wildlife management (Figure 1). Specifically, HD and CSS can provide instrumental, innovative, generative, reflexive, descriptive, and diagnostic contributions that can benefit fish and wildlife management. For example, HD and/or CSS can help determine why and how effective conservation actions are in a particular location or among a specific place-based community or illustrate how management efforts can create equitable outcomes, among many others.

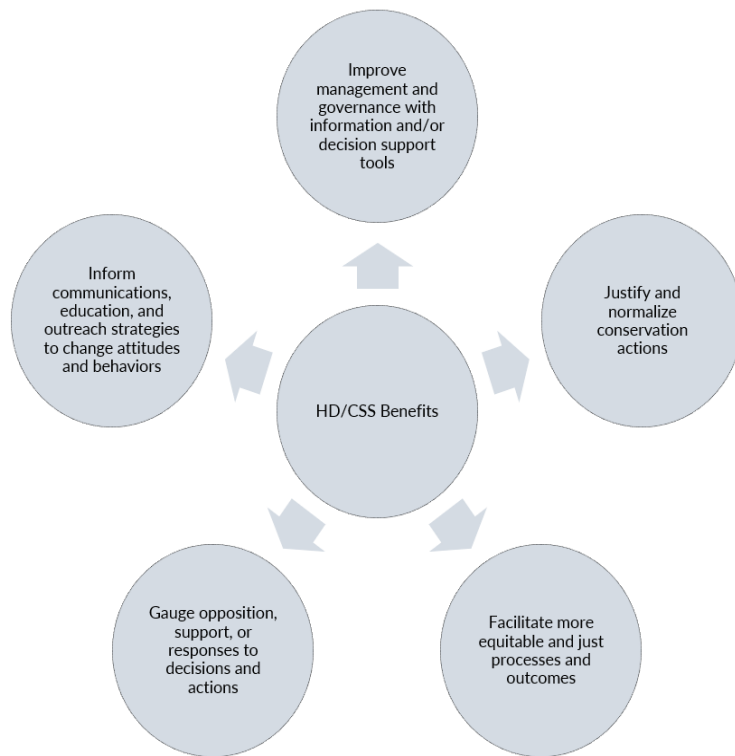


Figure 1. Selected HD/CSS Benefits to Fish and Wildlife Management (Bennett et al. 2015; Bennett et al. 2017; Scales and Adams 2023).

Part 2: Key considerations when conducting HD work

Like any good partnership, HD research should start with acknowledging your teammates' unique strengths, skills, and knowledge each brings to a project. Biologists must understand the essential nature of social science inquiry to create successful conservation management outcomes. Biological factors are important, but as we live in a human-centered world, the needs and preferences of humans are significant factors in the success of any fish and wildlife management decisions. First, we will focus on questions managers should be prepared to consider when conducting social science research and then take a deeper dive into specific methodologies using examples from the field.

Working with HD researchers

A common concern among HD researchers is being consulted or included too late in a project, process, or study. When HD practitioners are included at the outset of an inquiry, appropriate research questions and corresponding data collection techniques/methods can be identified, improving the efficacy of the effort overall. Thus, a best practice is to involve HD specialists early and often. When HD specialists are brought in after a project is underway or, worse, after a decision is already made (or management actions have been implemented), the conservation outcome will suffer. In extreme scenarios, the public or certain stakeholder groups may lose trust in the agency.

Suppose you have a particular issue or research question focused on understanding or integrating a human aspect of natural resources into management, decision-making, or policy (i.e., the definition of HD from Part 1). In that case, consulting with an HD researcher is advisable. However, given the wide range of expertise and disciplinary training many HD specialists have, you will want to be familiar with the types of questions that will help them understand your needs. Doing so will position HD specialists to assist you directly or help identify the right person to assist you. At most agencies in the West, HD specialists are either the only social scientists on staff or are one of a small team of HD specialists on staff. As a result, proper planning and early engagement with social scientists will go a long way in the success of a project or research study.



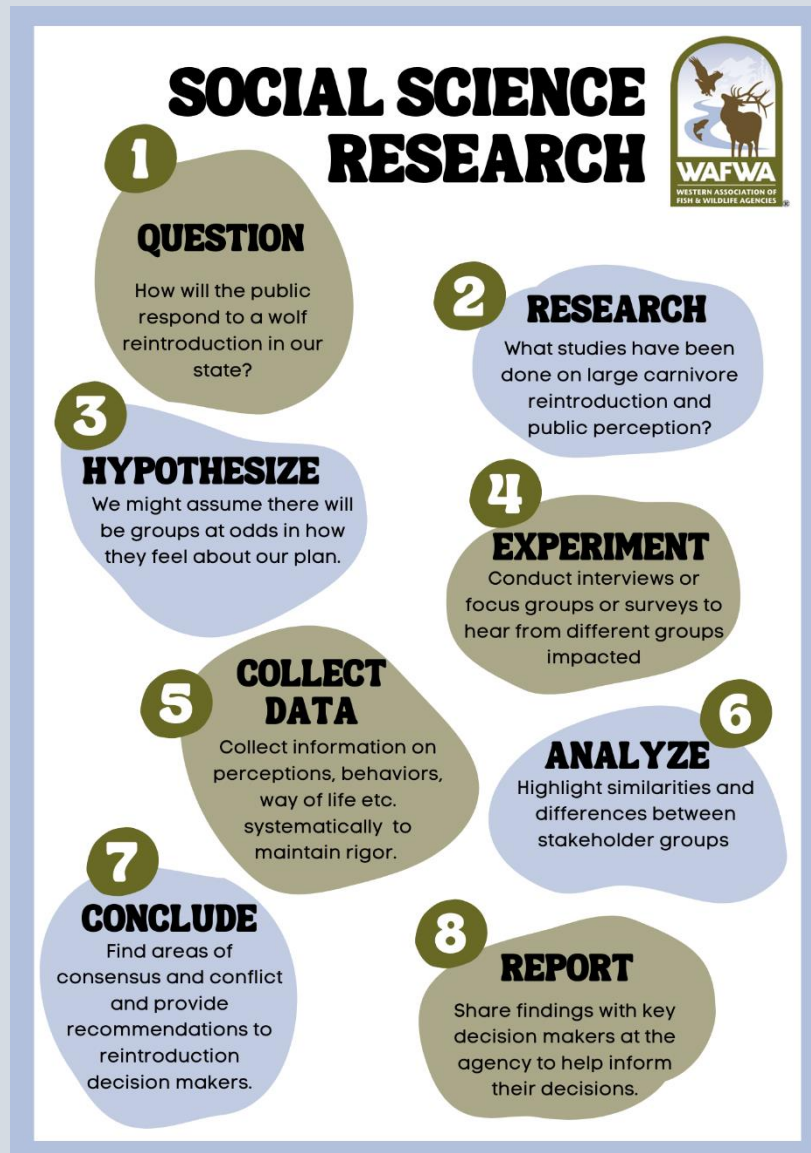
Figure 2: Topic areas for consideration when conducting HD research

Like any researcher, HD specialists approach any inquiry with a handful of logical and often linear sets of questions (Figure 2). For example, before starting a research study, HD researchers will likely ask collaborators why such a study is needed (or the goal/purpose). When working with an HD researcher, be prepared to provide the necessary background/context information to help them

understand why such a study is needed. This naturally lends itself to conversations about what types of data are needed, who, specifically, you need to learn from (i.e., which stakeholders), how you might engage these audiences (i.e., appropriate methods), and the expected timeline or deliverables. HD specialists will then build off this information to propose a social science study or approach appropriate for your resources and needs.

Box 7: HD Research Tip

If you think social science research is quick and easy, you are likely doing it wrong. Like biological research, social science data collection takes planning and time to ensure the research questions are answered, hypotheses are tested, and results are shared.



What are the identified objectives, and WHY do we need this information?

Research objectives and desired outcomes must be clearly articulated before selecting an appropriate method. Once objectives and outcomes are clear, various HD methods (Appendix B) from across disciplines (Table 1) can be tailored to accommodate research needs. Before selecting a method, it is important to consider where your jurisdiction lands regarding policy needs and how those may translate into particular methodological requirements related to public engagement, budget, time scale, or spatial scope of the work.

Whom do you need to learn from?

The “who” or which individuals, interest groups, or stakeholders must be engaged is one of the most critical steps in any social science inquiry. Unfortunately, it is often overlooked by non-social scientists who tend to skip to “how” the data should be collected. In many state fish and wildlife agencies, surveys are the default data collection tool, often resulting in unclear outcomes or data not representative of the groups that should have been engaged. A best practice among social scientists is to thoughtfully consider (or map out) which stakeholder groups are or could be affected by the problem (or outcome). These individuals should be consulted. We recommend Bryson’s (2003) article as a reference document for techniques to identify stakeholders. Appropriate stakeholder involvement will become increasingly important as the number of constituent groups in the WAFWA jurisdictions becomes broader and more polarized. Additionally, engaging broad audiences is part of fish and wildlife agencies’ public trust responsibilities, and doing so thoughtfully and holistically is more likely to result in increased relevance for agencies.

Box 9: HD Research Tip

“Failure to attend to the information and concerns of stakeholders is a kind of flaw in thinking or action that too often and too predictably leads to poor performance, outright failure, or even disaster.” -Bryson, 2004

WHEN and HOW should we plan to do HD research?

Finally, you need to know your project’s budget and timeline, which will also impact the methodologies used. Just as there is the right time and way to collect data in the ecological field, there is a right time and place in the HD field based on the population of interest (again, the “who” is critical – it always impacts the “how”). Biologists and HD researchers need to communicate with one another and with other staff about expectations and what is/is not feasible. These discussions need to take place early in any collaboration. Doing so will avoid difficult

Box 8: HD Research Tip

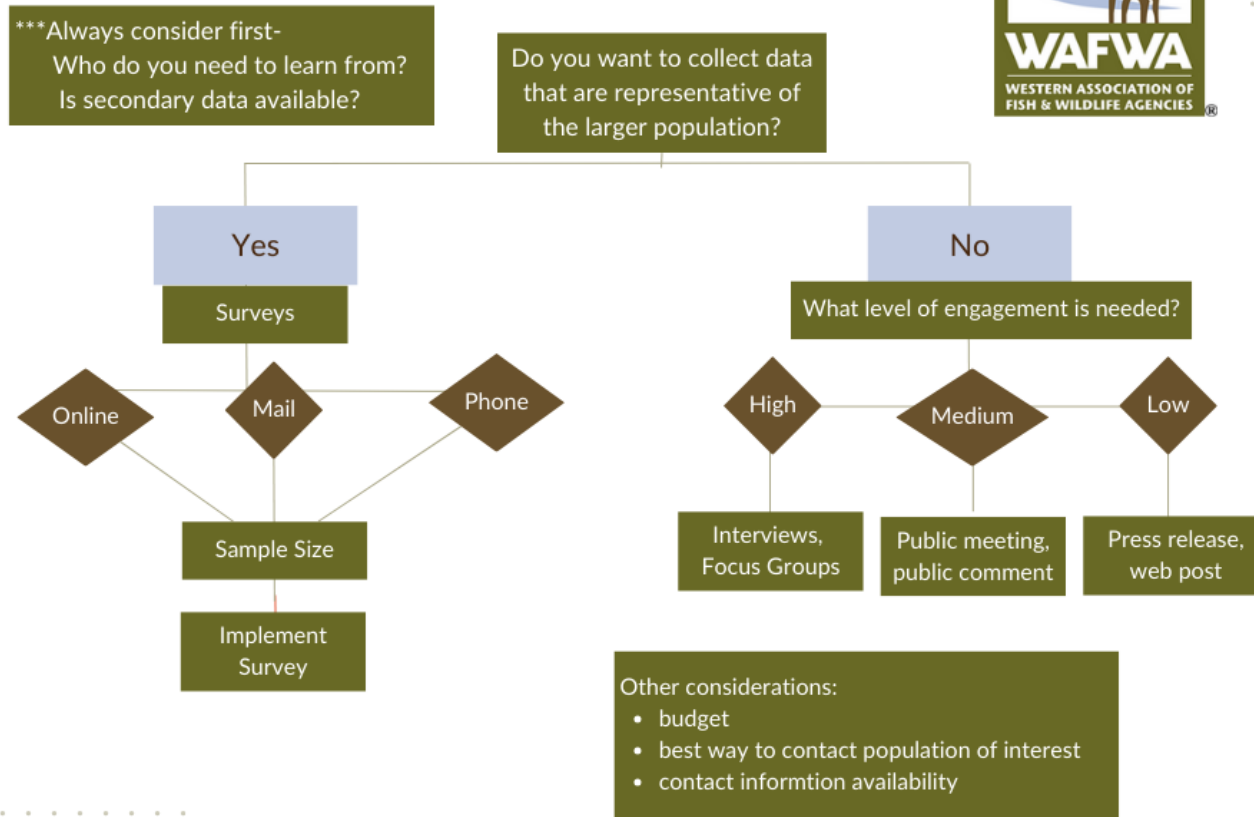
Social science data that is collected but isn’t used to make decisions, influence policy, or impact management efforts (i.e. it sits on the proverbial “shelf”) is often referred to by social scientists as “nice to know” data. Frequently, these are extemporaneous to answering the core questions driving an inquiry or are disconnected from the effort’s goals. These data are “nice to have” but detract from and can reduce the quality of social science studies/efforts

Box 10: HD Research Tip

Sometimes, the context of the resource decision is sufficiently understood, so further research is unnecessary. In these cases, an HD researcher may be able to provide additional studies or ideas, but their involvement is likely to be limited. In other cases, the needs of your team may be better met by related specialists like communications managers, educators, marketing specialists, or mediators. Meeting early with an HD specialist can help your team decide whether their involvement in your project is appropriate and direct you to other resources as needed.

conversations about roles, responsibilities, costs, etc., at the end of a project. By selecting methodologies and discussing the expected timeline and corresponding budget needed to carry out the inquiry, all partners (or collaborators) can work toward a mutually agreed upon outcome or communication protocol. The following page shows a diagram of questions you may be asked and what you and the HD researchers should consider together as you create a project to accomplish your goals.

Human Dimensions Research Decision Tree



Adapted from Kennedy & Quattuch 2019

Figure 3: A basic outline of a human dimensions research decision tree

Behind the curtain - methods used by HD practitioners

Throughout this section, we share several case studies to demonstrate how various HD methods have been applied across the West for effective wildlife management decision-making. The themes that these case studies will focus on are **wolves**, **water**, and **way of life**. For each, achieving HD objectives often requires a mixed methods approach (i.e., a blend of quantitative and qualitative methods) to understand the complex socio-ecological interactions embedded within. This section will only highlight a few methodologies in the social science toolbox. For a more extensive list of available methodologies, please see Appendix B.

Wolves

HD methods help address issues related to wolves as they reinvade the West. Qualitative methods, including qualitative surveys and structured or semi-structured interviews, have effectively identified underlying narratives (Jürgens et al., 2023) or gauged public attitudes and perceptions toward wolves, which can vary widely between rural and urban populations. These methods help identify underlying fears, misconceptions, and cultural values associated with wolves. Participatory workshops and focus groups can facilitate dialogue among stakeholders, including farmers, conservationists, and policymakers, fostering mutual understanding and collaborative solutions to wolf-human conflicts (Bisi et al., 2007).



Picture: Wolf reintroduction release, Credit: Colorado Parks and Wildlife

Box 11: Applied HD Example

One benefit of wolves to society is reduced collisions with deer on roadways. Raynor et al. (2021) found that, on average, Wisconsin counties experienced a 24% reduction in deer-vehicle collisions following wolf recolonization. When the value of property damage and medical expenses from collisions is accounted for, the authors found the benefits of wolf recolonization to drivers outweigh the costs to ranchers 63-to-1. These results can inform the design of compensation programs that ensure the benefits and costs of a management decision or policy are shared equitably across society.

Ethnographic research was conducted to better understand the human-wolf conflict in Washington (Anderson et al., 2022). This ethnographic work included qualitative data collection via participant observation, semi-structured interviews, textual analysis, and informal conversations with groups associated with wolf management. These methods helped further demonstrate how wolf-livestock conflict necessitates the management of norms, values, and human assumptions of wolf behaviors.

A recurring question regarding wolves in the West concerns their economic impact on rural communities. Economists have developed statistically powerful tools for measuring the effects of quasi-random changes on prices, quantities, and other economic measures using

observational (i.e., non-experimental) data. Causal analyses such as these can provide empirical evidence to test industry claims and better inform the appropriate amount to invest in compensation or mitigation programs.

To put the relative costs and benefits of wolf management decisions in context, economists use benefit-cost analysis (also known as cost-benefit analysis). This tool compares the aggregate costs of a policy or change to the aggregate benefits shared across society over time in a common metric, most frequently dollars. For example, while wolf recolonization can impact ranching operations, their effect on deer populations and behavior can also reduce vehicle collisions and associated property damages and medical expenses. The Office of Management and Budget recently updated federal guidelines for conducting benefit-cost analyses. It included extensive guidance on costs and benefits that do not have readily available prices, including fish and wildlife populations.

Box 12: Applied HD Example

van Eden et al. (2021) conducted a *discrete choice experiment* and found Washington residents would value a permanent wolf coexistence program at an estimated \$246 million per year. A similar study conducted in Colorado found residents of that state would value a sustainable wolf population at \$115 million per year (Hoag et al., 2023). These estimates provide evidence for increased public investment in wildlife conservation and suggest mechanisms for raising such funds.

Beyond reducing vehicle collisions, it is clear that many in society feel strongly that wolves should be

Box 13: Applied HD Example

Ramler et al. (2014) analyzed productivity data from 18 cattle ranches in Montana to measure the effects of expanding wolf ranges and depredations on calf weight when controlling for other factors such as climate and ranching practices. They found that wolf presence alone does not negatively affect average calf weights, though confirmed depredations were associated with smaller calves across the herd.

on the landscape regardless of the direct financial benefits (or costs) they experience. These individuals would likely be willing to pay large sums of money to protect wolves if given the opportunity, though the lack of markets or other mechanisms to allow this prevents them from doing so. From the economist's perspective, these individuals derive value from knowing wolves continue to exist in a place known as "existence" or "non-use" value. Economists have developed rigorous, standardized methods for measuring such values (i.e., assigning value when something is not traded in markets with prices) through

carefully designed survey questions that simulate market-like conditions. Recent studies have used these methods to measure the public's willingness to pay for wolf conservation.

Water

Surveys and questionnaires are commonly used to assess public awareness, attitudes, and behaviors related to water use and conservation practices. For example, contingent valuation methods can estimate individuals' economic value on water quality improvements, providing crucial data for cost-benefit analyses in policymaking (Mitchell & Carson, 1989). In-depth interviews and ethnographic studies are essential for designing culturally sensitive conservation interventions because they offer rich, contextual insights into local water management practices and the cultural significance of water bodies (Satterfield & Gregory, 1998). Additionally, participatory action research engages communities directly in conservation, ensuring their knowledge and priorities are integrated into sustainable water management strategies (Reed, 2008).



Picture: Lake Powell, Nevada. Credit: Wayne Gustaveson

Economists measure the value of water quality and other environmental features, like fish stocks, to recreationists by using travel costs as proxies for prices. This method, known as the “travel cost method,” is called a “revealed preference” method because it is based on observing actual decisions recreationalists make when presented with priced alternatives, i.e., potential destinations at different distances from the recreationalist’s home with different characteristics. These models of recreation demand require data on recreationists' trips, particularly their origins, and destinations, most often captured through mail or on-site intercept surveys (Lupi et al., 2020).

Understanding peoples' knowledge, or geographic literacy, of waterbodies can help inform conservation efforts, including how conservation groups or government agencies communicate, educate, and conduct outreach with the general public. Communication mismatches are fairly common and can lead to confusion or misunderstandings of conservation or management decisions (Jarvis et al. 2020). Two complementary surveys were conducted in order to gauge the geographic literacy of residents in the transboundary Salish Sea region with an emphasis on the Salish Sea and Puget Sound, two large connected waterbodies (Trimbach et al. 2021; Trimbach and Niggemann 2023). Both surveys were conducted electronically via web-based research panels (prepopulated and compensated samples of research participants coordinated and vetted by survey companies, like Qualtrics) consisting of regional residents.

Box 14: Applied HD Example

Using the travel cost method, Wolf et al. (2019) found Ohio residents of counties surrounding Lake Erie would be willing to pay an estimated \$76.8 million per year to prevent algae-induced beach closures, with anglers willing to foot as much as 90% of the bill. Using a similar model, Melstrom et al. (2014) found stream anglers in Michigan were willing to pay about twice as much for an increase in catch rates for brown trout or panfishes as for smallmouth bass or walleye. Policymakers can use these estimates to inform stocking choices and identify high-value waterbodies to prioritize for improvements or protection.

We can also examine how people tend to approach problems related to water use by classifying them into character profiles based on their responses to proposed survey questions. Cluster analyses benefitted a study conducted in the Red River region of Oklahoma and Texas. The authors determined that different types of managers approach water management decisions differently (Wineland et al. 2021). This study clustered managers by their pessimism or optimism related to water flows and the river's ability to provide for all the ecosystem services demanded, particularly in relation to environmental flows. This paper also used social network analysis to determine if these two clusters of decision-makers communicate with one another and hypothesizes that these varying viewpoints of water availability in the region may complicate environmental planning.

Way of Life

Across the North American West, there is a diverse range of traditional ways of life and traditional ways in which individuals interact with the environment. The conservation of these traditional ways of life in the context of wildlife conservation requires methods that capture the intricate relationships between communities and their natural environments. Ethnographic methods, including participant observation and life history interviews, provide deep insights into the cultural practices, beliefs, and social structures that shape conservation behaviors and attitudes. These methods help document the traditional ecological knowledge (TEK) that indigenous and local communities hold, which can be invaluable for conservation planning and implementation (Berkes et al., 2000). Participatory rural appraisal (PRA) techniques are also effective in engaging communities in the mapping and management of their natural resources, ensuring that conservation strategies respect and incorporate local priorities and practices (Chambers, 1994). Social network analysis can also elucidate the social dynamics and power relations influencing conservation outcomes, highlighting key actors and institutions that can drive or hinder conservation efforts (Bodin & Crona, 2009).



Picture: Razor clam digging, Washington. Credit: Tammy Davis

Communities rely on healthy places and harvestable local foods (e.g., fish, shellfish, plants, and wildlife) to maintain their wellbeing and ways of life. Multiple complementary studies have been conducted to better understand these connections in the State of Washington (Donatuto et al. 2011; Poe et al. 2016; Biedenweg et al. 2016). Interviews were conducted with indigenous community members to develop a more comprehensive multidimensional understanding of indigenous community health as it relates to seafood consumption and associated health risks (Donatuto et al. 2011). Another study integrated both semi-structured interviews with participatory workshops in order to gauge how shellfish harvesting contributes to indigenous and non-indigenous residents' senses of place and overall wellbeing (Poe et al. 2016). A mixed methods approach, that included

expert elicitation, community workshops, available data collection, and interviews, was implemented in order to develop a suite of human health and wellbeing indicators, including indicators that capture residents' ways of life (Biedenweg et al. 2016). These indicators are now used by a government agency to monitor the wellbeing and ways of life (e.g., fishing, shellfish harvesting, hunting, and cultural practices) of residents every two years (Harrington et al. 2023).

Conclusion: What is the future of human dimensions?

Nationally, HD research is gaining momentum. The desire for additional HD or social science training, research, or outreach efforts is often discussed at national-level meetings across the Association of Fish and Wildlife Agencies (AFWA). While this is encouraging, a suite of barriers remains to integrate social science more fully (and holistically) in agency decision-making, policy, and processes. The AFWA Social Science Subcommittee surveyed agency HD researchers in 2021 and found that all four barriers (ideological, institutional, knowledge, and capacity) to successful social science integration described by Bennett et al. (2016) stymie the actual integration of social information (Quartuch et al. *under review*). Similarly, in survey results of state, provincial, and federal leaders across AFWA member organizations, a high percentage of respondents indicated that capacity and knowledge barriers got in the way of social science integration. When ideological, institutional, capacity, and knowledge constraints persist, agencies will continue to miss out on opportunities to meet their missions and advance conservation outcomes.

As social-ecological systems become increasingly intertwined, the following areas of research will become increasingly important to managers, decision-makers, and the public to work together in understanding. Social scientists have identified key human dimensions concepts (and broad topics) that will likely continue to impact fish, wildlife, and natural resource management in the West and, more broadly, at national-level scales (Decker et al. 2024). These issues include:

- human-wildlife coexistence dynamics
- resistance to change
- environmental (in)justices
- wildlife disease
- Climate resilience
- methodological malaise (e.g., need for innovative approaches and methods)
- rapidly expanding communication technologies.

The human dimensions and CSS can partially address these by adopting a social-ecological systems perspective and embracing public-trust thinking and good governance principles.

HD or CSS groups are working to advance these efforts nationwide. Specifically, the Society for Conservation Biology Human Dimensions Working Group, The Wildlife Society Human Dimensions Working Group, the AFWA Social Science Subcommittee, the WAFWA HD Committee, the SEAFWA Social Sciences Technical Committee, and the MAFWA Conservation Social Science/Human Dimensions Technical Working Group are just a few. Additionally, federal agencies, including the United States Geological Survey SEAS Branch, NOAA, and the United States Fish and Wildlife Service, are working to increase social science capacity, improve CSS literacy, and provide tools, research, and other opportunities such as HD training across organizations. With the continuation of collaborative work across North America and partnering with champions of social science research within conservation organizations who actively support and elevate the importance and contributions of social scientists (and social science more generally), state and provincial fish and wildlife agencies will be prepared to face the conservation challenges of the 21st-century head-on.

Recommended Resources for Additional Learning (in no way an exhaustive list):

Websites

- [WAFWA Human Dimensions Committee](#)
- [HDgov website](#)
- [Climate and Economic Justice Screening Tool](#)
- [American Sportfishing Association License Dashboard](#)
- [National Survey of Hunting, Fishing, and Wildlife-associated Recreation](#)
- [International Association for Public Participation](#)
- [Pew Research Center](#)
- [U.S. Inland Creel and Angler Survey Catalog \(CreelCat\): A Database and Interactive Tool for Inland Fisheries Management and Research](#)
- <https://www.conservation.gov/>
- [North American Bird Conservation Initiative - Human Dimensions](#)
- [Conservation Social Science Conference 2024 – SCB Social Science Working Group](#)
- [Human Dimensions | U.S. Fish & Wildlife Service](#)
- [EnviroAtlas | US EPA](#)
- [People and Their Environments: Social Science Supporting Natural Resource Management and Policy | US Forest Service Research and Development](#)
- [Puget Sound Partnership - Public Opinion Research](#)
 - [HDP.pdf](#)

Peer Reviewed Journals

- Human Dimensions of Wildlife
- Leisure Sciences
- Society and Natural Resources
- Ecological Economics
- People and Nature

Gray literature

- [R3 Clearinghouse](#)
- [American Fisheries Society Gray Literature Database](#)

Literature Review:

- Anderson, R. M., Charnley, S., Epstein, K., Gaynor, K. M., Martin, J. V., and McInturff, A. 2022. The socioecology of fear: A critical geographical consideration of human-wolf-livestock conflict. *The Canadian Geographer* 67(8):17-34.
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Appendix A. Definitions of Human Dimensions

HD Definition	Source
<p>“the full spectrum of ways in which people relate to the environment including actions and behaviors that affect the health of the Puget Sound as well as the ways in which people benefit from engagement with the natural environment of Puget Sound” [applies to non-Puget Sound areas]</p>	<p>David J. Trimbach, Kelly Biedenweg, Trina Wellman, Emilie Franke, Leah Kintner, Kari Stiles, Mike Johnson, and Social Sciences Advisory Committee. 2020. Protocol for the Integration of Human Dimensions into Implementation Strategy Starter Packages. Puget Sound Partnership: Tacoma, WA.</p>
<p>“the complex web of human processes as they relate to non-human, natural resources, broadly encapsulated within the social sciences and humanities”</p>	<p>Ana K. Spalding, Kelly Biedenweg, Annaliese Hettinger, and Michael Paul Nelson. 2017. Demystifying the human dimensions of ecological research. <i>Frontiers in Ecology and the Environment</i>. 15(3): 119-119.</p>
<p>“a general term that refers to the many elements of conservation that are not wildlife and habitats”</p>	<p>U.S. North American Bird Conservation Initiative (NABCI) (2023) - A Guide to Incorporating Social Science in Bird Conservation</p>
<p>“the application of social science to management issues”</p> <p>“diverse approaches for using social science to understand and improve environmental policy, practice, and outcomes”</p>	<p>USGS - Human Dimensions (website)</p> <p>USGS - HD.gov (website)</p>

Appendix B. Table of social science methods and analyses

Methods (Data Collection and Analysis)	Description	Benefits	Shortcomings
Surveys	Various methods including mail, telephone, face-to-face, and online surveys to collect data on attitudes, behaviors, and perceptions related to wildlife.	Cost-effective, standardized data collection	Potential for bias, low response rates, limited reach
Interviews	Structured, semi-structured, and unstructured interviews to gather in-depth insights into human-wildlife interactions and perspectives.	Flexibility, in-depth exploration	Potential for bias, time-consuming data analysis
Focus Groups	Group discussions facilitated by a moderator to explore attitudes, perceptions, and behaviors towards wildlife through interaction.	Group dynamics, rich data generation	Difficulty in managing group dynamics, potential for dominant voices to skew results
Participant Observation	Direct observation of human behaviors and interactions with wildlife in natural settings to gain firsthand insights.	Real-time insights, contextual understanding	Potential for observer bias, time-consuming data collection
Ethnography	Long-term immersion in a community or culture to understand the social and cultural context of human-wildlife interactions.	Cultural insights, in-depth understanding	Long-term commitment required, potential for researcher bias
Document Analysis	Analysis of historical and archival documents to explore past human-wildlife interactions and policies.	Access to historical data	Potential for incomplete or biased records

Social Media Analysis	Analysis of social media platforms to gather insights into public perceptions, opinions, and behaviors related to wildlife.	Real-time data collection, large sample sizes	Data validity issues, ethical concerns about privacy
Photovoice	Empowerment of participants to capture and share their perspectives on wildlife through photography.	Participant engagement, visual insights	Interpretation bias, limited generalizability
Mapping and Spatial Analysis	Utilization of maps and spatial analysis techniques to visualize and analyze human-wildlife interactions geographically.	Visual representation, spatial understanding	Technical challenges, potential for misinterpretation
Behavioral Observations	Systematic observation of human behaviors in wildlife-related contexts to understand patterns and dynamics.	Direct observation, behavioral insights	Potential for observer bias, limited generalizability
Biological Sampling with Social Components	Integration of biological data (e.g., wildlife population trends) with social context (e.g., human attitudes, behaviors) to understand human-wildlife interactions.	Holistic understanding, data integration	Logistical challenges, potential for data integration bias
Regression Analysis	Statistical technique to analyze the relationship between dependent and independent variables quantitatively.	Quantitative insights	Assumes linear relationships, may not capture complex interactions
Cost-Benefit Analysis (CBA)	Economic evaluation method comparing costs and benefits of projects or policies related to wildlife conservation or management.	Informed decision making, quantification	Subjective monetization of non-market goods

Hedonic Pricing Models	Analysis of how the price of a good is influenced by its characteristics, used to estimate the economic value of environmental amenities provided by wildlife.	Economic valuation, non-market good	Requires accurate data, subjective valuation
Discrete Choice Models	Analysis of decision-making processes where individuals choose among alternatives, used to understand choices related to wildlife activities.	Captures individual preferences, trade-offs	Requires large sample sizes, assumes rational decision-making
Panel Data Analysis	Examination of data collected over time from the same individuals or entities to analyze trends and impacts of policies or interventions related to wildlife.	Controls for time-varying factors	Data collection may be resource-intensive
Input-Output Analysis	Analysis of interdependencies between sectors of an economy, used to estimate economic contributions of wildlife-related industries.	Comprehensive view of economic linkages	Requires detailed input-output tables, may oversimplify economic relationships
Econometric Impact Evaluation	Evaluation method to assess the causal impact of interventions or policies on economic outcomes related to wildlife conservation or management.	Identifies effective interventions	Requires careful selection of control groups, potential for selection bias
Ecological and Environmental Assessments	Evaluation of ecological factors such as habitat quality, biodiversity, and environmental conditions that influence human-wildlife interactions.	Provides ecological context	Limited focus on social factors, requires expertise in ecological assessment

Geospatial Technologies	Use of GIS (Geographic Information Systems) and remote sensing technologies to analyze spatial patterns and processes related to wildlife and human activities.	Spatial analysis, remote monitoring	Technical expertise required, data processing challenges
Participatory Mapping	Collaborative mapping exercises involving local communities to document spatial knowledge, resource use, and perceptions related to wildlife and habitats.	Local knowledge integration, community engagement	Potential for bias in data collection, limited scale and generalizability
Economic Valuation Methods	Various techniques (e.g., contingent valuation, travel cost method) to estimate the economic value of wildlife-related goods and services, such as ecosystem services or recreational activities.	Quantifies economic benefits	Relies on subjective valuation, may not capture all economic values
Facilitated Dialogues	Structured conversation among a group of people with an emphasis on conflict or shared interest	Local knowledge collection Community engagement	Can require skilled facilitation and extensive community outreach, buy-in, and planning
Cognitive Mapping	Use of interactive activities, like card sorting, that help visually illustrate a person's internal cognitive structure or representation of reality or a mental object	Local knowledge collection Quantifies understandings Identifies potential areas of value and/or conflict Visualizes understanding	Often requires multiple steps or phases, can be conducted in open- or closed-formats, and often requires the use of software for statistics and data visualizations

Community-Based Participatory Research	Approach (not method) to research that aims to be equitable, just, and collaborative through research co-creation	Can be used with any method Relationship and trust building Local knowledge collection Community engagement	Can require collaborative and co-creation skills, time and relationship building intensive, and can be challenging in conflict-ridden contexts
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